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Investigating the use of modality in academic spoken discourse: A functional account of U.S. Dissertation Defenses

por

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ABSTRACT

Investigating the use of modality in academic spoken discourse:
A functional account of U.S. Dissertation Defenses

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Systemic Functional Linguistics (SFL) represents a way of doing discourse analysis which attempts to integrate social and linguistic aspects of discourse. In SFL, language is seen as of particular importance among a set of semiotic systems involved in the construction and negotiation of social meanings, and in the transmission of culture. Grounded on the SFL construct, this study investigates how the use of modality in U.S dissertation defenses enables the participants to fine tune their propositions and proposals according to how explicit they want to be about where their assessments are coming from, how subjective or objective they want them to appear, how definite and how metaphorical. It enables the speakers to negotiate their knowledge, ideological and theoretical assumptions, beliefs, academic norms and contributes in important ways to opening up or closing down dialogic space. The data analyzed in the present study consists of eight U.S. dissertation defenses totaling 131,752 words or 13,508 clauses. Out of the 13,508 clauses comprising the entire corpus, 2,159 were coded as modal and were subsequently sub-classified according to Halliday and Matthiessen's (2004) modal network. The research questions articulated focused on: i) the probabilities attached to the system of modality; ii) the functionality of the mental process *I think*; and iii) on the most common interpersonal strategy employed by committee members to ask questions and to give recommendations and/or suggestions. In relation to the probabilities in the modal system, the results suggest that since language varies according to context and since this variation is taken to be systematic and predictable, the role that a probabilistic modeling of language can play in this regard is to enable us to describe explicitly the covariation of language and context. As for the functionality *I think*, the results suggest that it is a plurifunctional expression and that it is necessary to jointly consider the nature of the argument, the context of neighboring clauses and the syntactic position of the expression in order to better understand which function it fulfils. Finally, with regard to the interpersonal strategy employed by committee members to question, suggest and/or recommend, the results show that they expand metaphorically the speech functional system because it increases the meaning potential available for academic negotiation in the defenses. Further studies of modality from a functional perspective are called for, in particular to gain a better insight into the way in which speakers in various types of contexts express their beliefs, judgments and evaluations, into their motivations for selecting particular ways for expressing these subjective positionings, and into the relationship between modality and variables such as the purpose of the discourse, the role of the speakers in the interaction and their statuses.

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RESUMO

Investigating the use of modality in academic spoken discourse:
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A Lingüística Sistêmica Funcional (LSF) representa uma forma de fazer análise do discurso integrando aspectos sociais e lingüísticos da linguagem. Em LSF, a linguagem é considerada particularmente importante em meio a um conjunto de sistemas semióticos envolvidos na construção e negociação de significados sociais e na transmissão de cultura. Fundamentado no construto teórico da LSF, este estudo investiga como o uso da modalidade encontrado em defesas de tese norte-americanas permite aos participantes sintonizarem suas proposições e propostas explícita ou implicitamente em relação à fonte de suas avaliações e nivelarem tanto a sua subjetividade/objetividade, como a assertividade e o grau metafórico ou denotativo das mesmas. O uso da modalidade permite aos participantes negociarem o seu conhecimento, suas suposições ideológicas e teóricas, suas convicções, assim como certas normas acadêmicas e contribui de forma importante para estender ou restringir o espaço dialógico. O corpus analisado neste estudo é composto por oito defesas de tese que totalizam 131,752 palavras ou 13,508 orações. Das 13,508 orações, 2,159 foram codificadas como modais e foram subseqüentemente classificadas de acordo com a taxonomia de modalidade proposta por Halliday e Matthiessen (2004). As perguntas articuladas neste estudo enfocam: i) as probabilidades vinculadas ao sistema de modalidade; ii) a funcionalidade do processo mental *I think*; e iii) a estratégia interpessoal mais comumente empregada pelos membros da banca para fazer perguntas e/ou dar sugestões e fazer recomendações. Em relação às probabilidades no sistema modal, considerando-se que a linguagem varia de acordo com o contexto de forma sistemática e previsível, a função de um modelo probabilístico da linguagem é nos auxiliar a descrever explicitamente a co-variação entre a linguagem e o contexto. No que tange a funcionalidade da expressão *I think*, os resultados sugerem que seja uma expressão multifuncional, sendo necessário considerar conjuntamente a natureza do argumento, o contexto das orações ao seu redor e a sua posição sintática para uma melhor compreensão de sua funcionalidade. Finalmente, com respeito à estratégia interpessoal empregada pelos membros da banca para questionar, sugerir e/ou recomendar, os resultados demonstram que estes ampliam metaforicamente a função discursiva porque esta estende o potencial de significados disponíveis para negociação de pontos de vista nas defesas. Sugere-se que outros estudos envolvendo a funcionalidade da modalidade são necessários para que possamos compreender melhor as formas empregadas por interlocutores para a expressão de sua convicção, avaliação e julgamento em diferentes contextos, as suas motivações na escolha destes posicionamentos subjetivos e qual a relação entre modalidade e variáveis como o propósito do discurso, o papel dos interlocutores na interação e o seu status.

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CHAPTER 1

Introduction

> In the most general terms, the purpose of analyzing a text is to explain the impact that it makes: why it means what it does, and why it gives the particular impression that it does. (Halliday, 1994, p. 366)

> A ciência é um discurso aproximativo, provisório e incessantemente susceptível de retificações e questionamentos, porque seu próprio método se apresenta como perfectível. (Jipiassau, 1979, p.177)

1   Introduction

One of the most basic functions of language is to create interpersonal relationships between speakers and addressees through the way texts are worded. Speech act functions establish, among other things, whether we are offering or demanding, creating solidarity or emphasizing social distance. In these and other ways we use language to take a stance towards and socially orient ourselves and our texts to others. But we do not just use language to orient our addressees, real or potential; we also take a stance towards the ideational or propositional content of our own texts. Whatever we have to say about a particular subject, we can also tell others, in the same utterance, to what extent we believe what we say is likely, desirable, important, permissible, surprising, serious, or comprehensible. In making these evaluations of propositions and proposals, we also orient our discourse in the larger world of available social points of view on our subject, and we further define our identities as meaning-makers with particular values as well as beliefs.

Because language is a resource for doing all these things, we need to better understand just what interpersonal meanings it allows us to make about propositions or proposals,

actions, events, and persons. We want to know in what different ways the same basic sorts of interpersonal meanings can be made, and how these are instantiated in small units such as the clause or the nominal group and across longer stretches of coherent discourse.

Many different approaches to discourse have begun to focus on the bidirectional link between language and society, taking into account the cultural aspects of discourse, a step further than the more traditional description and explanation of language-related phenomena. As Ford and Wagner (1996, p. 277) put it, "the study of recurrent linguistic patterns has become, for numerous scholars, inseparable from the study of patterns of social interaction".

Spoken discourse, which is of particular relevance for this study, has been analyzed from a variety of perspectives, with sociological, philosophical, linguistic and critical approaches all making important contributions towards understanding the nature of face-to-face interaction. The pervasiveness of spoken interaction in daily life has made it an interesting domain of study for researchers with various backgrounds (e.g., ethnography, sociolinguistics, philosophy, social semiotics). At various times and in various ways, analysts from all these perspectives have sought to describe aspects of how talk works. Within ethnography, new ways of thinking about spoken interaction emerged in the 1970's from Conversation Analysis, notably the work of Sacks, Schegloff, Jefferson and their followers. Sociolinguistic approaches arise from the interdisciplinary connections between sociology, anthropology and linguistics. From sociolinguistics we have contributions from the work of Hymes, Gumperz and Labov. Speech Act Theory and Pragmatics have added important insights to our understanding of how people interpret dialogue. And within linguistics, the study of spoken discourse has been pursued most actively by approaches interested in both structure and the functions of authentic discourse, notably the Birmingham School and Systemic Functional Linguistics (SFL). More recent perspectives have emerged from social

semiotic orientations which arise from interdisciplinary connections between linguistics and

critical theory, including Critical Linguistics and Critical Discourse Analysis (CDA).

Systemic Functional Linguistics (SFL), the approach I have used to analyze the

discourse found in the corpus US dissertation defenses, represents a way of doing discourse

analysis which attempts to integrate social and linguistic aspects of discourse. Present day

SFL preserves the principal characteristics of the version put forward by Halliday in his

Language as a social semiotic (Halliday, 1978). As this title suggests, language is seen as of

particular importance among a set of semiotic systems involved in the construction and

negotiation of social meanings, and in the transmission of culture. Thus, as a sociologically-

oriented theory, SFL is very much concerned with the relationship between language and

social context.

SFL has become an important line of research in language. It has its roots in the work

of the British linguist J.R. Firth (Halliday's mentor), but it has spread to Australia (its main

locus), and to other countries of continental Europe, Asia and South America. The recognition

that SFL has deserved academic standing may be seen by the many publications in the area.

Halliday (1994, p. xxix-xxx) provides a list of more than twenty uses to which linguistics may

be put. Some of those for which SFL has proved particularly suitable include: *the discourse of*

mathematics (O'Halloran, 2005; Veel, 1999; Lemke, 2003), *the discourse of psychiatry* (Fine,

2005), *studies on multimodality* (Baldry & Thibault, 2005; O'Halloran, 2004, Kress & van

Leeuwen, 1996), *educational discourse* (Christie, 2005; Unsworth, 2005a, 2005b, 1999),

academic writing (Ellis & Ravelli, 2004), *translation studies* (Vasconcellos, 1997; Steiner,

2004; Teich, 2003; Steiner & Yallop, 2001), *genre studies* (Martin & Rose, 2005; Meurer,

2002), *corpus linguistics* (Halliday, 2005; Thompson & Hunston, 2005), *the discourse of*

medical organizations (Iedema, 2003), *the discourse of the media* (Kress, 2003), *the discourse*

of history (Martin & Wodak, 2003; Coffin, 2002), *the language of conferencing* (Ventola et

al., 2003), *child language acquisition* (Painter, 1998), *critical discourse analysis* (Fairclough, 1992; Heberle, 1997), to name but a few.

The SFL approach offers two major benefits for the investigation of spoken discourse:

- it offers an integrated, comprehensive and systematic model of language which enables conversational patterns to be described and quantified at different levels and in different degrees of detail;

- it theorizes the links between language and social life so that spoken discourse can be approached as a way of doing social life. More specifically, the discourse found in the defenses can be analyzed as involving different linguistic patterns which both enact and construct dimensions of social identity and interpersonal relations.

It is primarily these two advantages of SFL which are responsible for its applications in the range of domains pointed above and which have determined its choice as the theoretical foundation for this study.

1.1   Purpose of the study

This dissertation aims at investigating a heavily instantiated genre, a specific text type found in tertiary U.S educational institutions, namely the dissertation defense. I investigate these texts from the perspective of Halliday's (1978; 1985; 1994) and Halliday and Matthiessen's (2004) systemic functional grammar (SFG) with a focus on issues of language and interpersonal relations. I carry out a descriptive analysis and an interpretation of interpersonal lexicogrammatical elements in the dissertation defenses which contribute to make these texts a specific kind of spoken text. The analysis contributes to the understanding that the study of interpersonal meanings involves looking at what kinds of role relations are

established through talk, what attitudes participants express to and about each other, and how they negotiate their knowledge and their academic statuses.

The following questions have guided me in terms of which textual and contextual features at both macro and micro levels to investigate:

1.   How can the interpersonal patterns of choice observed in the corpus of dissertation defenses be represented in terms of the grammatical system as a whole (i.e., as sub-systems of the system)? How may a paradigmatic grammar such as SFG be enhanced if probabilities are ascribed to every feature of a system or a system network? Can the incorporation of information on the actual patterns of choice realized in the corpus be a motivation for working towards the probabilistic modeling of language?

2.   Given the very high frequency of occurrence of the mental process *I think* many questions emerge. Does *I think* express lack of commitment to save the speaker's face, or is it a device for avoiding straightforwardness and hence a device for saving the hearer's face? Is it an expression of uncertainty and tentativeness? Can it express authority, or lack of it? Can it be used to open up dialogic space, or all of the enlisted functions depending on the situational context?

3.   What is the most common interpersonal strategy employed by committee members to ask questions and to give recommendations and/or suggestions and how is it realized lexicogrammatically?

Exploring all these questions, this research characterizes U.S dissertation defenses in relation to their systemic and lexicogrammatical elements within the microcosm of the universities of Michigan and Indiana.

1.2   Reasons for the selection of U.S dissertation defenses

Whereas research into the assessment of higher degrees, and particularly into the doctoral dissertation has tended to focus largely on the experiences and the role of those involved in supervising or examining (Dillon, 1981; Bargar, 1983; Isaac & Quintan, 1992; Johnston, 1997; Delamont, 1998; Denicolo 2003); on the comparative study of institutional policies and practices (Phillips, 1994; Jackson & Tinkler, 2000; Durling 2002; Hoddell et al, 2002; Shaw, 2002; Morley et al, 2002, 2003); on doctoral students' accounts of their defenses (Baldacchino, 1995; Tedesco, 1997; Kiely, 1997; Burnham, 1997; Hartley & Jory 2000; Wallace & Marsh, 2001; Hartley & Fox, 2002; Wallace, 2003); and on how to prepare students for their doctoral defense (Kulenschmidt, 1992; Tinkler & Jackson, 2002; Trafford & Leshem, 2002; Trafford, 2003; Hartley & Fox, 2004), research into the actual discursive characteristics of the oral defense remains limited to a very small number of studies.

Hence, one of the primary aims of the present study is to extend the small body of research on dissertation defenses, so that we can broaden our understanding in relation to how meaning is constructed in this important rite of passage where doctoral candidates typically emerge as part of an academic elite. Moreover, it is hoped that by offering an overall picture of some of the discursive features found in doctoral defenses, and how certain interpersonal strategies are used to achieve specific rhetorical effects, the study may be able to shed further light on how the genre is shaped and, possibly, offer prospective candidates useful information regarding some of potential strategies for a successful oral defense, as well as a grasp on some of the criteria frequently adopted by examiners to assess both - the final product and the candidate.

Finally, given that data collection is always a critical issue in any research, when I started my doctoral program at PGI, I found out that the English Language Institute (ELI) of the University of Michigan made transcriptions of various academic spoken events (among

which dissertation defenses) freely available through their institutional website (the Michigan Corpus of Academic Spoken English (MICASE)). I then used the transcriptions of two defenses in a paper I wrote for one of the disciplines I took at PGI and eventually submitted it to the *Journal of English for Specific Purposes*, where it has been published (Recski, 2005). At the beginning of 2003, I sent the same paper to Prof. John Swales at the ELI who read it and included some of my thoughts on a chapter he was writing on dissertation defenses for his latest book *Research Genres* (Swales, 2004). This paper served as a springboard for my obtaining a four-month grant at the ELI during June – October 2003, where I was able to interview several scholars and graduate students, collect additional defenses for my corpus, attend doctoral defenses at various faculties, and extend and recycle my reference literature.

1.3   Method

The data analyzed in the present study consists of eight dissertation defenses: four which had been previously collected by the ELI team in the initial phase of MICASE (1998 - 2001); three which were subsequently recorded by me during the second term of 2003 in Ann Arbor, Michigan; and one which was kindly made available by Professor Allen Grimshaw (Indiana University) and was recorded at Indiana University in 1975 (see Table 5.2 for further details).

After the three dissertations I collected had been properly transcribed according to the transcription conventions adopted by the ELI research team (see Appendix B), the next step concerned the textual analysis proper. Each dissertation transcript was broken down into clauses which were initially analyzed as being modal or temporal. Out of the 13,508 clauses comprising the entire corpus, 2,159 were coded as modal and were subsequently sub-classified according to Halliday and Mathiessen's (2004) modal network.

A crucial device employed for handling the daunting amount of data I set out to scrutinize was a software tool called the *Systemic Coder* (O'Donnell, 2002), which facilitates the linguistic coding of texts. The linguistic categories chosen to be analyzed are organized in terms of a systemic network, which is employed to code the entire corpus. Thus, I fed Halliday and Mathiessen's modal network into the software and then coded all of the modal clauses according to it. The codings were then statistically analyzed and the most prominent modal features were selected for a more detailed investigation.

In addition to the *Systemic Coder* I have also made use of another computer software for handling the data – the *WordSmith Tools* (Scott, 1996). Among the several tools available within the *WordSmith* suite, the *Wordlist* and the *Concord* tools were particularly useful. The *Wordlist* helps the researcher identify the common words in a corpus, information which is useful, for example, when determining which linguistic features to prioritize and which to disregard. The *Concord* provides a formatted version or display of all the occurrences or tokens of a particular word/expression in the corpus with a predetermined amount of context.

 For a closer investigation of modal features, then, the data was transcribed into text files to be used with both the *Systemic Coder* and the *WordSmith Tools*. This way, taking into account all of the eight dissertation transcripts, modal features (selected during the coding of modal clauses) were examined in order to provide further evidence of what interpersonal strategies are represented in the corpus.

The results provide an appropriate background for the analysis and interpretation of some of the interpersonal meanings which can be found in the discourse U.S dissertation defenses.

1.4   Outline of chapter content

In Chapter 2, I discuss wide-ranging aspects of the graduate experience including: a) institutional as well as personal views in relation to the obstacles normally confronted by graduate students and their advisers along the PhD avenue; b) likely factors affecting the choice of dissertation topics; c) criticism that has been voiced in relation to the written format of dissertations in the field of humanities; and d) previous research on the written characteristics of doctoral dissertations.

In Chapter 3, I narrow down the focus and review the scarce literature on doctoral dissertation defenses. The chapter provides information in relation to the variation of dissertation defenses across different geographical contexts; it attempts to place U.S dissertation defenses in relation to the typical situational context which surrounds them, and it reviews previous studies which have focused on the organizational structure of U.S dissertation defenses.

In Chapter 4, I provide a general review of the literature on modality, defining and delimiting the semantic domain of modality to be used as the analytical framework. In Chapter 5, I present the methods employed for handling the corpus.

In Chapter 6, I discuss the results obtained in relation to the relative frequency of occurrence of the different types of modalities in the corpus as a whole, the patterns of occurrence or distribution of associations and how these associations can be located with respect to the grammar as a whole. In Chapter 7, I discuss the results in relation to two prominent interpersonal strategies found in the data, namely, the use of the mental process *I think* and the examiners' use of Metaphors of Mood (based on Halliday's interpersonal level).

Finally, in Chapter 8, I present the conclusions of the study and attempt to make suggestions for pedagogical applications and future research.

CHAPTER 2

The Doctoral Dissertation:
A long-distance run for the doctoral degree

> Writing a thesis/dissertation is the most formidable task for any graduate student. This is not only because of the daunting size of the document but also because of the high standards to which the thesis/dissertation is held. The writing challenge is not only demonstrating knowledge related to the research but also using that knowledge to "argue logically and meaningfully the meaning of the research results" (Council of Graduate Schools in the U.S, 1991, p.11)

2   Introduction

The Ph.D. awarded by universities is a research degree certifying that the candidate has capabilities and training for independent scholarly work. The culmination of the degree program is the doctoral dissertation and normally the associated oral defense. According to a policy statement of the Council of Graduate Schools (1991), the dissertation fulfills two major roles: (i) it is a training experience which upon completion shows that the candidate can independently address an important problem in the field, and (ii) it makes an "original contribution to knowledge" (Berelson, 1960). Further, the document also notes the following:

> the degree to which the research done by the students is independently conceived and conducted may vary greatly, depending on the nature of both the field of research and the sponsorship. In all cases, however, students will be expected to make original contributions if the research is to form part of the doctoral dissertation. (p. 21)

Quite apart from the specific characteristics of the doctoral dissertation as a process and a document in itself, the dissertation can also be viewed as reflecting much of our academic and intellectual culture. Most obviously, the dissertation reflects capabilities of the author – the training received, the technical skills, the analytical and writing abilities

developed, and his/her dexterity in defending the crafted document in an oral examination before experts in the field (Lemke, personal communication). The dissertation also reflects on the work of the advisor. A successfully crafted dissertation that is subsequently published as a book, or as separate articles in prestigious international journals can enhance the reputation of the advisor among peers in the field, in addition to identifying the student as a likely independent future contributor to the same field. Conversely, dissertations that are not published in either format (book or article(s)) *may* not reflect favorably on the advisor, and the local and national reputation of the advisor may not be enhanced (at least in the US). From an institutional perspective, the reputation of the program or department might be affected by the quality of the dissertations produced by its Ph.D. graduates, reflected by the fact that external accreditation teams commonly examine recent dissertation as part of a program evaluation.

For the people involved in the Ph.D. journey, the dissertation also has informal, emotional, and historical importance which extends beyond the document itself. When faculties at doctoral-granting institutions refer to *their students*, they typically are referring to their graduate advisees. Without the dissertation, identifying one's students probably becomes a difficult task. The dissertation and the process leading to it provide an informal and emotional link between student and advisor which can extend far beyond the graduate student experience (Swales, personal communication). In reality, the student is becoming a colleague of the advisor.

The dissertation is also a common experience that links those who have attained the academic doctorate. Their career tracks subsequent to the doctorate may have been quite different, but those who have attained the doctoral degree will have the process of writing and defending a dissertation in common. The dissertation provides a historical record of

accomplishment of the student/author and provides the common core of all Ph.D. programs, which may differ in most every other aspect.

Apart from its cultural, informal, and historical academic roles, the dissertation affects the state of knowledge in the relevant field(s). As pointed out by Berelson (1960, p. 173), the dissertation is intended to make a "contribution to knowledge". Furthermore, the research program initiated in a dissertation can be the foundation of research programs subsequently followed by the student/author; furthermore, the doctoral dissertation is sometimes subsequently published, and may be the groundwork for the early stages of the research career of the scholar.

During the past decades, several issues have converged to renew interest in the role of the doctoral dissertation in Ph.D. programs in the United States. Increases in time to obtain the degree in American universities (Evangelauf, 1989; Johnson, 2000; Cadman, 2002; Valero, 2001) and projection of shortfalls in the number of persons trained to hold faculty positions (Bowen and Sosa, 1989; Freeman et al., 2001; National Center for Education Statistics, 1995) are matters of concern. At the same time a declining proportion of new Ph.D.s are pursuing academic careers, and an increasing proportion of Ph.D. graduates are not U.S. citizens (Association of American Universities, 1998). Along with societal factors, such as technological sophistication requirements, credentialing expectations, and explosions in the state of knowledge, these trends have invited researchers (myself included) to reexamine practices that are common to graduate education in the United States.

Although this dissertation is mainly concerned with the final stage of the doctoral dissertation process, that is, that of the dissertation *defense* in the U.S.A, I believe it is pertinent to offer the reader a more kaleidoscopic view of the many stages and facets involved in the doctoral dissertation process as a whole. Thus, this chapter reviews the literature on the

doctoral dissertation from a number of different perspectives that extend its ultimate stage, the dissertation defense.

The chapter is organized as follows. Section 2.1 discusses wide-ranging aspects of graduate experience such as common problems and difficulties related to writing the dissertation, perceptions from both candidates and supervisors regarding the obstacles they normally confront along the Ph.D. avenue, and the importance of advisor-advisee rapport in achieving positive outcomes. Section 2.2 describes some of the factors that may motivate the selection of topics in dissertations. Section 2.3 reviews some of the criticism that has been voiced regarding the overall format of the written dissertation. Section 2.4 briefly describes previous research strands on the structure of the written dissertation as well as on some of its rhetorical and linguistic features. Finally, Section 2.5 summarizes the chapter.

2.1   General aspects of the doctoral degree journey

Previous studies of doctoral education have examined a variety of aspects of the doctoral process ranging from the meaning and content of a student's educational process to the influence of the dissertation on potential career success (Berelson, 1960; Heiss, 1970; The Horace H. Rackham of Graduate Studies, 1976; Porter and Wolfe, 1975; Thayer and Peterson, 1976; Schuckman, 1987). Of these, the Michigan study (1976) and Porter and Wolfe (1975) study examined the doctoral dissertation in substantial detail.

In his foundational work on graduate education in the United States, Berelson (1960) examined the duration of doctoral study in response to growing concerns with lengthening times to degree. He found differences across fields of study, with lack of financial support being the major obstacle to completion of doctorate.

The content of the doctoral dissertation may be affected by various factors, some of which vary in importance by field. Perhaps the major factor to be addressed in defining the

dissertation is what is to constitute a contribution to knowledge in the field. Whitley (1984, p. 33) has described modern science as involving "continual novelty production" in which "reputations are based on the utility of the results for colleagues' research". However, "the scope of problems tackled, the extent of theoretical integration of results" will vary depending on the scientific field (ibid, p. 83). Acceptable doctoral dissertations are likely to show field-related variability as well if the dissertation is to be judged as a contribution to the state of knowledge of the field.

Hull (1988) made similar arguments from a somewhat different perspective. He argued that science itself could be described as an evolutionary process, during which research groups prospered and failed in analogy to species, with ultimate failure the more common outcome. Hull notes that within a field, particular conceptual approaches "wax and wane in their ascendancy, as gradualists and those adopting discrete changes have alternated in the ascendancy in evolutionary biology" (p. 3). Hull also suggests that factors other than "reason, argument, and evidence […] have a significant influence" on the direction of research (p. 4). Science is a social process in which "to some extent, scientists evaluate substantive views on the basis of their source" (p. 5). These factors correspondingly affect the *doability* of particular lines of research. Alternatively, it can be argued as well that the publishability of certain lines of research will affect the likelihood of it being conducted.

Another factor affecting the dissertation is the expectation of the field of study. Ziolkowski (1990) notes that science and engineering have adjusted expectations of the Ph.D. to the state of the discipline. Graduate students in the sciences often work in laboratory research groups, and dissertations often emerge from these group projects. The use of previously published work on the dissertation has become an option. Issues of 'originality' and 'independent contribution' have a somewhat different meaning than in the humanities or education. Similarly, differing views of the graduate educational process – can have an impact

on the time taken to complete the degree and on the expectation of the dissertation, including its raw length. Thus, differences within and among fields in conceptual development, preferred approaches, common practices, and expectations can affect the nature of the doctoral dissertation.

Under a more psychological prism, issues as varied as advisor-advisee relationship, problems associated with the various stages of the doctoral student's educational tenure, anecdotal accounts of the Ph.D. experience, standards of excellence looked for by examiners, and related topics have extensively been addressed in a number of studies in the literature. (Bargar & Duncan, 1982; Seeman, 1973; Jacks et al., 1983; Sales, 1975; Toombs, 1977; Robinson, 1997; Kiely, 1997; Tedesco, 1997; Johnson et al., 2000; Dillon & Malott, 1981, Dudley-Evans, 1991, to name but a few).

Johnston et al. (2000) investigate the quality of training provided in British universities with a particular focus on how supervisors monitor the performance and progress of their graduate students. The central argument they put forward is that there is a problematic character related to the ideas of autonomy and independent scholarship in the traditional practices of postgraduate pedagogy. The authors claim that "the supervision relationship is often fraught and unsatisfactory […] marked by neglect, abandonment and indifference" (p. 136), and add that at least in the humanities and social sciences, the Ph.D. as a form of research training is "based on the idea of the independent scholar working free from connection with the 'outside world', a disembedded and disembodied figure driven by the love of ideas, of scholarship, alone" (p. 146). Johnston et al. do not suggest that the remedy for this apparent magisterial disdain is the proactive exercise of *pastoral* guidance; rather they propose that research training should help produce scholars who are able to "develop sensitivities to the concerns of others, a willingness to work with others, and a capacity to reason or make judgments on the basis of contextual information rather than relying purely on

abstract, universalizing principles" (p. 145). Personally, I believe that the experience of isolation often appears so widespread that it may be considered structural and endemic, a seemingly (at least in the humanities) *necessary* feature of the doctoral journey for many, rather than an accidental difficulty. In fact, it may, in some senses, be a condition of the production of independence and autonomy, which is *probably* one of the goals of the pedagogy and practice of the Ph.D.

Similarly to Johnson et al. (2000), Seeman (1973), Dillon and Malott (1981), and Bargar and Mayo-Chamberlain (1983) consider aspects of supervisor-student relationship in the context of research training by analyzing the teaching-learning conditions designed to enhance the development of research competence. Overall, they suggest that research learning is most effective when the learning climate is designed to foster conditions of creativity, when it is seen as a task related to the development of personal effectiveness and personal goals, and when explicit provisions are made to foster growth toward autonomy and professional maturity.

In a related study, Jacks et al. (1983) investigate some of the possible reasons which may lead to successful or unsuccessful dissertations and conclude that students who receive high levels of support from their advisors are more likely to succeed in graduate school and persist to complete their degrees. Belcher (1994) focuses on the kinds of training provided by advisors, how well three nonnative doctoral students were qualified for their academic communities, and how receptive they were to modifying their practices. She concludes that the weaker students were those who had a greater divergence in relation to their advisors' perception of writing objectives and readership expectation, and that no such divergence was found for the most successful student, because of the successful relationship between advisor-advisee.

Robinson (1997), Kiely (1997), and Tedesco (1997) provide personal accounts of their own graduate experience. Robinson (1997) attempts to redress the prescriptive bias of previous studies on student-supervisor relationship with a more pragmatic and realistic account of the practical realities of this relationship as he perceived them. He presents a structured personal reflection ordered under a series of thematic headings such as deciding on the topic, the day-to-day relationship, his changing of supervisors, the impact this had on his research, and other underlying themes. Kiely (1997) relates and reflects on her experience as a PhD student at a Trinidad Tobago university from 1988 to 1991. Some of the lessons she claims to have learned are that one should not let the research dominate one's life, that it is vital to utilize the correct and appropriate research method, but that, at the same time, this is a matter of trial and error, and, finally, that a good relationship with one's supervisor is crucial. Tedesco (1997) tells the reader through her personal lens, the problems that a foreign student might face while doing a PhD in a foreign country. She centers the discussion on how she overcame the language barrier being an Argentine studying in Britain, the problems she had developing the central ideas for her dissertation and the problems she had in writing the dissertation.

Criticism of the quality, utility and format of American doctoral dissertations is an added issue discussed in the literature. Porter and Wolfe (1975) debate the relative scientific merit and usefulness in teaching research techniques in a sample of doctoral dissertations in psychology by surveying the judgments of 252 authors in relation to their own experience and in relation to possible alternatives to the traditional dissertation requirement. The results obtained indicate, according to the authors, that respondents found the dissertation "an enjoyable experience and believed it to be a valuable one" (p. 1061). They also report that a substantial number of respondents, especially those who had followed nonacademic careers, regretted that they had not had more work in statistics and research design. Additionally, they

found considerable support from the authors that a doctoral program should be oriented towards professional practice rather than research.

This section has demonstrated that the doctoral degree journey is a complex and multifaceted endeavor, one in which several personal, local, departmental, institutional, socio-cultural variables combine to shape and establish certain social practices. The next section reviews another important related aspect of the *doctoral journey*, that of choosing one's topic.

2.2   Selecting a dissertation topic: reviewing relevant factors

Given the potential impact of doctoral dissertations on the literature of the field being examined and on the research careers of the authors, the factors leading to the choice of a dissertation topic may have a significant place in the broad picture of the doctoral degree.

Extensive research has been carried out on how and why certain topics are chosen to become dissertation defenses. Using interviews, Heiss (1967) examined graduate education exclusively at the University of California-Berkley, and in a subsequent study (1970), she broadened her focus to a national sample. A study conducted at the Horace Rackham School of Graduate Studies (1976) focused specifically on the role of the dissertation in doctoral education and included survey data on topic selection as well.

The data reported below is a summary of some of my findings based on earlier literature on dissertation topic selection. Overall, the main factors which are likely to influence topic selection revealed in this literature are the following:

(i)   the amount of independence a student has in the selection of a dissertation topic varies from academic division to academic divison (Berelson, 1960; Heiss, 1967, 1970; Horace Rackham, 1976; Isaac et al., 1989);

(ii)   students in the hard sciences report less freedom in choice of topic than do students in the humanities and education (Isaac et al., 1989);

(iii)   Potential for publication, in addition to the interest of the student, are important features in topic selection (Sessions, 1971);

(iv)   Career considerations, advisors, and peers are factors influencing topic selection (Barr, 1984);

(v)   The field the academics belong to, equipment constraints, as well as scarcity of funds will play a major role in deciding one's topic (Isaac et al., 1989);

(vi)   In both hard and soft-sciences, according to a survey involving 417 graduate students across ten academic divisions, the single most important factor in the choice of a topic was the candidates' own preference (Isaac et al., 1989, Berelson, 1960).

Not surprisingly, the candidate's own preference was found to be the most important factor in topic selection in Isaac et al's study. In fact, it would be surprising, I should think, to find students consistently carrying out projects they are not fond of for their dissertations – at least within a range of viable options! Nevertheless, it is important to stress that topic selection *is not*, in most circumstances, a unilateral decision – it normally involves a fair degree of exchange and negotiation between candidate and advisor.

The above findings suggest that students will probably have varying degrees of influence on their dissertation projects and differing relationships with faculty in their field of inquiry. For instance, in the hard sciences, the next step may be obvious for both candidate and advisor, whereas in the humanities a broader array of options may be possible from a given point in the candidate's personal development and research. Furthermore, the selection of a topic may depend on the availability of appropriate equipment (e.g. as in Engineering, Physics, Chemistry) or on the possibility of publication (e.g. as in Education and Humanities).

In sum, then, these findings clearly indicate that there is a range of factors that may affect the choice of a dissertation topic: professional considerations, equipment limitations, candidate as well as advisor personal preferences, likelihood of publication, trends in the

field, and related academic issues. The extent to which these issues interact or are independent of one another presumably depends on the paradigmatic constraints of each field.

2.3   The format of the PhD dissertation: the two sides of the coin

The final format of the written dissertation normally depends on the academic research cultures of the candidate´s department. These cultures may include disciplinary or interdisciplinary ideas and values, particular kinds of expert knowledge and knowledge production, cultural practices (for instance how research is done, and how supervision is exercised), departamental sociability, other internal and external intellectual networks and learned practices. Presently, the consensus, regardless of diverging departamental practices, seems to be that the dissertation should be both a training instrument and an original and significant contribution to knowledge. In response to this apparent consensus, Duke and Beck (1999) voice their strong criticism of the format of dissertations in the field of education in the United States. According to them, the dissertation serves neither as a training instrument, nor as an original and significant contribution to knowledge. They argue that the traditional format of the dissertation, that is, "a lengthy document […] on a single topic presented through separate chapters" can be said to be "ill-suited to the task of training doctoral students in the communicative aspects of educational research" in addition to being "largely ineffectual as a means of contributing knowledge to the field" (p. 31). Duke and Beck's critical claims are centered on two main points: (i) that dissertations have a very limited audience and dissemination; and (ii) their lack of generalizability for the writer, i.e., a person normally writes only one dissertation throughout his/her life.

The audience, in fact, will probably be restricted to the committee members, and perhaps the few friends, family members, and colleagues who can be *persuaded* to read it. Even though dissertations are considered public documents, the length and style associated

with them make them impractical for many audiences. This limitation in terms of audience, according to Duke and Beck makes "its status as a piece of research as questionable as its status as a genre" (p. 32). Here, though, I would have to disagree with Duke and Beck on the following grounds: even though a piece of research is not usually recognized until it is communicated, and others know about it and have enough information to enable them to test its authenticity, we cannot go as far as claiming that because of its restricted audience it does not qualify as a genre[1]. If audience was a criterion for deciding whether or not a certain episode constitutes a genre, we could not say, for instance, that a diary could be regarded as genre, since it is very likely that no one but its writer will have access to it. It seems to me that a diary is a genre as much as a dissertation, regardless of the scope of their readership. The reason for this assumption lies in the simple fact that people, or societies, give genre nomenclatures to different types of communicative episodes that they are familiar with. These nomenclatures are exteriorized through written or spoken texts and their corresponding rhetorical circumstances.

On the other hand, I do agree with Duke and Beck as far as dissemination is concerned. They point out that in order to be received by wider audiences dissertations would need to be rewritten either as books or as series of articles. This process, notes Krathwohl (1994), prevents new scholars from moving onto fresh projects and exploring the exciting possibilities afforded by their new status as doctored professionals. Indeed, not only does the traditional dissertation format have an unacceptably limited readership, but it also presents barriers to widening that readership through publication. Reid (1978), in reference to the field of biology, nicely captures the irony of the re-editing process:

> Logistics of the final push toward assembling and getting approval of the traditional dissertation are wrong from the standpoint of revision for publication. The student is ending "a stylized charade in which the victim is encouraged to produce a 200-page tome, only to be told

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[1] I use the term "genre" here in accordance with Swales (1981, p. 10) to mean "a recognized communicative event with a shared public purpose and with aims mutually understood by the participants within that event"

after its approval that *now* he's to operate on his tetaroma[2] for publication" (Chermin 1975). Faced with a move to a new location and new work responsibilities, publication gets postponed for weeks, months, or indefinitely. (p. 652 – original emphasis)

So why do doctoral students spend 2-4 years designing a document in a format that will have to be readapted if it is to achieve a wider public? The answer to this question deserves a dissertation of its own and I shall not advance it any longer here. The fact of the matter is, as Duke and Beck nicely point out that "[w]ith an ungeneralizable genre comes a missed opportunity for transfer of knowledge and skills that would actually be of benefit to students in the long term" (p. 32).

The question is: what are some of the possibilities to turn the dissertation into a more digestible and far-reaching type of genre? According to Porter and Wolfe (1975, p. 1060) one possibility would be to transform the traditional format of the dissertation into several small-scale research articles that can range from being (i) nonoriginal, (ii) original, no demand for positive findings, (iii) original, some requirements for positive findings, and (iv) learning of specific research skills in class or by special instruction with a commensurate reduction in dissertation scope. On a similar vein, Krathwohl (1994, p. 31) proposes that graduate students should "write the dissertation as an article (or series or sets of such articles) ready for publication, [using] appendixes for any additional information the committee may desire for pedagogical and examination purposes". Duke and Beck (1999, p. 34) go even further in envisioning that "each chapter of the dissertation would have its own abstract, literature review, research question(s), methodology, results, and conclusions – it would be a self-contained research article manuscript ready to be submitted for publication".

While some of these alternatives are just beginning to be tested in the humanities and social sciences, the so-called 'hard-sciences' have been accepting alternatives to the traditional format of the dissertation for decades, usually in the format of a collection of

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[2] A *teratoma* is a type of embryonic tumor.

articles that have already been accepted for publication in indexed journals (Monaghan, 1989). For instance, Mangan (1996) and Durling (2002) point out that recently, graduate students in fields as varied as speech communication, arts, design, and classical archeology have taken advantage of the affordances of computer technology[3] by submitting their dissertations in CD-ROM format, the interactive nature of which gives readers a better appreciation of visual data such as videos of people talking and 3-D models of buildings or ancient tombs. What this change of paradigms means is that the format of the dissertation, once identical in all disciplines, now varies depending on the field – and the audience – for which it is produced. The Council of Graduate Schools, in the seminal 1991 report *The Role and Nature of the Doctoral Dissertation* acknowledges this trend and seems to support its continuance, concluding that

> [g]raduate education would be wise to honor the disciplinary differences […] even to encourage them. Departments are well advised to review periodically the expectations of their discipline, the mission of graduate education, and how the dissertation serves that mission. Dissertation research should provide students with hands-on, directed experience in the primary research methods of the discipline. The dissertation should prepare students for the type of research/scholarship that will be expected of them after they receive the Ph.D. degree. (Council of Graduate Schools, 1991, p. 15)

Similarly, Dong (1998) argues in favor of a disseration format involving multiple articles because it not only "gives graduate students on-the-job training, preparing them for what they will be expected to do in their fields after they receive their Ph.D degree", but also because it "reduces the time for publication if dissertation chapters can be submitted directly for journal publication" (p. 371).

If doctoral students were given the option of writing the dissertation as a series of articles ready to be submitted for publication, this, apparently, would address the problem of limited readership of the traditional format. From the outset the student would be writing the dissertation not solely for a small audience and his/her committee, but for a wider audience of

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[3] For a good discussion of the impact of technology on the dissemination and format of theses and dissertations see Edminster and Moxley (2002).

professionals in the field, the same audience for whom he or she would be expected to write throughout his or her career. This would increase the potential of the dissertation to have a real impact on research and practice. Furthermore, to the extent that the candidate would be expected to write research articles for publication throughout his or her career, writing the dissertation would support the development of a generalizable skill under the kind of close mentorship largely unique to doctoral training.

In another possible dissertation format, I would like to suggest that the dissertation could be comprised of a variety of different professional genres. For example, a dissertation could consist of one article targeted at researchers and a companion article aimed at practitioners, or one article for a journal in the candidate's narrow field of study and another for a journal in the candidate's broader field of study. In this format, the dissertation could offer a formal mechanism whereby students would receive guided practice writing for different kinds of audiences. This would offer important preparation for the nature of the field one is inserted, in which one is expected to be able to communicate effectively with a variety of audiences.

However, in adopting alternative formats for the dissertation, it is important that we do not overlook the strengths of the traditional dissertation format. Indeed, as I go through my dissertation process as I write this chapter, I certainly think that the dissertation in its current form would not have endured as long as it has if there was not a certain amount of consensus about the value of this form and the advantages it holds for doctoral students like myself and the community of scholars who grant doctoral degrees. This is in accordance with Isaac et al. (1992), who note that the process of writing a dissertation provides not only a central focus for all Ph.D. programs, but also a shared experience for everyone who has achieved an academic doctorate.

Another strength of the traditional dissertation format is that it provides an explicit template for the writer to follow. If the format is one that is widely used in the author's field, and not just invented for the purpose of doctoral training, then the dissertation writer should have no trouble locating models, whether in research journals, in published books, or elsewhere. It is important to note, as I have previously argued, that the dissertation as it has been traditionally written is independent from publishing bodies. Decisions about acceptance of the dissertation are traditionally made by the student's dissertation committee, and not by outside organizations, which, in my opinion, is a strength of the traditional dissertation format that should also be preserved.

2.4 "Keyboards on" – previous research on the written characteristics of doctoral dissertations

In order to have the chance to defend the dissertation, postgraduate students have to write it first. The writing of theses/dissertations has been a topic of interest for many researchers for the past three decades. Most studies that have been conducted in this area focus on the importance of writing a dissertation considering the organization of practical work, the conceptualization of arguments linking the different parts of the whole, and the correct academic tone.

According to these manuals and style guidelines, successful thesis/dissertation writing, or at least what is looked for in the overall assessment of a dissertation when discussing its quality, is achieved when the whole is more than merely the sum of its component parts. An investigation of the writing guides which have been published in the last three decades indicates that this is a growing area of interest. Table 2.1 illustrates this prolific literature.

Table 2.1 List of some of the thesis/dissertation writing manuals published in the last 30 years.

Year	Author(s)	Book Title
1973	Sugden	*The graduate thesis: the complete guide to planning and preparation*
1974	Campbell	*Form and style: theses, reports, term papers*
1979	Davies & Parker	*Writing the doctoral dissertation: A systematic approach*
1980	Roy	*Writing and defending a thesis or dissertation in psychology and education*
1981	Sternberg	*How to complete and survive a doctoral dissertation*
1986	Becker	*Writing for Social Scientists: How to start and finish your thesis*
1986	Woodford	*Scientific writing for graduate students: A manual on the teaching of scientific writing*
1987	Miller	*The thesis writer's handbook: a complete one-source guide for writers of research papers*
1987	Watson	*Writing a thesis : a guide to long essays and dissertations*
1991	Huckin & Olsen	*Technical writing and professional communication for non-native speakers of English*
1991	Gil	*Como elaborar projetos de pesquisa*
1991	van Wagenen	*Writing a thesis: substance and style*
1992	Madsen	*Successful dissertations and theses: a guide to graduate student research from proposal to completion*
1992	Rudesdan & Newton	*Surviving your dissertation*
1993	Odgen	*Completing your Doctoral Dissertation or Master's Thesis*
1994	Preece	*Starting research: An introduction to academic research and dissertation writing*
1994	Teiltelbaum	*How to write a thesis: a guide to the research paper*
1996	Cervo & Bervian	*Metodologia Científica: para o uso de estudantes universitários*
1996	Eco	*Como se faz uma tese*
1996	Higgins	*Approaches to research: a handbook for those writing a dissertation*
1996	Turabian	*A manual for writers of term papers, theses, and dissertations*
1997	Newman	*Theses and dissertations: a guide to writing in the social and physical sciences*
1998	Bolker	*Writing your dissertation in fifteen minutes a day: a guide to starting, revising, and finishing your doctoral thesis*
1998	Glatthorn	*Writing the winning dissertation: a step-by-step guide*
1998	Fitzpatrick	*Secrets for a successful dissertation*
1998	Maunch	*Guide to the successful thesis and dissertation: a handbook for students and faculty*
1998	Webster	*Developing and writing your thesis, dissertation or project: a book of sound advice about conceptualizing, organizing, developing and finalizing your terminal graduate research*
1999	Holtom	*Enjoy writing your science thesis or dissertation: a step by step guide to planning and writing dissertations and theses for undergraduate and graduate science students*
1999	Walters	*The readable thesis: a guide to clear and effective writing*
1999	Zerbubavel	*The clockwork muse: a practical guide to writing theses, dissertations, and books*
1999	Murrel et al.	*Research in medicine: planning a project – writing a thesis*
2000	Severino	*Metodologia do trabalho científico*
2000	Swetnam	*Writing your dissertation: how to plan, prepare and present your work successfully*
2000	Pyrczak	*Completing your thesis or dissertation: professors share their techniques and strategies*
2000	Thomas & Brubaker	*Theses and dissertations: a guide to planning, research, and writing*
2000	Swales & Feak	*English in today's research world: A writing guide*
2001	Silva & Estera	*Metodologia da pesquisa e elaboração de dissertações e teses*
2001	Rudestan	*Surviving your dissertation: a comprehensive guide to content and process*
2001	Thomas & Brubaker	*Avoiding thesis and dissertation pitfalls: 61 cases of problems and solutions*
2002	Garson	*Guide to writing empirical papers, theses, and dissertations*
2002	Meloy	*Writing the qualitative dissertation: understanding by doing*
2003	Cooley	*Thesis and dissertation writing at postgraduate level: theory and classroom practice*
2003	Dunleavy	*Authoring a PhD: how to plan, draft, write, and finish a doctoral thesis or dissertation*
2004	Roberts	*The dissertation journey: a practical and comprehensive guide to planning, writing, and defending your dissertation*
2005	Hart	*Doing your masters dissertation: realizing your potential as a social scientist*
2005	Germano	*From dissertation to book*

More than a decade ago, Swales (1990, p. 188) observed that the genre *doctoral dissertation* was "an area that discourse analysis [had] largely avoided […] partly because of the daunting size of the typical text." Fortunately, despite Dudley-Evans's (1999, p. 28) plea that "the work on genre analysis in EAP extend beyond the confines of the article to look at the related academic genres of the essay, the report and the *dissertation*" (emphasis added), we now know a great deal more about the discoursal features of doctoral dissertations/theses than we did a decade ago. Below I offer a synoptic view of the considerable growth of such literature (Table 2.2):

Year	Author(s)	Topic
1984	James	A case study on the successes and failures of "Marcos" - a non-proficient Brazilian sociology student - writing his Ph.D. dissertation in the UK
1985	Hanania & Akhtar	Quantitative study of the distribution of finite verbs in relation to rhetorical divisions (e.g., Introduction, Method, Discussion, etc) of MSc theses in the fields of biology, chemistry and physics
1986	Dudley-Evans	An investigation of the introduction and discussion sections of MSc. dissertations
1988	Hopkins & D-Evans	A move analysis of the discussion section of MSc dissertations from the department of Biology at the University of Birmingham
1988	Dudley-Evans	A study on one-to-one supervision of students writing MSc or Ph.D. theses
1988	Richards	Description of an intensive ESP thesis-writing course targeted at learners' needs
1991	Dudley-Evans	A study on the comments made by a supervisor on the drafts of a British doctoral student from plant biology
1993	Hewings	An investigation and comparison of conclusion sections from MBA dissertations and Research Articles from the fields of Economics and Marketing
1996	Dong	A study of the use of citations for knowledge transformation by non-native doctoral students' writing dissertations in science
1997	Paltridge	Description of a program which aimed at helping ESL students prepare for thesis and dissertation writing by focusing on the thesis proposal as an important part of that process
1998	Dong	Based on a survey of 169 graduate students and their thesis/dissertation advisors, the study compares the article compilation and the traditional five chapter thesis/dissertation and examines the impact of language and cultural differences on non-native students' thesis/ dissertation writing
1998	Stålhammar	A report of a course offered to students in the Humanities faculty at Göteborg University based on the survey of certain linguistic elements of 30 doctoral dissertations drawn from the disciplines of English Literature, English Language, Applied Linguistics, Economics, Psychology, and Educational Sciences

Table 2.2 continued

1999	Thompson	A study based on interviews with eight Ph.D. supervisors from the Departments of Agricultural Botany and Agricultural Economics at the University of Reading investigating issues such as the conventionalization of dissertations cross-departmentally, how dissertations differ from books or articles, and what appears to be the central communicative purpose of the dissertation in each department
1999	Bunton	An investigation of the ways in which 13 Hong Kong students use metatext to orient and guide their readers through their Ph.D. theses
2000	Shaw	A study comparing the argument structures found in discussion sections of research articles and dissertations
2000	Ridley	An investigation of the different organizational patterns found in 50 dissertations from the faculties of Pure Science, Engineering, Medicine, Arts, Architectural Studies, Educational Studies, Social Sciences and Law with a special emphasis on the literature review
2002a	Thompson	A corpus-based study on the use of modal auxiliary verbs in 39 Ph.D. dissertations written by native speakers at the University of Reading from the departments of Agricultural Botany and Agricultural and Food Economics
2002	Paltridge	An investigation of the extent to which published advice on the organization and structure of theses and dissertations in Australia concurs with what happens in actual practice
2002	Bunton	A move analysis of 45 Ph.D. dissertation introductions drawn from the departments of Chemistry, Ecology and Biodiversity at the University of Hong Kong
2002b	Thompson	An investigation of the purposes of explicit reference (citation) in 16 PhD Theses from two areas of research – Agricultural Botany and Agricultural Economics
2003	Hyland	An investigation of the social and cultural textualization of gratitude found in acknowledgements of 40 Ph.D. and M.A. dissertations written by non-native speakers of English at the University of Hong Kong involving the following disciplines: Electronic Engineering, Computer Science, Business Studies, Biology, Applied Linguistics, and Public Administration
2004	Hyland	Idem to Hyland (2003)
2004	Hyland & Tse	Idem Hyland (2003)
2004	Swales	A chapter describing the state of the art related to Ph.D. dissertation writing. Some of the issues discussed in the chapter involve the structures, styles, and rhetorical and linguistics features of dissertations

Table 2.2 Synoptic view of the literature on theses and dissertations

It can be argued that the doctoral dissertation (similarly to many other academic genres) is in a state of constant change because of numerous factors. One such factor is the velocity of technological change: the growth of Electronic Theses and Dissertations (ETDs) described in detail by Edminster and Moxley (2002) points to the new and exciting possibilities of sound, image, colors, interactivity, etc, that are currently available and that

were considered science fiction not so long ago. Other factors that may account for this constant flux in the style, format, and purpose of dissertations are related to contextual variables such as institutional policies, departmental formalisms and conventions, scholarly expectations, advisor-advisee relationships.

When asked what the communicative purposes of writing a dissertation probably were, Swales replied, "it all depends" (personal communication). To see why this appears to be so, he invites us to consider the diagram presented in Figure 2.1. According to Swales (2004, p. 136), Figure 2.1 shows that "any one candidate's dissertation is enclosed in a variable envelope with its particular shape – its horizons and expectations – affected by both external and internal forces." Thus, at one extreme, we may find a candidate whose aims are to write the dissertation, and to abandon academic life; someone who is only interested in obtaining the degree. In such case, as Swales (2004, p. 136) points out, the envelope in Figure 2.1 "expands upwards, especially towards the upper-left quadrant, but shrinks in the bottom half." We may also find candidates who are devoted researchers, with several publications, and who may already hold academic positions or have good prospects for a postdoc, for whom the writing of the dissertation and its subsequent defense are a crucial stage in the pursuit of their academic careers. In this context, Swales (2004, p. 136) explains, "the envelope stretches downward and only lightly takes into account the upper quadrants."

For another group of graduates, usually those in the humanities, the dissertation may be seen as a sophisticated draft of an ensuing book, or series of articles, which will represent a springboard to the academic careers they will eventually pursue. Finally yet importantly, we may recognize those candidates who, as Swales (2004, p. 137) comments, "love the social and intellectual life of being doctoral students in a culturally-rich university city and thus for whom the dissertation will likely turn out to be nothing more than a one-ticket out of paradise."

General

Institutional
(Graduate School)

Division (e.g. Social Science)
Discipline
Department

Candidate
Advisor(s)
Micro-community
Committe
Colleagues

Subfield
Topic
Approach

Specific
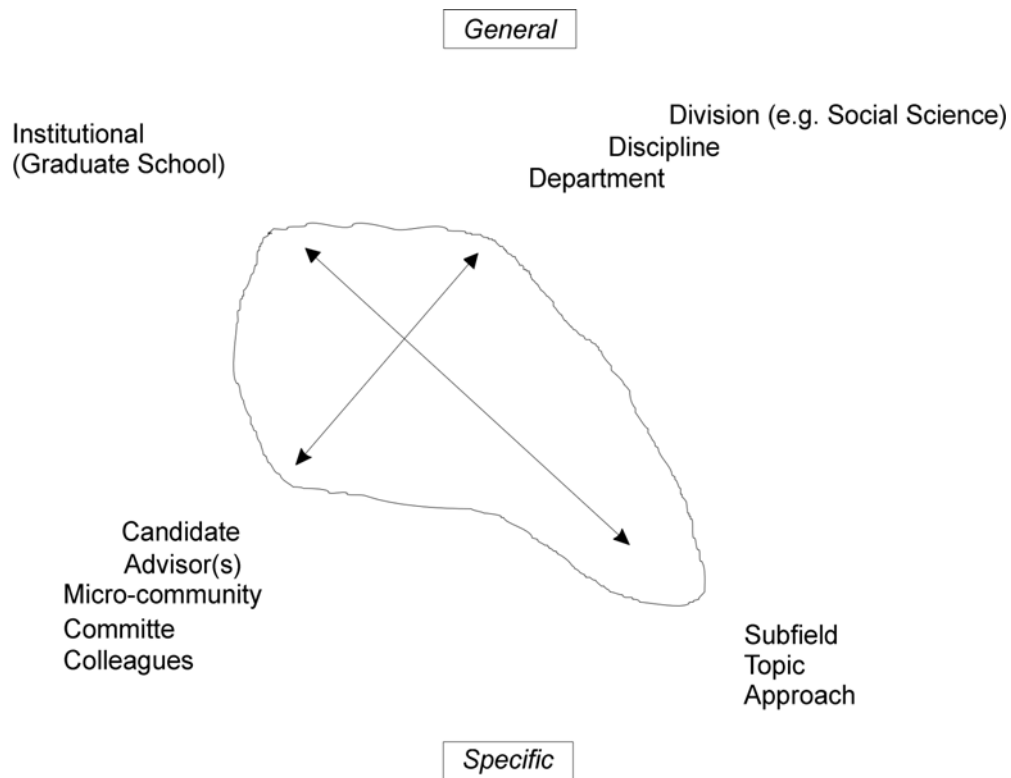
Figure 2.1 Variables shaping the form and purpose of a dissertation (reproduced from Swales, 2004, p. 136)

The several possible contours of Swales' *academic envelope* seem to illustrate the fact that institutional, departmental, socio-cultural, local and personal variables come together, at varying extents, to shape the forms and purposes of doctoral dissertations. Something that Swales (2004, p. 138) nicely captures when he argues that

> [s]ometimes dissertations are more and sometimes less an "occasioned academic product"; sometimes more and sometimes less a recognized contribution to the research literature; sometimes more and sometimes less a collaborative (indeed co-authored) enterprise; and sometimes more and sometimes less a waystage in an academic career."

2.5   Summary

During the course of this chapter, I have tried to offer the reader a somewhat kaleidoscopic view of some of the several variables involved in what I have at the beginning

of the chapter called the "doctoral long distance run". My partial account has overlooked other genres such as the writing and subsequent defense of doctoral proposals, the (dis)approval of the dissertation defense, issues related to students' access to research communities, gender issues. Nonetheless, the chapter has described at length the literature on

(a)   some of the wide-ranging aspects of the graduate experience including common problems and difficulties related to writing of the dissertation;

(b)   some of personal views shared by both candidates and supervisors regarding the obstacles normally faced along the doctoral journey;

(c)   some of the factors leading to the choice of a dissertation topic and how this is likely to impact the careers of the authors;

(d)   how disciplinary or interdisciplinary ideas and values, particular kinds of expert knowledge and knowledge production, cultural practices, intellectual networks and learned practices may affect the format of dissertations;

(e)   how the discoursal and rhetorical characteristics of written doctoral dissertations may be a reflex of the interspersing of a series of institutional, departmental, socio-cultural, local and personal variables.

CHAPTER 3

Doctoral defenses in the US:
Contextualizing social-cultural and discoursive aspects

> Are dissertation defenses, on the one hand, just "meaningless rituals", mere epideictic celebrations, and/or simple instances of "just going through the motions"? Or are they, on the other hand, tough and true oral examinations of the submitted work, consisting of carefully prepared but unpredictable interrogations of the texts under review and thoughtful and intelligent responses by the candidates? Or are they sometimes both, or at least sometimes more and sometimes less one or the other? (Swales 2004, p. 145)

3   Introduction

There are many differences related to the perceived purpose of a doctoral defense. Variations occur in the purpose and centrality of the oral examination, its length, and its style and tone. For some (e.g., institutions, examiners, supervisors) the defense is ancillary to the examination of the bound dissertation, being merely a forum to authenticate authorship, or to act as a rite of passage into a select club of academics. For others the defense is meant to be "the student's day" (Parsloe 1993, p. 59), "a chance to parade […] hard earned expertise" (Burnham, 1994, p. 33), the "successful completion of a long, arduous but ultimately rewarding experience" (Smith 1991, p. 56), or "the ultimate academic hurdle which confers the equivalent of a professional warrant to erstwhile apprentices of academe" (Baldacchino 1995, p. 71). For still others, the purpose of the defense is more of an examination to check the candidate's ability to explain orally his/her work and to provide indication of her/his breadth and depth of knowledge by being able to answer searching questions on theory and research practice. For yet others, the defense is a confrontational experience in which candidates are required to demonstrate their ability to argue with academic rigor while

standing up to critique from other experts (Lemke, personal communication). Thus, the style and tone may vary from celebratory and supportive to hostile, with examiners appearing as positive gatekeepers, initiating newcomers in the field, or negative gatekeepers, ensuring that all but the best are kept out (Swales, personal communication).

Alternatively, we might interpret the defense as a fairly typical ritualized activity where participants appear to be satisfying aspects of discourse and the culture-specific aspects of a defense. Committee members dutifully ask important questions of the candidate's research, work that is supposed to be an original contribution to his/her chosen field of study. But at the same time, the participants seem to be satisfying what could be called a previously agreed-upon understanding that the dissertation was acceptable except for what were presumed to be routine changes or revisions. I am not saying that surprises do not occur, or that committee members can not be dissatisfied with the candidate's performance, but that fairly common social constraints and goals are called upon and sought by most of the committee members throughout defenses. These constraints and goals may take various forms, but their guiding principle may seem to be that of preserving the integrity of the meeting and the dignity of the candidate and committee members, even when a committee member or the candidate seems to be pushing things too much or behaving in a somewhat overconfident manner.

Whatever the purpose(s) of doctoral defense(s) is/are, the fact remains that up-to-date only a few researchers have delved into the discoursal complexities and characteristics of this final stage of the doctoral degree marathon. Much of what we know about dissertation defenses from a discoursal perspective comes from the 1177 combined pages of Grimshaw (1989) and Grimshaw (1994), where prominent scholars (e.g., Peter Burke, Michael Halliday, Ruqaya Hasan, Charles Filmore, John Gumperz, Peter Burke, Aaron Cicourel, etc) analyzed

in detail some of the discoursal properties of the genre using as a corpus a single sociology defense recorded in a complex manner at Indiana University in 1975[4].

This chapter is organized as follows. Section 3.1 illustrates how dissertation defenses can vary in terms of ritualistic practices, length, levels of formality, and language in different geographical contexts around the world.

Anchored by the SFL register concepts of field, tenor, and mode, section 3.2 attempts to place dissertation defenses in relation to the typical situational context which surrounds them. The aim here is to attempt to anticipate part of the language that will come forward in such ceremonies by being better informed about the nature of the rhetorical situation, the relationship among the participants and the role language is serving so that specific discursive goals are attained.

Section 3.3 reviews the scarce literature on linguistic studies involving doctoral defenses. Two major works, that of Grimshaw (1994) and Swales (2004), and one recently published article by Recski (2005) are discussed.

Section 3.4 investigates the structural configuration of dissertation defenses in the US. By drawing on previously proposed structural outlines (Swales 2004; Hasan 1994; Grimshaw et al. 1994; Burke 1994) this section aims to show the way dissertation defenses are structurally organized, at least at the University of Michigan. In order to facilitate the readers' comprehension of how each move[5] is manifested linguistically, the section also attempts to place each move alongside dissertation excerpts that may be thought of representing them.

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[4] The corpus of study of all investigators in Grimshaw's (1994) book is a ten-minute excerpt – "The Common Segment" – which stretches from the middle of the assessment period to the middle of the signing of forms in the defense. This, in turn, does not mean that all of the investigators have constrained their analyses *only* to these ten minutes.

[5] According to Motta-Roth (1995, p.16), "[t]he concept of move usually adopted in Genre Analysis (commonly associated with the work of Swales, 1981, 1990) relates to a given schematic structure found in the text which has specific rules for form and context of use in relation to the function that it performs in the genre".

3.1 Doctoral defenses around the world: an overview of ritualistic practices

Before we look at the discoursal characteristics of US doctoral defenses, it is particularly useful to put this event-type into a broader geographical context. Doctoral defenses may differ in terms of ceremonial procedures, levels of formality, nomenclature, and length outside the US.

In *Brazil*[6] (and more specifically at UFSC) the public defense normally occurs in front of five examiners: the supervisor plus two internal and two external. The defense begins with a brief presentation by the candidate of the essential points of the dissertation, then, normally fifteen minutes are allowed to each examiner for questions and comments, and also fifteen minutes for the examinee's answers. At the end of the session, the committee gives marks or a grade in a private meeting, and the final results are publicly proclaimed. The candidate's advisor, who normally does not ask questions, is there to conduct the ceremony, introducing the examiners and giving a little background on the candidate's involvement with the program as well as academic achievements.

In *Britain* there is no public defense or grading of the dissertation. The *viva* or private oral examination is held between two committee members and the candidate (although there might also be an independent chairperson). The examiners recommend that the dissertation be awarded (or not) to the appropriate university or institution committee. Any required revisions must be completed before the degree is awarded (Hartley 2000, p. 28).

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[6] It is necessary to comment here that there is a great deal of departmental variation in relation to how the ceremony is conducted across different faculties. For instance, I have recently attended a dissertation defense at the Nursing Department, where prior to the "public" defense, there was a three-hour closed section with the examiners (from 9am to 12pm) to discuss the technicalities involving the research. In the afternoon, there was a public presentation of the research to the academic community, friends, and family, but no questions were asked. After the candidate's presentation the chair asked the committee members to briefly state why they had approved the dissertation.

It is interesting to note here that there has been particular interest on the British viva because it stands in marked contrast to other non-British education systems (e.g. North American and continental European countries). Whereas in North America and continental Europe the dissertation is normally examined by members of a committee who have worked with the candidate for some time, together with other professors from other departments in the same university[7], in the UK the viva is not public, and as it was mentioned above, it is held between two committee members and the candidate. This public restriction has lead the British viva to be compared to an "ill defined limbo" (Wason 1974, p. 274), to a "holy cow; a paradigm" (Baldacchino 1995, p. 72), to the "process that is least exposed to the gaze of academics" (Tinkler & Jackson 2000, p. 174), and to "one of the best kept secrets in British higher education" (Burnham 1994, p. 30). Explanations for this "black box bias" (Baldacchino 1995, p. 71) are not difficult to propose. Burnham (1994, p. 31) succinctly describes his personal view of the viva:

> The candidate is ushered into the internal's office to shake hands with the external she/he may have cited (even revered) but in all probability never met. This is followed by approximately two/three hours of fitful conversation in which the candidate makes numerous gaffes and the examiners mechanically take turns probing areas that are often peripheral to the thesis but reflect their area of specialisms.

Some scholars argue that some examiners are frequently motivated by "non-academic agendas" (Tinkler & Jackson 2002, p. 90) or "subterranean agendas of values and ideologies" (Morley et al. 2002, p. 268), such as self-promotion, a desire to establish their intellectual superiority in relation to the candidate and his/her co-examiner(s), and the promotion of their own theoretical and/or ideological perspectives. Baldacchino (1995, p. 73), for instance, explains how this may come about

> Examiners may be more intent to impress, […] rather than (or in preference to) listening to and engaging with the student. Examiners may feel that their reputation is at stake, unless they

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[7] That is to say, there may be from three to six committee members at the defense, with no *one* voice, probably no external, previously completely unknown to the candidate, who may be taken to be an *all-powerful voice*.

somehow prove to be more knowledgeable or to be capable of prizing open argument; hence, an element of critique may be indulged in perfunctorily.

and Johnson (1997, p. 345) concludes that "as with gatekeepers to any community, examiners are most likely to pass theses which fit with their own ideologies."

The fact that the assessment procedures for the doctorate in the UK remain relatively unscrutinized appears to be a reflex of "strict rules on confidentiality, [which means] examiners' reports [and vivas] are seldom open to scrutiny or any form of quality control" (Johnson 1997, p. 334).

The Norwegian *disputas* are extremely ritualized events. Burling (1997) comments that the committee is composed of two *opponents* and a third member (normally the candidate's adviser) who does not question the candidate but who often serves an administrative role during the ceremony. Late in the afternoon of the day anteceding the *disputa,* the candidate is asked to give two lectures of 45 minutes each where the audience has the chance to ask questions. He comments that the lectures are introduced quite formally and they may attract up to 50 or more fellow students, faculty, friends and, of course, the members of the committee. He adds

> [t]he first lecture is on a topic of the candidate's own choice, sometimes on a subject related to the dissertation though not a part of the dissertation itself, but sometimes the candidate selects an entirely different topic as a demonstration of more breadth than a relatively narrow dissertation can show. You can expect this lecture to have been very carefully prepared, fussed with, even agonized over. It is a test of the student's ability to develop and present an interesting perspective on a topic of special interest to him or her, and to plan and present a scholarly lecture. The topic of the second lecture is assigned by the committee and given to the candidate three weeks before the event. It should have some connection to the student's previous work, but not be something that the student has specifically worked on before. It is a test of the student's ability to organize material within a fixed time and present it in an orderly way. You can be sure that the candidate has looked forward to receiving the topic with considerable apprehension, and that he or she has done little in the three weeks before the lecture except to work on it (Burling 1997, p. 9).

On the very next day, precisely at 10:15, the *disputa* begins. In Oslo, the place normally chosen for it is the auditorium where the Nobel peace prize is awarded once each year. If such is

the sumptuousness of the place chosen for a Norwegian *disputa*, we may expect nothing less

than an extremely formalized ceremony. In fact, this is nicely portrayed in the following

description offered by Burling:

> As at a wedding, the members of the audience rise as the participants enter, and they
> remain standing until the principals have taken their seats. […] Ideally the dean him- or
> herself should preside […] The representative of the fakultet *(faculty)* wears an academic
> gown. Male opponents are expected to wear dark suits, and women the structural
> equivalent of a dark suit. Candidates sometimes wear national dress *(bunad)*. The
> representative of the fakultet makes the formal introduction and asks the candidate and the
> first opponent to take their places. For the next hour and three quarters, the opponent will
> stand and direct the proceedings. Close to noon, when the first opponent has finished, the
> fakultet's representative brings the morning session to a close and announces when the
> afternoon session will convene. The audience rises once again, and the central characters
> of this drama march out. There is about an hour's break. The main actors have lunch
> together, and others seek sustenance wherever it can be found in the neighborhood. People
> then reassemble at the announced time and the second opponent leads the afternoon
> session, much as the first opponent did in the morning. Again the fakultet's representative
> formally closes the disputas and announces that a report will be given to the kollegiet (the
> governing body of the university) which will later formally confer the new title upon the
> candidate. The committee members file out for the last time, and there may, at last, be a
> chance to shake the hand of the candidate (Burling 1997, pp.10-11).

Towards the evening there is a very formal banquet (*doctors middag*) with usually

40 to 50 people where the candidate is both a guest honor and a host.

In *China* the defense committee typically consists of a chairperson (an external

professor) and six other professors, two or three of whom must be external to the

institution (Hartley 2000). The candidate defends his/her thesis for 40-50 minutes in a

public defense open to the entire university or institution. Following this there are 30-40

minutes for questions, starting with those from the committee but sometimes including

questions from the audience. The candidate and the audience then leave and the committee

discusses the thesis and the defense in private. They then vote in secret. The thesis has to

be approved by at least five of the seven members of the committee for the award of the

PhD to be recommended. This recommendation is made to a larger academic committee of

the university or institution - with perhaps as many as 15 professors - where it has to be

agreed by two-thirds of the membership.

Doctoral defenses are public in *France*. The candidate gives a presentation (usually 20-30 minutes) and is then examined by the external examiners for about 15 minutes before being asked one or two questions by each member of the examining panel (which might number up to seven people) and in some places also by members of the audience. After the questioning the committee retires, decides on the marks/grade, and then returns. The candidate is awarded the diploma and told his grade (Hartley 2000, p. 24).

According to Fortanet (personal communication), the *Spanish* defenses are normally held in medium-sized rooms with usually 10 to 20 participants, including the candidate's supporters (family, friends, faculty members and other postgraduate colleagues). She comments that the PhD dissertation "has to be in deposit for one month" and that access is granted to any member of the academic community[8]. As regards the committee board, Fortanet comments that:

> The candidate's adviser is not a member of the committee. There are five members, one of them is the President, then, there is a secretary and three more members. The members of the committee can either belong to the same university or to another university. They can even be members of foreign universities. The only requirement is that they must be PhD doctors. Usually there is one or two members who belong to the same university and the rest belong to other Spanish universities. The President is usually a senior lecturer, what we call "Catedratico", the highest level of professor at the Spanish university system. The other members are usually lecturers with a tenure. The department of the adviser approves the defense of the thesis, and a list of 10 PhD doctors, five of whom are proposed as full members and the rest as substitutes. The PhD committee of the university after considering a brief CV of the proposed members approves them and makes an official appointment.

The defense itself takes about two hours, with 30 to 45 minutes for the candidate to present her/his work and the committee members being allotted from 10 to 15 minutes to present their questions and/or comments. Questions and/or comments follow a strict order from the youngest to the eldest except for the President, who always speaks at the end. The candidate, then, can either answer each of the questions or answer all of them at the end,

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[8] Fortanet mentions that the academic community learns about this 'deposit' through signs that are placed in boards scattered throughout the candidate's department, but adds that the date and time of the defense is not made public. Inmaculada Fortanet is a senior faculty member at Universitat Jaume I in Castellon – Spain.

which, according to Fortanet, is more usual. When questions are over, the President thanks the members of the committee and the candidate, and then asks the audience and the candidate to leave the room. The committee meets during some minutes and reaches a decision as regards the evaluation of the thesis. Both candidate and audience are asked back into the room and the secretary announces publicly the verdict.

Surprisingly, in *South Africa* there are no such things as a PhD defenses. The reason for this, according to Diana Kilpert[9] (personal communication), is largely because South African universities normally do not have the financial means to bring overseas experts to conduct the ceremonies, specially with the unfavorable Rand exchange rate.

In *Germany* the structure and content of the doctoral defense varies between individual universities (Hartley 2000, p. 22). In many of the old universities, Hartley comments, the candidate has to complete a so-called *Rigorosum*. This is a two-hour session which consists of a one-hour oral examination in the candidate's main subject and a half-hour examination in each of the candidate's two subsidiary subjects, both of which have to be approved by the faculty. The oral examination is always attended by a third-person who keeps a written protocol of the proceedings. According to Hartley, in the newer universities this second part of the process to obtain a PhD often takes the form of a public defense. Here, he comments, the candidate has to give an oral presentation on a topic set by the faculty, followed by a question and answer session with the faculty during which the candidate has to defend the points he/she has made during the presentation.

Finally, in the *United States* two hours are usually set aside for the dissertation defense, the time and place of the defense being typically published beforehand. This is quite

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[9] Diana Kilpert is a senior faculty member in the Department of English Language and Linguistics at Rhodes University, Grahamnstown – South Africa. Her exact words to describe how she felt for not having the opportunity to defend her dissertation were: "It's a pity, because I would have enjoyed defending my dissertation"

a heavily instantiated genre, with tens of thousands of exemplars in any one calendar year[10].

Typically, the principal defense participants include a candidate, the candidate's chair or advisor, additional faculty members from the candidate's department, and one or more faculty members from other departments. As Grimshaw notes:

> Typically, the defense participants have views about appropriate evaluative criteria for both the written product (and the research it incorporates) and the candidate's performance in the defense proper as part of their stock of cultural resources; typically, the institutions themselves have normative charters of varying degrees of specificity and enforceability. These dissertation defenses vary somewhat from institution to institution, discipline to discipline, department to department; they collectively differ from defenses of fifty years ago and from those in the societies from which the practice was originally borrowed. A satisfactory answer to the question of how defenses vary over time and place is also an answer to the question of how social structure is generated, sustained, reproduced and changed. (Grimshaw 1994, pp. 444-445)

3.2 The systemic-functional view of *context of situation* in doctoral defenses in the US

Before I introduce what is understood as 'context of situation' in SFG, it is important to briefly highlight some of the basic assumptions underlying this powerful theoretic framework. Halliday's (1985; 1994) and Halliday and Matthiessen (2004) systemic-functional grammar has provided an important linguistic tool taken up by discourse analysts to scrutinize texts. Language is seen as social semiotics, that is, it is seen as a social process, as one of the possible systems of meaning that constitute human nature. Language, text and social context are intimately interwoven in the process of creating meaning, of organizing and building human experience. The lexicogrammatical forms of language are studied in relation to their

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[10] According to a survey titled "Degrees and Other Formal Awards Conferred" carried out by the U.S. Department of Education, National Center for Education Statistics, Higher Education General Information Survey (HEGIS), and Integrated Postsecondary Education Data System (IPEDS), from the 1970's up to 2001 (the last year it was possible to obtain statistical data) the astonishing number of doctoral degrees conferred in the US amounted to 977.212! If we divide this figure by three decades, we end up with a means of 32.500 doctoral degrees a year! In relation to the Brazilian context, I found that in three decades, the number of dissertations jumped from 107 in the biennium 1960-1961 to 3.142 in the biennium 1989-1990. Only in the biennium 2000-2001, the most recent for which I could obtain statistical data, a total of 4.842 dissertation had been written and defended in Brazilian universities (Instituto Brasileiro de Informação em Ciência e Tecnologia, 2003).

use to achieve social goals (Halliday & Hasan 1989; Halliday 1985, 1994; Eggins 1994, 2004; Halliday & Matthiessen 2004).

Halliday's grammar is called *systemic* because its heart lies in its system networks, which represent meaning potential from which the speaker or writer selects. In the generation of a particular linguistic unit such as the clause, features are selected from the appropriate networks for that unit to form a 'selection expression', which is then fed into a set of realizational rules linking systemic choice to its realization in terms of grammatical structure, lexical items and intonation.

Another crucial concept in SFG is its interpretation of *function*. SFG is a functional grammar in the general sense that it subscribes to the claim that languages are as they are because of the functions they serve in social communication, and so tries to motivate the shape of the grammar in functional terms. Nevertheless, it is in developing the concept of *metafunctions* that SFG really makes a distinctive contribution to functional approaches to language.

At this point, it is useful to provide a brief overview of the concept of metafunctions. Halliday and Matthiessen (1999) define them as follows:

> **Ideationally**, the grammar is a theory of human experience; it is our interpretation of all that goes on around us, and also inside ourselves. […] **Interpersonally**, the grammar is not a theory but a way of doing; it is our construction of social relationships, both those that define society and our place in it, and those that pertain to the immediate dialogic situation. […] **Textually**, the grammar is the creating of information; it engenders discourse, the patterned forms of wording that constitute meaningful semiotic contexts. From one point of view, therefore, this "textual" metafunction has an enabling force, since it is this that allows the other two to operate at all. But at the same time it brings into being a world of its own that is constituted semiotically. (pp. 511–512; emphasis added)

In its *ideational* function, language serves for the representation of the world outside and inside the language user: this is thus the content or representational function of language. In its *interpersonal* function, language serves to set up and maintain social relations, including communication roles such as questioner and respondent, and to express the language user's

own attitudes and comments on the contexts. In its textual function it enables the construction of situationally relevant and coherent passages rather than just a messy collection of sentences.

In SFG, then, the context of any situation is made up of three register variables, field, tenor and mode, which in the semantic stratum correspond to the ideational, interpersonal and textual metafunctions, as visualized below:
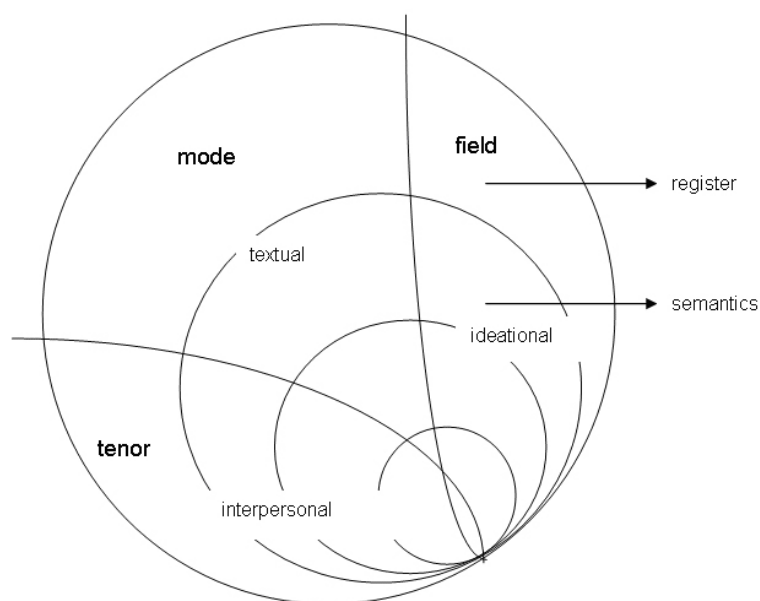
Figure 3.1 Context of situation in relation to metafunctions (after Martin 1992)

Figure 3.1 shows that the register variables of field, tenor and mode respectively determine the ideational, interpersonal and textual metafunctions of the semantic system, simultaneously interrelating one another.

Thus, one important facet of language, as advocated in SFL theory, is that it always takes place in a context. We do not merely know a group of vocalic signals or act as if we were walking grammars or dictionaries. We know language in the sense that we know how to use it; we know how to interact with other people, to select language that is adequate to the situational context we find ourselves in (Halliday 1994a).

Malinowski (1935) coined the term *context of situation*, a notion which was to play a

large part in Firth's (1957) thinking and, later, in Halliday's (1973, 1978). Malinowski's claim

was that in order to understand an utterance, we need to know not only the literal meanings of

the words, but also all the complex of social detail in which the utterance occurs. For systemic

linguists, the context of situation of any discourse type may be described by register variables

introduced in Figure 3.1. According to Halliday (1978, p. 31) "[t]hese three variables, taken

together, determine the range within which meanings are selected and the forms which are

used for their expression", in other words, how situational variables frame linguistic choices.

Let us return now to the context of situation of dissertation defenses. Given that we

have a fairly good idea of the situational context where doctoral defenses occur, it is

reasonable to assume that we may be able to anticipate *some* of the language that is likely to

transpire there. But precisely what do we need to know about the situational context of

doctoral defenses, or about any other discourse type, in order to make such anticipations about

the language we expect to find? The answer offered by Halliday is that we need to know the

field, the tenor and the mode of any discourse, because "collectively they serve to predict the

text" (Halliday 1978, p. 62). Halliday and Hasan (1989, p. 12) describe field, tenor and mode,

as follows:

> FIELD: refers to what is happening, to the nature of the social action that is taking place; what
> is that the participants are engaged in, in which the language figures as some essential
> component?
>
> TENOR: refers to who is taking part, the nature of the participants, their statuses and roles:
> what kinds of role relationships obtain among the participants, including permanent and
> temporary relationships of one kind or another, both the types of speech role that they are
> taking in the dialogue and the whole cluster of socially significant relationships in which they
> are involved?
>
> MODE: refers to what part language is playing, what it is that the participants are expecting the
> language to do for them in that situation: the symbolic organization of the text, the status that
> it has, and its function in the context, including the channel (is it spoken or written or some
> combination of the two?) and also of the rhetorical mode, what is being achieved by the text in
> such categories as persuasive, expository, didactic, and the like.

Thus, field, tenor and mode allow us to perceive the systematic relationship between language and its environment, which, in turn, can be of assistance for interpreting any discoursal situation as a semiotic structure. But let us once again return to our semiotic environment – that of doctoral defenses. Hasan (1994, p. 144) characterizes the social environment of the 1975 sociology defense she analyzed as a configuration of the following contextual variables:

Field = defense of dissertation on the sociological origins of female radicalism

Tenor = examiners: expert group of sociologists: chairman and colleagues. Examinee: mature age, experienced researcher. Social distance among participants: non-maximal

Mode = phonic channel: dialogic process. Spoken medium. Role of language constitutive

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Table 3.1 Hasan's (1994) contextual configuration of the 1975 sociology dissertation defense

Even though Hasan's conceptual configuration of the most significant contextual variables does provide a clear picture of what the semiotic environment of a US doctoral defense was, at least in 1975, I would like to propose an extension of such configuration to encompass further information. The conceptual configuration I present below is based on Halliday (1994b), on the seven MICASE dissertation defenses and on the 1975 sociology defense which constitute my corpus of analysis[11].

► **Field** = Defenses of doctoral dissertation. Research areas: a) cross-cultural social psychology, b) the jazz pianist Keith Jarret, c) the use of Artificial Intelligence to automate flight controls, d) fossilized plants in Ecuador, e) social justice and non-violence social change in the Environmental Justice Movement, f) modeling reacting gases and aftermath devices for internal combustion engines, g) gastric acid secretion models, h) the sociological origins of female radicalism

► **Tenor** = NATURE OF THE SOCIAL ACTIVITY: institutionalized; AGENT ROLES: **Examinee**: PhD candidate (assumed role = convincing examiners of aptness for award of degree), **Supervisor**: Chair (assumed role = administrative: to get the committee to support in consensus the recommendation for the candidate's doctoral degree), **Examiners**: Senior Faculty (assumed role = assessment of candidate's qualification (knowledge + oral skills); negotiation of own views in order to arrive at a consensus), **Audience**: friends, colleagues, family; AGENT ROLE RELATIONS: hierarchical: unequal power between candidate and examiners since these are already members of an academic *elite*; SOCIAL DISTANCE: non-maximal

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[11] These will be fully described in Chapter 5.

► **Mode** = CHANNEL: mostly phonic but also graphic (use of overhead projectors and computer software); MEDIUM: spoken with occasional reading; LANGUAGE ROLE: constitutive; PROCESS SHARING: dialogic

There are basically two differences between my outline and that of Hasan. Firstly, as far as tenor is concerned, I have included the notion of power relationships, which may be a part of what she terms agent role relationships. In doctoral defenses, unequal power relations are manifested primarily by the statuses of the participants: on the one hand we have experienced senior faculty members and, on the other, graduate students craving to become members of a select club. This unequal power among the participants, in conjunction with the social and institutional constraints of the genre will most likely grant the discourse roles of questioners, doubters and contradicters to the committee members, and those of defendants, or responders, to the candidates. Furthermore, it is these discourse roles, which stem from unequal power relations among the participants that are likely to determine the selection of most options in the Mood system.

Secondly, in relation to the mode of discourse, I have included a channel of communication which probably did not exist back in 1975 – that of computer-aided visual communication. The use of non-linguistics semiotics, as pointed out by Rowley-Jolivet (2002) in an investigation of conference talks, helps to ensure that the most important elements of the message will be communicated. This can be achieved by a set of descriptive tools such as formulae, diagrams, photos and schematics, which by drawing on the shared visual knowledge of the participants help to speed up the communicative process. Rowley-Jolivet (2002, p. 20) also suggests that visual communication serves an interactive purpose in that it helps to set up a relationship with the members of the audience as well as to guide them throughout the presentation. The synchronic use of two channels – visual and verbal – comments Rowley-Jolivet, contributes to create a coherent discourse where logical relations are established visually and where matching relations are ensured through visual repetition.

Thus, to date, visual communication is an important organizational device which can be used to guide the audience, to compensate for the limited oral skills of the presenter, to facilitate interaction among the participants and to improve the quality of the presentation.

This section has attempted to show that doctoral defenses are associated with particular situation types which display particular configurations of field, tenor, and mode (corresponding respectively to the ideational, interpersonal, and textual metafunctions). More importantly though, a linguistic theory such as Halliday's grows and solidifies through its use – and the test of its worth is how well it enables us to talk about language and connect it to society. In the case of doctoral defenses, I believe that by utilizing the concepts of field, tenor, and mode we are able to obtain a 'bigger picture' of the language found in such ceremonies. This bigger picture enables the analyst (me or anyone) to work on the details without losing sight of the whole. In sum, in SFL the emphasis shifts from taking things apart to putting things together again in a broader perspective, the metafunctions serving as the theoretical concepts that enable us to understand the interface between language and what is outside language. In fact, it may be suggested that SFL aims at bringing language and society together. To do this, it has been designed to make it possible to look very closely at the grammar while at the same time keeping the social context in view. As Hasan (1999, pp. 52-53) draws our attention to "[M]uch of the complexity of describing language lies in maintaining both the social and the linguistic perspectives simultaneously, something that systemic functional linguists ideally attempt to do". (For further discussion on the usefulness of metafunctional concept see, for example, Halliday 1994a, pp. 33-36; Halliday and Matthiessen 1999, pp. 511-32). SFL is a very powerful theoretical tool for understanding the intricacies of language; nevertheless, we must realize that language is so vast and so multifaceted that we will never get to the end of the task of describing and explaining it no matter how much we try.

3.3 Characterizing the overall discoursive patterns of doctoral defenses

This section describes nine linguistic investigations which have been carried out on dissertation defenses. Out of these nine studies, seven are part of Grimshaw's (1994) book *What's going on here? Complementary Studies of Professional Talk*. These include:

a)   Theoretical and methodological suggestions for using discourse to recreate aspects of social structure – by Aaron Cicourel

b)   Segmentation and the control of a Dissertation defense – by Peter Burke

c)   Situation and the definition of genres – by Ruqaiya Hasan

d)   "so you say 'pass' … thank you three muchly" – by M.A.K Halliday

e)   The role and function of formulaic speech in conversation – by Lily Wong Filmore

f)   Humor in academic discourse – by Charles Filmore

g)   The politics of a conversation: Conversational inference in discussion – by Jenny Cook-Gumperz and John Gumperz

The other two studies described in this section are a chapter of John Swales' (2004) book *Research Genres* and an article recently published by Recski (2005) in the *English for Specific Purposes* journal. Since Burke (1994), Hasan (1994), Swales (2004), and Grimshaw et al. (1994) propose a structural configurations for the dissertation defenses they have analyzed, their findings will be further considered in Section 2.4.

In Grimshaw's (1994) book, the two sociologists (Cicourel and Burke) are interested in at least two questions: a) what is the relation of discourse structure to social structure, and b) how does discourse create/reflect emergent social structure/relations.

Cicourel (1994) is interested in investigating what we have to know about the contexts of production of discourse in order to see how it reproduces and/or modifies previously existing social structures. In relation to dissertation defenses he argues that the relevant contexts include not only the histories of social relations among the participants

(the ethnography of the interaction studied) and the state of shared knowledge in the disciplines the participants represent, but also the textual product at issue, that is, the actual dissertation. He is concerned to demonstrate that what is going on interactionally can be misunderstood if contexts are not properly described. He comments

> The historical conditions under which we undertake the analysis of discourse or textual materials must be established prior to any claims of cross-cultural and invariant or universal aspects of speech or paralinguistic and non-verbal data. The conditions under which we obtain the data become the first order of business. (p. 65)

In retrospective, Cicourel's chapter is a tentative set of guidelines for how we might develop some systematic procedures for the analysis of discourse materials. According to him, such guidelines are needed for using discourse materials to understand complex interpersonal social relationships and forms of social organization. The portions of transcript he analyzes are concerned with the way different sources of information (the text itself, the researchers knowledge and perception, and other sources) could be used to explain what he terms the "fairly bounded event known as the doctoral dissertation defense" (p. 89).

Burke (1994), in contrast, believes that answers to at least some questions about social structure/relations can be obtained by careful attention to an extended record of conversational interaction alone (i.e., with context of text but without context of situation). He asks, how is the text under investigation vertically integrated and coordinated (i.e., what are the principles of hierarchy – part-whole relationships?) and horizontally linked (i.e., what are principles of textual cohesion?)? How are these principles of textual organization related to principles of social organization or, more specifically, of social control? He argues the necessity of a distinction between "programs" or "agendas", which focus on interactional outcomes, and "scripts" or "schemata", which focus on the manner in which interaction is itself produced. He is concerned to demonstrate the importance, for control, of having an

agenda, a sense of where interaction is going, and a further sense of critical junctures for coordinating interaction. He goes on to argue

> Vertically, control operates when one segment serves as context in which other segments are interpreted. Without getting into the question of who can and/or should have such control or whether anyone will "go along with" the attempt of anyone to exert such control, the evidence is that whoever initiates such larger segments tends in fact to control the context of the segments contained within. (p. 124)

Burke notes that overall the chair of the defense controlled the larger segments, introducing them both with discourse markers (e.g., *so, well, okay*) and metacommunication (e.g., *Let's move on*) describing what was to occur. He also notes that during the questioning, the other faculty members used the same general format to introduce each question subsegment. This raises, according to Burke, the possibility that such a format for introducing segments may not only mark the segment as a higher-order segment, but may also mark the initiator as one who has control. In this regard, having control has at least two implications according to him: a) the context is set by the person in control, and b) the floor returns to the person in control for the next opportunity to initiate a turn. In this way, Burke comments, "control perpetuates itself" (p. 121).

In her chapter, Hasan (1994) begins with the observation that even in genres like the defense, which may have highly specified and shared agendas and scripts, it will nonetheless sometimes possible that discourse will occur which notably diverges from what is normally expected in a dissertation defense. She asks, how does the discourse produced in interaction reflect the constraints of the context of situation (the outcome of field, tenor and mode interaction)? How far can discourse diverge from the expected structure potential of the genre before situational contexts may be perceived as having changed? Can one change without the other also being redefined? She is concerned to demonstrate that a variety of considerations of, for example, *optionality*, fixed or variable order, singularity of occurrence, and so on, of elements must be specified in characterizing fields of discourse;

and, moreover, that even an ordinary activity such as a *chat* will manifest deeply patterned regularities. She argues that a distinction can be made between those subtexts which, while possibly divergent, are integrated into the main text and have the function of sustaining tenor and those (such as the dispute over gender discrimination, a recurrent issue in the 1975 sociology defense) which may be tenor-altering and do not contribute to the completion of the ongoing activity (i.e., the defense).

Hasan (1994, p. 167) concludes by arguing we need to have sufficient contextual information to be able to construct the structure potential of a genre. She goes on to note that the "[g]eneric outline cannot be arrived at by simply looking at *mode*, or *tenor*, or *field*: the three together constitute the significant contextual construct providing sufficient information about the nature of the discourse type that can appropriately unfold".

In his chapter, Halliday (1994b) starts from the premise that, as outsiders, analysts can never participate in the shared meanings generated by the creators of text. That caveat acknowledged, he tells the reader that he views the text as an instance of a particular register and from the orientation of a grammarian. From that perspective he investigates the effects of particular situation types and the settings of the register variables of field, tenor, and mode. He then shifts the analysis to how the pragmatic ends of discourse affect the microstructure of that discourse and how the participants employ resources of the grammar (e.g., clauses complexes, thematization, and modality) in pursuit of their own, more immediate ends (e.g., to change topics and to express judgments of probability/usuality and/or obligation/inclination). Halliday argues the necessity of focus on word selection for understanding the process through which text and context are mutually generative, and maintains that all texts are performative and that discourse both is and reproduces macrostructures. This is nicely capture when he states that

The text before us [dissertation excerpt] exemplified the power of discourse to change the environment that engendered it. In particular, Lee [PhD candidate] emerges from the text as a changed persona; and in the process, her relation with all the others has undergone a change. We might want to think of the entire text as a kind of expanded performative: "we dub thee PhD". But this would obscure a more fundamental point, which is that *every* text is performative in this sense. There can be no semiotic act that leaves the world exactly as it was before" (Halliday 1994b, p. 200; emphasis on the original)

As regards the deployment of modality (my main concern in this dissertation), in the 10-minute stretch of text he analyzed, Halliday argues that modulations appears as a significant feature in the evaluations of the dissertation, which are essentially judgmental. Since there are scholarly norms and expectations involving both the written product and the oral presentation, the grammar of obligation expresses this characteristic, both directly in instances such as *should you have examined…?*, and symbolically as in *she ought to be commended*, where the obligation is on the committees' part – they have the duty to commend her, but the motif of the maintenance of scholarly norms is clearly present.

Regarding modalizations, Halliday maintains that they characterize especially those parts of the discourse involving some degree o interpersonal negotiation: the examiners expressing their views to arrive at a consensus. Halliday suggests that "the extended use of modalization allow it to function as an armistice, terminating the preceding encounter while at the same time providing a foretaste of what cold war that is obviously going to come" (ibid, p. 195). Here he is referring to the fact that the committee board, after having sent the candidate away and having gone through deliberations, is now ready to recall the candidate and give the final verdict.

The formulaic language investigated in Lily Wong Fillmore's (1994) chapter includes clichés (e.g., *be my guest*) as well as idioms (e.g., *a shot in the dark*) and speech routines (e.g., *okay, let's move on*). She locates her concern in an important issue of language learning. She asks: what is formulaic speech and how can it be identified? How can formulaic language be characterized as an element of speakers' linguistic resources (i.e., to

what extent is formulaic language a matter of "rules knowledge" and to what extent "item knowledge")? What is the function of formulaic language in speech production? She argues that formulaic language cannot always be identified because new formulae are invented, because new uses of old ways of saying things are found, and because some individual speakers have their own special stock of formulaic language. She is concerned with the relation between formulaic language and fluency in unplanned discourse, seeing this relation as closely linked to the question of what has to be acquired in order to make easy use of language.

Wong Filmore concludes that there is the possibility that formulaic expressions are created freely by the speakers "exercising their grammars in the construction of sentences that express their intentions" (p. 263), but that it is much more likely that these expressions function as set units which are kept ready for use by the speakers in the interaction. Formulaic language, she argues, play an important role in conversation in that they provider speakers "with handy, ready made references to the things they need to talk about, and allow speakers to talk without having to construct everything form scratch" (p. 269).

Toward the close of the 1989 volume, Grimshaw has a section entitled "An Unaccounted for Empirical Finding", where he discusses what he believes to be certain stylistic oddities and inconsistencies in the defense he had so meticulously examined. He observes:

> It does seem possible, however, that there are speech events which are defined as somehow simultaneously formal and informal - formal because of institutional constraints and the importance of the business at hand, informal because of the nature of interpersonal relationships among conteractants. I have a hunch that this defense constitutes such an event, one in which considerations of "official" goals and setting interact with the character of personal relationships to define the situation as "serious but informal." If this is true, mutual selection of a "mixed" variety is itself metaphorical, simultaneously signaling and reinforcing joint acceptance of the situation defined. The frequency of such varietal mixes can only be determined by looking at other speech events characterized by different ends, degrees of "officialness", and interpersonal relations. (Grimshaw, 1989, pp. 522-523).

However, as Swales (2004, p. 149) brings to our attention, this mixed variety style, with its combination of formal and informal phraseology, with its blending of "technical jargon" with "the contractions and hesitations of on-line everyday speech", ends up being "broadly characteristic of academic speech as a whole". For this reason, Swales proposes that the register found in doctoral defenses needs to be characterized in its own terms, and not in terms of "some odd collection of heterogeneities". He goes on to say:

> In fact, what we see here is the performed and recurrent proliferation of academic personae, be they candidates, committee members, speakers or questioners, who do not want to "talk like books" and yet who, when speaking, are "on show" as careful and thoughtful human beings; who are repositories of expertise and yet […] capable of humor; and who are able to wear their scholarship sufficiently lightly so as not to alienate the other participants and whose reactions to their own utterances they (usually) closely monitor. (Swales, 2004, p. 149)

Some part of this is captured in the Cook-Gumperz and Gumperz chapter in Grimshaw's (1994) book where they explore the ability of the participants of the 1975 sociology defense to "use conversational strategies to make themselves understood and to achieve communicative goals" (p. 375) in this particular social setting. The central argument put forward by Cook-Gumperz and Gumperz (1994) is that there maybe ways in which by managing the articulation between formal and informal phases in a dissertation defense we can perceive how the participants manage to negotiate what they know, how they appear to know what can and what cannot be said, how their information is to be presented and in what tone. The conclusion reached by the authors is that the overall goal of a doctoral defense is to "reach an agreement on the quality of the dissertation under consideration by the group without jeopardizing existing interpersonal relations" (p. 393). Basically, it appears to me that, as the social distance among the participants in a defense decreases, so can the expression of a relaxed attitude. Hence, in doctoral defenses, where the participants are normally long-term members of the same academic community, naturally we would expect to

find a fairly high degree of informal language interspersed with both technical jargon and ceremonial language.

In his chapter entitled "Humor in Academic Discourse" in Grimshaw's (1994) book, Charles Fillmore explores episodes in the 1975 sociology defense which caused laughter among the participants. He describes humor as being "an expression of the collective experience of the participants" and comments that it "receives response only from those who share common concerns" (p. 272). Given that a dissertation defense is not first and foremost an entertainment, Fillmore (1994, p. 273) suggests that the types of humorous episodes that take place during such rituals are, by and large, a "*diversion* from the ritual's main purpose" (original emphasis).

In order to examine a number of dimensions along which he could contrast the instances of conversational humor that emerged in the 1975 sociology defense, Fillmore (1994, p. 274) established five parameters of description, namely: (a) the conversational *maneuvers* the humorist performs in saying something funny; (b) the *target* of the humor; (c) the *theme*, or issue which gives a humorous remark its point; (d) the *motive* the speaker may have had for making the joke; and (e) the humorist's *manner of participation* in the defense. Fillmore concludes by suggesting that usually the humorists' conversational goals are: to participate the most they can without boring the other participants and making their contribution somewhat worthwhile for the others; to get in with others so that they will like, perceive how clever they are, and respect them; show that they are no threat to them and try to amuse them; and show that they are not affected when their own esteem is threatened by ridiculing the opponent or by displaying a mood which is incompatible with their supposed loss of face (p. 308).

In investigating four contemporary defenses recorded at the University of Michigan, which are part of the MICASE, Swales (2004) suggests that instances of humor may have all

sorts of different origins, such as anxiety, embarrassment, relief or repair. Like Fillmore (1994), Swales chooses to concentrate primarily on places where laughter is generated by something said[12]. He suggests that the initial segment of a defense, or what Grimshaw *et al.* (1994, p. 52) have termed "settling in", heartens the interactants to use humor as a means of easing the tension, creating a non-confrontational type of atmosphere, and/or making the ceremonial aspects of the genre seem less formal. He, nevertheless, disagrees with Fillmore in relation to humor being present in defenses as a "diversion from the ritual's main purpose" and suggests that humor is normally used

> to lubricate the wheels of the genre, so that discussion proceeds in an informal atmosphere of solidarity and co-operation ("we are all human beings here"), but yet is structured to explore seriously the relevant issues in both considerable depth and breadth. (Swales 2004, p. 170)

It may be argued, based on the brief discussion of some of the role(s) of humor in doctoral defenses offered above, that recognizing what counts as humor or not is not an easy task. This is so for the simple fact that the detection of the speaker's linguistic play puts the analyst at risk of being wrong, given that the observed linguistic play might be a characteristic of the speaker's parlance unknown to the analyst, or a solemn attempt to make use of the resources of the language – to shape language to achieve something communicatively that was not initially intended to be achieved. The context often allows for the recognition of humorous intents; however, they might not be so easily recognizable in the case of a successful unsmiling face.

Finally, Recski (2005) investigates the discourse of PhD candidates in two dissertation defenses (Biology and Psychology). He attempts to show (a) that levels of modal certainty are an important characteristic of the discourse of PhD candidates, and that they work together with hedging to maintain the student's face, and (b) that in PhD defenses interpersonal meanings habitually spread themselves through the clauses functioning as a means to

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[12] This is transcribed as ((laughter)) in the 1975 sociology defense, and <SS LAUGH> in the MICASE.

announce the tonality and force of the propositions that are being made as well as to foreground the attitudinally salient information and background ideational content. The modal features investigated in his study include: modal auxiliary verbs, modal adverbs, lexical verbs, conditional clauses, nouns, evaluative adjectives, degree words, quantifiers and metalinguistic comments.

In discussing his results Recski suggests that parallel to the strategy of tentativeness or low commitment, candidates also make use of strategies to accentuate their own certainty. He suggests that this latter strategy is at least as important as the former one and that in fact, it is closely linked to it. He notes

> When candidates avoid giving direct answers to difficult, and at times face-threatening questions, they nevertheless try to have relatively long turns, in which they wish to reinforce their own points of view. In the DDs [dissertation defenses] discussed above we find many items expressing strong commitment towards the candidates' main propositions, together with an accumulation of items expressing a negative attitude towards aspects that go against their propositions. (2005, pp. 18-19)

Recski points out that since the modal devices he investigated occur in combination with one another, their effect is therefore cumulative. Thus, he argues that in this way a prosody is formed unfolding in numerous ways along the transcripts. This prosody, in turn, reflects the candidates' strong commitment to the validity of the propositions, and this meaning is amplified by being selected recurrently.

Recski (2005, p. 21) concludes that the modal prosody in the discourse of the two candidates he investigated "was typically 'confident certainty', since the speakers' purpose was to convey an image of reliability and knowledgeability". Contrarily, the author comments that when candidates are faced with challenges from the committee members which might be negative from their point of view, the modality they employed appears to be "low degree of commitment". In sum, the author suggests that three major functions of modal expressions have appeared in the transcripts he meticulously investigated (p. 21):

(a)   A high degree of commitment to the truth value of a proposition reflects the candidates' aim to convince others of the truth of a debatable point of view.

(b)   Modal choices are linked to the candidates' engagement with the proposition and also to their degree of knowledge. When the candidates' attitude towards the state of affairs expressed in the proposition is positive, strong commitment will accompany the ideational choices; when the attitude is negative, weak commitment will aim to play down the importance, relevance, etc. of the 'unwelcome' argument.

(c)   Modal choices are linked to the candidates' role in the discourse. When they are confronted with face-threatening questions which they have to deal with, hedging and uncertainty features reflect a position of 'defendant'.

3.4   The typical structural organization of doctoral defenses in the US

In the Multiple Analysis Project (MAP)[13], three scholars (Grimshaw et al 1994; Burke 1994; Hasan 1994) propose an outline structure for the 1975 sociology defense they have analyzed. The rest of this section is dedicated to review these three outlines and place them together with a more contemporary view, that of Swales (2004), of how a dissertation defense may be structurally organized, at least in the US. This structural overview of the genre shall give us both a starting point and shall allow us an opportunity to see the obligatory as well as optional structural aspects of this particular and important academic spoken genre.

Grimshaw et al. (1994, pp. 52-53) provide a description of the 1975 sociology defense proposing a division into four major segments:

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[13] The MAP is an undertaking of the Committee on Sociology of the Social Science Research Council at the University of Indiana. The main goal of the project was to have a comprehensive study in which representatives of different disciplinary orientations and different theoretical and analytic perspectives within the several disciplines concurrently investigated the same speech event.

Opening segment ↓	["setting in"; outline of procedures by the chair, brief narrative statement by the candidate, summary of the dissertation]
Defense Proper ↓	[long segment, typically about an hour, ordinarily committee members take turns in asking questions, but flexibility usually accepted; towards close candidate may be asked about future plans and prospects]
In Camera Segment ↓	[typically quite short, committee sends candidate (and others) out of the room to evaluate dissertation and the oral defense, usually a pass with some written revisions required]
Closing Segment	[Candidate (and others) return; congratulations (sometimes qualified and contingent), necessary bookkeeping (signing forms etc); leavetakings, often quite extensive]

Figure 3.2 Grimshaw et al's outline of the 1975 sociology defense

According to Swales (2004), the advantage of Grimshaw et al's (1994) outline lies in its directness and its simple format. Nonetheless, Swales hypothesizes that if such outline has a weakness, it would appear to be related to the superficial specification of the long *Defense Proper* segment.

The sociologist Peter Burke offers a different outline of the 1975 sociology defense. Burke (1994, p. 100) divides the ceremony into five stages, which I presented diagrammatically below:

Introductory Background ↓	[personal background of Lee; review of the dissertation]
Questions ↓	[A. Pat → B. Sherm → C. James → D. Pat → E. Lee]
Assessments ↓	[A. James → B. Sherm → Pat (1) → Pat (2)]
Interlude ↓	["filler" conversation while the chair collects the candidate]
Wrap-up	[Signing; further questions from Pat]
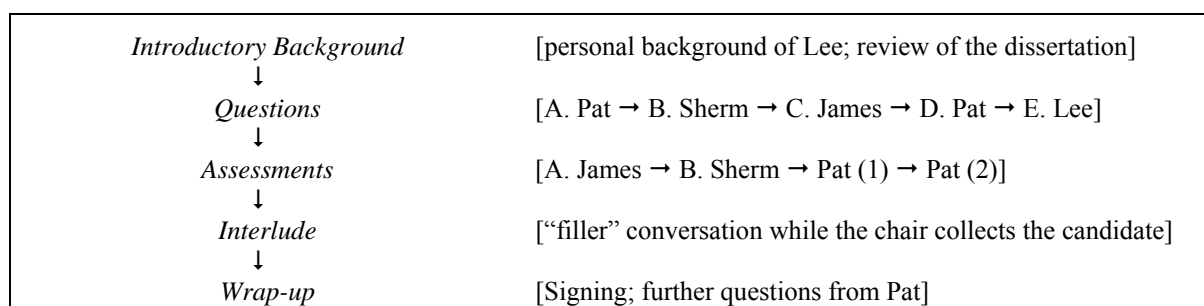
Figure 3.3 Burke's outline of the 1975 defense

Some differences as well as similarities emerge when we compare Figures 3.2 and 3.3. For Burke, the *Interlude* constitutes a distinct stage, whereas Grimshaw et al. integrate it into the *In Camera* segment. When commenting on this structural difference between Burke and Grimshaw et al., Swales (2004, p. 153) proposes that

> Burke does this because the Interlude is longer than customary since the candidate had gone in search of something to drink in a building unfamiliar to the participants, rather than hanging (nervously) about in the corridor outside the defense room and thus immediately "on call".

More importantly, Swales contends, "Burke's structure is much more focused on the roles of the individual participants" (p. 153), as we can see in the "rounds" of questions in the second segment.

In her chapter in Grimshaw's (1994) book, entitled "Situation and the Definition of Genres", Hasan describes the outline of any discourse type as:

> an overall plan, a general formula, which is capable of specifying (a) what *elements*/parts must/may occur in each and every instance of a particular discourse type; and (b) how these various elements stand in relation to each other. […] The construction of an outline – a generic structure potential – is bound up with the identification of the members of that genre, the assumption being that all members of a given genre will always possess certain elements in common. (Hasan 1994, p. 128-29; original emphasis)

Perhaps, the most important element, shared by the participants of a dissertation defense is the fact that all of them will cooperatively engage (one assumes) in the completion of a social activity. What this means is that they are moving towards a goal and that the completion of such goal requires that they go through specific stages. Hasan (1994, pp. 140-141) suggests that if we add the notion of movement towards a goal into the "nature of the social activity", viz. its *field* of discourse, we should be able to "isolate [the] significant stages" of such activity. In the 1975 sociology dissertation, she was able to reconstruct the following fourteen stages (parentheses indicate optional stages):

Table 3.2 Hasan's (1994) Inventory of significant stages in 1975 sociology defense

(1)	(Greeting)	=	G
(2)	(Personal Introduction)	=	PI
(3)	Procedural Orientation	=	PO
(4)	Candidate's Preface	=	CP
(5)	Committee's Queries	=	CQ
(6)	Candidate's Enquiries	=	CE
(7)	Candidate's Dismissal	=	CD
(8)	Committee's Opinion	=	CO
(9)	Candidate Recall	=	CR
(10)	(Verdict Affect)	=	VA
(11)	Verdict Ratification	=	VR
(12)	(Advice to Candidate)	=	AC
(13)	Task Closure	=	TC
(14)	Leave Taking	=	LT

Hasan (ibid, p. 142) suggests that every single stage of a doctoral defense "is an element of the structure of that activity, in the sense that each stage contributes to the completion of the activity". Nevertheless, she proposes that providing an outline for any discourse type involves more than just offering an inventory of potential elements. She claims that "[i]n order to see an outline clearly, we need also to show how the various elements may construct a structure", and suggests that one should investigate if such elements are constrained to occur in a particular order. The results of such investigation, as Hasan (ibid, p. 143) proposes, should allow us to see that:

> The outline of a discourse type – its generic structure – is *not a rigid plan*, permitting no variation; rather, texts belonging to the same genre *can* display variations in outline *within a limit* that is specified by the generic structure potential (my emphasis).

If we return to Table 3.2 then, we notice that four stages are optional, namely, G, PI, VA and AC. The reason why G and PI can be regarded as optional, in line with Hasan (ibid, p. 144), is because "the participants need not be perfect strangers"; if this is the case, G and PI

may be regarded as unnecessary. However if there is a great social distance among the participants, i.e., some of them may be seeing each other for the first time, G and PI will be obligatory stages in the social activity. AC may also be regarded as optional on the grounds that the candidate may have had such an outstanding performance that there is no need for further advice. VA may also be an optional stage because, as Hasan (ibid, p. 146) puts it, "the completion of the activity of defense or its legitimation does not depend upon the candidate's being congratulated for success or commiserated for failure". On the other hand, Hasan (ibid, p. 145) claims that PO is an obligatory stage because of "the near-legal nature of the activity", that is to say, even though the participants are all acquainted with the procedures involving the genre Ph.D. defense, "the candidate's interests have to be seen to have been guarded by presenting an overall plan of the proceedings which involves the candidate in putting up his or her defense".

In sum, Hasan (ibid, p. 147) claims that a doctoral defense is "an activity whose goal is the legitimation of the status of an emerging scholar", and that such goal is achieved "at the stage called Committee's Opinion, which is concerned with arriving at a concerted verdict regarding the candidate's merits." The stages that follow the CO are, using Hasan's terms, mere "formalities".

Hasan (ibid, p. 146), then, makes the following generalizations as regards the generic structure potential of the 1975 sociology defense:

a) all obligatory aspects of the *structure potential* are related to the *field of discourse*;

b) optional elements are irrelevant to the generic identification of a discourse; by implication *field* would emerge as the most relevant situation variable where the notion of *genre* is concerned;

c) optional aspects of the structure are related to the *tenor* and *mode* of discourse;

d) by implication, *tenor* and *mode* are more sensitive to the construction of social relations;

e) the optional elements present in one generic structure potential may also be found in some

    other generic structure potential; but that the obligatory elements are not so shared across

    two (or more) distinct generic structure potentials.

What Hasan is postulating with these sets of generalizations regarding the structure of

dissertation defenses is that all texts falling within this genre will display an outline, a *generic*

structure potential, which is some permitted variation of the overall outline.

On the basis of the MICASE data, Swales (2004) proposes a rearrangement of

Grimshaw et al's original structural model of dissertation defenses. Differently from

Grimshaw et al's structure, Swales adds to the *Preliminaries* an early *In Camera*[14] session,

noting that this is a common practice, at least in the US, and that it helps to "form a natural

boundary between the Preliminaries and the Defense Proper" (p. 159). Swales then builds into

the structure the idea of 'rounds' and highlights the importance of paying special attention to

the longest segment – that of the Defense Proper. The resultant outline picture proposed by

Swales can be seen in Figure 3.4 (parentheses indicate optional moves):

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[14] Of the fourteen Ph.D. dissertation defenses I had the opportunity to attend while I was in Ann Arbor studying at the University of Michigan; only four displayed this so-called "early in-camera" segment. The purpose, indeed, in all three was for the committee members to reach a consensus, prior to the candidate's presentation, in relation to the flow of events during the ceremony.

Part A   *Preliminaries*

Greetings
↓
(Personal Introductions)
↓

early In Camera → ⌈ Chair asks candidate and any audience to leave;
     | Committee reviews evaluations and agrees on procedures;
     ⌊ A member recalls candidate and any audience

Part B   *The Defense Proper*

(Chair summarizes agreed procedures)
↓
Candidate attempts a presentation (usually about an hour)
↓
(Rounds of questions by the members)
↓
"Free" questioning by the members
↓
(Questions or comments invited from candidate and/or audience)

Part C   *In Camera Session*

Part D   *Closing Segment*

Candidates (and others) return
↓
Results indicated with congratulations to the candidate
↓
(Discussion of what more needs to be done)
↓
Necessary book-keeping; signing forms, etc
↓
Leave-takings (party arrangements, photos, etc)

Figure 3.4 Structure of US Dissertation Defenses (Swales 2004, p. 160)

In the MICASE project, *parts* of seven recent doctoral defenses in the fields of Psychology, Musicology, Electrical Engineering and Computer Science (EECS), Biology, Immunology and Microbiology, Mechanical Engineering and the School of Natural Resources (SNRE) have been recorded. The sociology defense recorded at the University of Indiana in 1975 contains all four major segments proposed by Swales above. Only the defense on EECS presents indications of an early *in camera* session in the *Preliminaries*. The beginning of this early *in camera* session appears when the candidate's adviser, clearly performing an administrative role, produces the following utterance

EXCERPT 1 [02:29 – 02:40]

Chair: so if you wanna fill that out um, the tradition is that before we get started, everybody else leaves and the committee meets
Candidate: oh it's on tape. yes, I'll be talking to you later

The beginning of the *Preliminaries* is commonly signaled by the chair introducing the

candidate and asking him/her to summarize his/her work as well as to give an indication as to

why the topic is of his/her own interest. For instance, the chair in the Biology defense starts

by saying

EXCERPT 2 [02:00 – 02:02]

Chair: here for Elizabeth Behenski, and I'm here to announce the, defense of um Beth's, thesis. [270-word comment on the candidate's background] so, I'm gonna let Beth go ahead.

similarly, the chair in the Musicology defense also handled the management of this initial

stage by stating some of the traditions in the department

EXCERPT 3 [04:13 – 04:38]

Chair: alright well, welcome, all of you, to th- I think we shoulda got a bigger room, but we didn't (SS LAUGH) know. uh, we'll start off the the defense the way that we, typically do in in the department is to have the candidate, make a brief statement about, his involvement with the topic of the dissertation. uh, so, would you like to, talk about that, [*Candidate*: yeah] very, briefly?

the chair in the Psychology defense, using a rather informal tone introduces his advisee and

invites him to summarize his research by saying

EXCERPT 4 [00:25 – 00:33]

Chair: okey-doke, uh well Kim Sook was gonna do another, very brief summary of what he's up to. uh to bring it all up on our screens...

likewise, the chair in the Immunology defense starts by giving a personal record of the

candidate and his involvement with the topic of the defense

EXCERPT 5 [06:45 – 13:04]

Chair: so good morning bright n' early for- for some mathematics this morning. um welcome to uh the thesis defense it's my pleasure to introduce uh Ian Joseph today he's defending his thesis in the

Department of Immunology and Microbiology, um before I introduce Ian what I'll do is give a little background so you can understand what he's been doing for the past six years here in Michigan [1.127-word comment on the candidate's background] okay, so without further ado I'll introduce Ian Joseph who's gonna talk to you today about a virtual study of gastric acid in Helicobacter infection

in addition to requesting the candidate to state the reason(s) which motivated his research, the

chair in the SNRE defense made sure he laid out the agenda for the defense and obtained

consent from the committee members

EXCERPT 6 [02:48 – 03:54] 🎤

Chair: what I'm gonna do is go through an agenda and have consensus on the agenda and then we will take the ball rolling okay. […] uh Scott's gonna give us a little background in terms of how you get interested in non-violence uh as a strategy for intentional social change followed by probably a twenty to thirty-minute presentation on the part of Scott, uh then there will be questions by the committee, by the committee, okay, followed by questions by the guest guests, and then that's followed by a a private meeting by the committee because we have to go through deliberations and then after deliberations we will invite Scott back into the room, uh and we will give him the results, uh and that's the agenda. any questions or any additions or any <P: 04> was the agenda okay?

At the beginning of the *Defense Proper* segment, candidates normally present the

study (about one hour), what was achieved with it, and possible implications. It is not

uncommon in the transcripts to find committee members interrupting during the candidates'

monologue. Such interruptions may be motivated for several purposes, for instance, one of the

examiners in the Psychology defense feels the necessity to clarify procedural aspects related

to the genre at the very beginning of the defense. Here the candidate is interrupted after his

first minute of presentation

EXCERPT 7 [02:36 – 03:10] 🎤

Examiner: c c-c- could i ask a procedure question? um, should we interrupt throughout, this or how do you how do you wanna proceed? […] I mean cuz there're various points of which, i think i might wanna want clarification and or comment on certain things

in the EECS defense, the first interruption is motivated by a need from one of the examiners

to clarify a set of tests called *task action pairs* (TPAs) which are going to be incorporated in

the *Cooperative Intelligent Real-time Control Architecture* (CIRCA) which is a system

designed by the candidate to control airplanes autonomously

EXCERPT 8 [11:20 – 12:01]

Examiner: do the um, tests overlap between different, um TAPs?
Candidate: uh no, the planner is set up so you can only choose one action for each state.
Examiner: so wait assume these tests are things like sensing. um
Candidate: yeah so so basically if you start with a description of a plan as, a list of states, that go with an action, then we basically pass that list of states into the I-D-three decision-making algorithm and it comes up with, tests that uniquely describe that set of states, versus all of the other states that you don't do that action in...
Examiner: okay so y- so any kind of overlap is handled by that process not by, [*Candidate*: right] not, when it's, not at scheduling time.

What normally follows the candidates' initial monologue are the questions brought up by the committee members which are usually mediated by the chair. For example, in the Biology defense, after the candidate has presented her research, the chair signals that the round of questions is on its way and informs the audience about a party after the ceremony:

EXCERPT 9 [45:46 – 46:08]

Chair: before we start questions I just want to remind those of you who may not have heard there's a um, party at my house this evening to um, celebrate Beth's defense and there's maps here it's in Saline so please take a map and um see us there about seven-thirty. and, does anybody have any questions?
Candidate: (questions?) yes Mark.

likewise, in the Musicology defense, the chair administrates the end of the candidate's preface and points out, rather humorously, that the candidate is ready to take questions from the committee members:

EXERPT 10 [13:32 – 13:46]

Chair: okay, alright well now we'll get down to the hard part. (SS LAUGH)
Chair: okay we'll go around the table and we'll uh uh, ask questions make comments, whatever, so Bob, you wanna start, with you?

The chair in the SNRE defense also signals that the candidate's initial presentation is over and that the floor is now opened to questions. Notice that he determines how questions are to be asked, that is, "one by one", each committee member will have his/her "space" to ask questions, the other examiners having the possibility to join in, in case they have related questions. Thus, by referring back to Figure 4, we notice that the chair in the excerpt below

allows for two of Swales' optional moves to happen: rounds of questions by the examiners

and questions invited from the audience

EXCERPT 11 [50:45 – 51-29] 🎙

Chair: thanks a lot for [*Candidate*: (xxx)] that uh informative presentation Scott [*Candidate*: sure] and so moving on to the next phase of the agenda, uh, the-, what I'd like to have happen is- and that is each faculty member will get a chance to ask Scott questions, okay, one by one, uh and uh if at any point any faculty member has a question related to, uh, the previous questions feel free to join in okay. but at least each faculty member gets some space, in terms of asking these questions. uh and then after we've got all gone around, have some (xxx) questions then we'll (xxx) to the audience (xxx) as well. so, uh does that uh feel okay with people?

The end of the *Defense Proper* segment and the indication that the *In Camera* session

is on its way is also typically signaled by the chair as excerpts 10 to 14 attest:

EXCERPT 12 [01:16:12 – 01:16:17] **Psychology Defense** 🎙

Chair: other questions? …um, okay, you wanna give us a couple of minutes then
Candidate: thank you [END OF TRANSCRIPT]

EXCERPT 13 [01:45:51 – 01:45:57] **SNRE Defense** 🎙

Chair: well let's have a couple of questions from the audience and then um bring about the closure um section

EXCERPT 14 [01:26:16 – 01:29:25] **Musicology Defense** 🎙

Chair: alright is there anything anybody else, really, wants to say? okay uh we'll ask all of you to leave [COMMITTEE RECESSES]

EXCERPT 15 [recording unavailable] **Sociology Defense** 🎙

Chair: okay why don't you go get a drink and there's a room up here y'know right at the head of these stairs that has comfortable chairs in it although I I mean I don't know how long we'll be but just so I can find you because this building is
Candidate: I'll be in the room at the head of the stairs

EXCERPT 16 [02:03:30 – 02:03:43] **Mechanical Engineering Defense** 🎙

Chair: … with this uhm I would uh want to ask the audience to please excuse us for a few minutes, it won't be long, my son is playing a soccer game so (SS LAUGHS) [END OF TRANSCRIPT]

The Musicology and Sociology defenses are the only ones in which the *Closing*

Segment has been recorded. Here we find traces of the necessary book-keeping and signing of

forms which constitute, as pointed out by Swales, part of a defense's final stage:

EXCERPT 17 [01:29:56 – 01:30:09] (candidate and committee members talking about the hardcopy of the **Musicology defense**) 🗣

S4: I brought the wrong version with me so I have to get you my uh (cover)
Candidate: okay so, okay
Chair: (xx) brought the wrong one, so he's gonna get, he's gotta give you his right one
S3: yeah this is, this mine
Candidate: does this stay with, okay
S4: oh okay (LAUGH)
Candidate: I just wanna know whose is whose
Chair: well here
S5: oh i put my name on mine.
Candidate: okay

EXCERPT 18 [recording unavailable] **Sociology Defense** (candidate returns to the room) 🗣

Chair: we have something for you to sign
Candidate: couple of somethings
Chair: yuh

Towards the very end of the *Closing Segment* in the Musicology defense we find a committee member offering the last breath of advice to the candidate. The comment regards a particular stylistic format that was misused by the candidate in his written work:

EXERPT 19 [01:30:45 – 01:30:53] 🗣

S3: and make sure you, make sure you use double quotation marks when you_ cuz in in in the first draft [*Candidate*: I yeah I've] I saw there were some times when you were using [*Candidate*: right] just single [*Candidate*: right] quotation marks
Candidate: I've tried to a- [END OF TRANSCRIPT]

When combined, the information on the US doctoral defenses allows us to see the overall structure of the genre with the typical stages involved in the accomplishment of a unique social practice: the legitimation of a new member in a targeted discourse community.

3.5   Summary

This chapter has shown that there are many differences in the perceived purpose of a doctoral defense. It has been suggested that a defense may be seen as an opportunity to verify authorship, as an institutional rite of passage, as a chance to examine how the candidate orally

handles critique and daring questions involving several aspects of his/her research, as a ritual which may range from celebratory to hostile, as a fairly typical ritualized activity where participants appear to be satisfying aspects of discourse and the culture-specific aspects of a defense.

Placing doctoral defenses into a broader geographical context, the chapter has also shown how these types of events may differ in terms of ceremonial procedures, levels of formality, nomenclature, institutional requirements, length, etc. outside the US.

By describing the register variables of field, tenor and mode (*context of situation*) in doctoral defenses in the US, an attempt was made to shed light on the systematic relationship between language and its environment. It has been argued that this type of contextualization can be of assistance for interpreting any discoursal situation as a semiotic structure.

The chapter has also reviewed the structural overview of the genre based on the views of four different scholars (Grimshaw et al, 1994; Burke, 1994; Hasan, 1994; and Swales, 2004) and it has been argued that such outline offers both a starting point and a chance to see the necessary as well as the discretionary structural aspects of this particular and important academic spoken genre.

In the next chapter, I shall discuss in detail the complex semantic domain of modality. Anchored on the SFL perspective on interpersonal meaning, Chapter 4 will provide the theoretical tools which are necessary in my attempt to unveil how the participants of doctoral defenses negotiate knowledge, power and solidarity with each other, and how unfolding modal prosodies contribute to that negotiation.

CHAPTER 4

The complex semantic domain of modality

> A language is a highly elastic multidimensional semantic space, and speakers move around freely within, stretching it indefinitely according to their needs. We might at any time hear something like *Well – I think that would probably be the best plan, wouldn't it*? (Halliday 1995/2005, p. 234)

4   Introduction

Whether we speak or write, the linguistic message conveys not only content, but also our relation to that content, both personally and socially, as well as our relationship to our audience, either implicitly or explicitly. Culturally, we have conventionalized the shape of particular genres; for example, buying bread at your local bread store involves certain linguistic conventions which differ significantly from those for giving directions or defending your PhD dissertation. Content and *the way chosen to express* it are invariably influenced by both the personal and cultural envelope in which the text is enclosed.

In Chapter 3, I have provided an outline of what this personal and cultural envelope might look like in relation to US PhD defenses. I have suggested that PhD defenses show formal and informal characteristics and that alongside passages of rigorous scientific reasoning, PhD defenses might be expected to contain many features of a conversational mode, reflecting the ongoing interaction between candidates, advisers and committee members. To gain a clearer picture of the deployment of interpersonal discourse in doctoral defenses, we need to investigate in detail the linguistic resources the participants employ to negotiate information and goods and

services; in other words, the interpersonal and interactional factors which shape how knowledge and knowing is displayed in these event-types.

The aim of this chapter is two fold: (i) to provide a general review of the literature on modality (Section 4.1); and (ii) to define and delimit the semantic domain of modality to be used as the analytical starting-point for the present work (Section 4.2).

In very simple terms, I should think it is pertinent to investigate the interpersonal features found in the dissertation defenses because together they enable the participants (candidate, chair, and committee members) to fine tune their propositions and proposals according to how explicit they want to be about where their assessments are coming from, how subjective or objective they want them to appear, how definite they are, how metaphorical and so on – they enable the speakers to negotiate their knowledge, ideological and theoretical assumptions, beliefs, academic norms and contribute in important ways to opening up or closing down dialogic space.

Nevertheless, it is important to draw attention to the fact that because of the complex lexicogrammatical and semantic nature of most modal expressions – but in spite of their homogeneity as a class, that is, they all express some kind of modality – any attempt to systematically classify and pin down *every single* modal expression is extremely difficult. What I am suggesting is that *I am not sure* that it is possible to say exactly what every single modal form *means* in any particular context of situation. In PhD defenses, such as the ones analyzed here, where the participants are trying to achieve simultaneously, I believe, the goals of arguing with academic dexterity on the research topic discussed; being sensitive to the face-needs of the other participants; qualifying assertions to encourage the flow of discussion, etc, then it may be too hasty to conclude that this form expresses A and that form expresses B. Speakers make use of the semantics and lexicogrammar of modal devices to say many things at once.

4.1   Modality and its semantic definitions

A great deal of work done on trying to define the concept of modality in semantics has been heavily influenced by modal logic and the notion of possible worlds, in which propositions and events may be seen as *real* or *true* (cf. Perkins 1983; Palmer 1986)[15]. Thus modalities such as *alethic* (relating to the notion of truth), *epistemic* (relating to knowledge and belief), *deontic* (relating to social obligations), *evaluative*, *boulomaic* (relating to desire), *casual*, and other modalities have been suggested by Rescher (in Perkins 1983). Of these, it is primarily *epistemic* and *deontic* modality that are central from the point of view of natural language and that are most frequently grammaticized in the system of English. Some researchers also distinguish a third type, commonly called *dynamic* modality, which relates to physical necessity and possibility (e.g. *He can run*; notably Palmer 1979 and Perkins 1983; Bybee et al. 1994, however, call this variety *agent-oriented* modality, and Halliday & Matthiessen 2004 call it *readiness*).

There are several partially conflicting definitions of epistemic modality (by far the most investigated). As was noted above, this modality is related to knowledge and belief. Yet many researchers involve the notion of 'truth' in their definition of epistemic modality. Thus Lyons (1977, p. 797) states:

> Any utterance in which the speaker explicitly qualifies his commitment to the truth of the proposition expressed by the sentence he utters, whether this qualification is made explicit in the verbal component […] or in the prosodic or paralinguistic component, is an epistemically modal, or modalized utterance.

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[15] Modality has proved a rather difficult area to delimit and conceptualize already at the level of semantics. Perkins (1983, p. 18) defines modality in a very broad way as "the qualification of the categorical and the absolute as realized […] within the code of language". Such a notion necessarily cuts across many grammatical categories and includes lexicogrammatical means as well. Indeed, considerable confusion and disagreement prevail in linguistic theory on how the semantic area of modality and the grammatical category of mood should be identified and classified in the first place.

Palmer variously refers to epistemic modality as an "indication by the speaker of his (lack of) commitment to the truth of the proposition expressed" and "as the degree of commitment by the speaker to what he says" (1986, p. 51), although the latter appears to be a much broader definition than the former. Coates (1990, p. 54) refers epistemic meanings to the speaker's confidence or lack of confidence in the truth of the proposition expressed in the utterance. And Bybee et al. (1994) argue that markers of epistemic modality indicate something less than a total commitment by the speaker to the truth of the proposition. As observed by Willet (1988, p. 52), such definitions are set in a context of formal logician's view that propositions are either necessarily true, necessarily false or contingently true. The notion of truth of propositions has almost been a *sine qua non* in semantic research on modality, but it is not necessarily helpful for a more interactionally-based study such as the present one. Indeed, some linguists have opted for a less rigorous definition. For instance, Perkins (1983, pp. 29-30) states that in their epistemic meanings the modals (i.e. the English modal auxiliaries) express the speaker's state of knowledge or belief or opinion about the proposition, while Holmes (1982, 1984) simply refers to epistemic modality as degrees of certainty. However, the types of epistemic modality most commonly distinguished by many of the above scholars are possibility, probability and inferred certainty, whether they make reference to truth in their initial definition of epistemic modality or not.

The relationship between the notions of epistemic modality and *evidentiality* has always been somewhat problematic. Evidentiality has commonly been understood to refer only to the source of knowledge and the type of evidence that a speaker has for making a claim or assertion. Where evidentiality fits in with epistemicity and which one is considered the superordinate category varies from one researcher to the next. Thus Chafe (1986), King and Nadasdi (1999) and Nuyts (2000, 2001) discuss evidentiality in a broad sense as attitudes towards knowledge, coding both the speaker's attitude towards the reliability of knowledge and his/her source of

knowledge or mode of knowing, and Biber and Finegan (1988, 1989) consider epistemic modality under evidentiality. Similarly Biber et al. (1999), Conrad and Biber (2000), Berman (2004), Silver (2003), Charles (2003) and Reilly et al (2005) include under epistemic stance markers, not just certainty, actuality, precision and limitation, but also the source of knowledge of the perspective from which the information is given. There is indeed evidence that epistemic modality and evidentials are related (cf. Bybee et al. 1994, p. 180, for example) and the dividing line between the two may be fuzzy. According to Traugott (1989), they also share a great number of similarities in their semantic development. The choice of one as a superordinate category over the other appears to be then almost a matter of terminological convenience.

As there are so many different ways that the concept of modality has been defined, some narrower than others, it is natural that there are other terms and concepts that come close to it, sometimes covering partly the same area of language use. Another very important concept that cuts across the area of modality is that of *hedges*. Like definitions of modality, those of hedges also vary a lot in scope. The use of hedge as a linguistic term goes back at least to the early 1970s, when Lakoff (1972) published his article *Hedges: A Study in Meaning Criteria and the Logic of Fuzzy Concepts.* Lakoff was not interested in the communicative value of the use of hedges but was concerned with the logical properties of words and phrases like *rather, largely, in a manner of speaking, very,* in their ability "to make things fuzzier or less *fuzzy*" (Lakoff 1972, p. 195). Nowadays, hedges are treated as realizations of an interactional/communicative strategy called *hedging.* Thus, many scholars (Rounds 1981, 1982; Banks 1994; Grabe & Kaplan 1997; Crompton 1997, 1998; Fortanet et al. 1997; Myers 1990; Curnick 2000; Hyland 1996a, 1996b, 1998; Salanger-Meyer 1993, 1994, 2000; Skelton 1988, 1997; Vartalla 1999; and Vassileva 2001; to name but a few), who discuss the role of hedges in scientific texts, see them as modifiers of the writer's responsibility for the truth value of the propositions expressed or as modifiers of

the weightiness of the information given, or the attitude of the writer to the information. According to them, hedges can even be used to hide the writer's attitude.

The concepts of modality and hedge thus overlap to a lesser or greater extent depending on their respective definitions. This connection is very clear in the case of modal verbs with epistemic meanings. When hedges are taken to be modifications of the commitment to the truth-value of propositions, for example the English modal auxiliary *may* is always listed as a typical example. Sometimes also the deontic meanings of modals allow interpretation as hedges (Thompson & Yiyum 1991). For example, in English the hypothetical *would* could be seen as a hedge because it makes an utterance non-categorical. Preisler (1986, p. 92) actually points out that "even when modal forms convey speaker-external meanings, these are often given interpersonal significance by the particular context in which they appear, usually as part of a tentativeness strategy". It seems possible to see the relationship between modality - mostly of the epistemic type - and hedges in two ways: either modality is the wider concept and includes hedges (which is my view on the matter) or the other way round, hedging is the umbrella term and modality a part of it.

Vagueness is another concept close to modality as it refers, among other things, to the use of expressions like *about*, *sort of*, i.e. expressions that denote the impreciseness of quantity, quality, or identity, which is very much like Lakoff's "fuzziness" (cf. Channell 1990; 1994).

As to the motivation for the use of modality, a lot of the discussion has concentrated on their use in spoken discourse, and the most frequently mentioned motivating factor is *politeness,* as defined by Brown & Levinson (1987). Brown and Levinson (1987, p. 13) drawing on Goffman (1967) suggest that the term 'face' encompasses two specific kinds of desires: the need not to be imposed upon (*negative face*), and the need to be liked and admired (*positive face*). They suggest that behavior which averts imposing on others may be labeled *negative politeness*, while behavior

expressing affection in relation to others may be labeled *positive politeness*. According to this approach, any utterance which could be understood as a stipulation or intrusion on another person's free will might be considered a *face-threatening act*.

Many scholars writing on the subject (Leech 1983; Brown & Levinson 1987; Heberle, 1997; Holmes 1984, 1995; Myers 1991; McLaren 2001; Bargiela-Chiappini 2003; Strauss 2004) maintain that *everybody* has face needs or basic desires. Simpson (1990, p. 74), for instance, points out that "modality, politeness and the presentation of information are crucially linked". Politeness, thus, appears to be a multicultural context-bound pragmatic concept, in the sense that it may be employed in different ways, under varied circumstances with distinct rhetorical effects. However, it is possible to criticize some of the earlier speech-act based treatments of modality in view of the approach and the method of analysis that they have adopted. Their tendency was to encapsulate a vast array of modal markers into a uniform description, rather than focusing on the range of interactional functions of individual items. Many of these studies are based on the widely acclaimed politeness taxonomy proposed by Brown and Levinson (1978/1987), which in turn is based on Goffman's notion of maintenance of 'face' as a necessary condition of in-teraction. In effect these studies seem to impose a top-down model on the data and attempt to include all the emerging functions under this overarching macrofunction. Such analyses are likely to ignore functions of modal items that do not conform to the idea of linguistic politeness and face-saving (Kärkkäinen 2003).

More recently, *stance* has begun to be regarded, not as static phenomena residing within individual speakers, but responsive to interactional requirements and social contexts within which speakers and recipients interact. Thus, the focus has moved from the individual speaker towards a more dialogic approach, and towards the *social construction of meaning.* Fox (2001) deals with grammatical evidentiality (i.e. information source) in English in the construction of authority,

responsibility and entitlement. She claims that evidentiality is employed by language users in constructing their authority to make particular claims in particular social interactions, and concludes that evidential marking is responsive to and constructive of the relationship between speaker and recipient.

Similarly, He (1993) also argues that modality points to the social construction of knowledge systems and of the relative discourse statuses between the participants in interaction. He studies modality in institutional discourse within the framework of interactive discourse analysis, drawing insights from conversation analysis. In academic counseling encounters, knowledge about institutional structures, roles and goals inhabits the details of the participants' movement-by-movement conduct, so that speakers modify their modal values according to several factors. Following Halliday, He divides modal operators (auxiliaries) and modal adjuncts into low and high categories: low modality is expressed by modals like *can, may, don't have to* and adjuncts like *I don't know, I think, I don't think* and *perhaps,* while high modality is conveyed by modals like *must, should* and *have to* and adjuncts like *I'm sure, certainly, of course* and *never* (He 1993, p. 510). Both students and counselors use high modality values when they are dealing with facts. Students use low modality values to make requests, to state personal preferences and desires, and to proffer solutions to their own academic problems. Counselors on the other hand resort to low value elements to suggest means, methods, and options to the students, as well as to give advice. Interestingly, He claims that when high-value modal elements are used by the counselors to give advice, these are often preceded by low-value modal adjuncts such as *I think* or *might* to mitigate the force of the advice, as in *Uh I think you should late-drop (.2) these classes* (1993, p. 522).

Finally, Appraisal Theory (Martin 1997, 1999, 2000a, 2000b; Martin & Rose 2003; Martin & White in press, White 2000, 2003) has been set up in SFL in order to account for

evaluative language in a systemic way. In appraisal theory, the various shades of evaluative meanings which can be expressed in language are classified into numerous types of subtypes, which are organized in a systemic network. An overview of systems which have been developed in appraisal investigations is given in Figure 3.1.

According to Martin and White (in press), appraisal theory

is concerned with the interpersonal in language, with the subjective presence of writers/speakers in texts as they adopt stances towards both the material they present and those with whom they communicate. It is concerned with how writers/speakers approve and disapprove, enthuse and abhor, applaud and criticize, and with how they position their readers/listeners to do likewise. It is concerned with the construction by texts of communities of shared feelings and values, with the linguistic mechanisms for the sharing of emotions, tastes and normative assessments. It is concerned with how writers/speakers construe for themselves particular authorial identities or personae, with how they align or disalign themselves with actual or potential respondents, and with how they construct for their texts an intended or ideal audience.

Thus, appraisal theory sets as its major goal to link various types of evaluative language to such a common semantic space, and it does so by modeling the organization of this space in a semantic system network, as shown in Figure 4.1. The lexicogrammatical means which are thus drawn together by the notion of appraisal, and which construe the options in this system network are extremely diverse, and range from grammatical to lexical, as shown in some of the realizations displayed on Figure 4.1.

Particularly interesting for the purposes of this study are some of the heteroglossic strategies found under ENGAGEMENT in the appraisal network in Figure 4.1. Informed by Bakhtin's and Voloshinov's notions of dialogism and heteroglossia, Martin and White advocate that all verbal communication, be it written or spoken, is always 'dialogic' in nature, because we always disclose in one way or another what has been said/written before, and at the same time we try to anticipate the responses of actual, potential or imagined readers/listeners. The authors then go on to say:

under the heading of 'engagement' [are] all those locutions which provide the means for the authorial voice to position itself with respect to, and hence to 'engage' with, the other voices and alternative positions construed as being in play in the current communicative context.
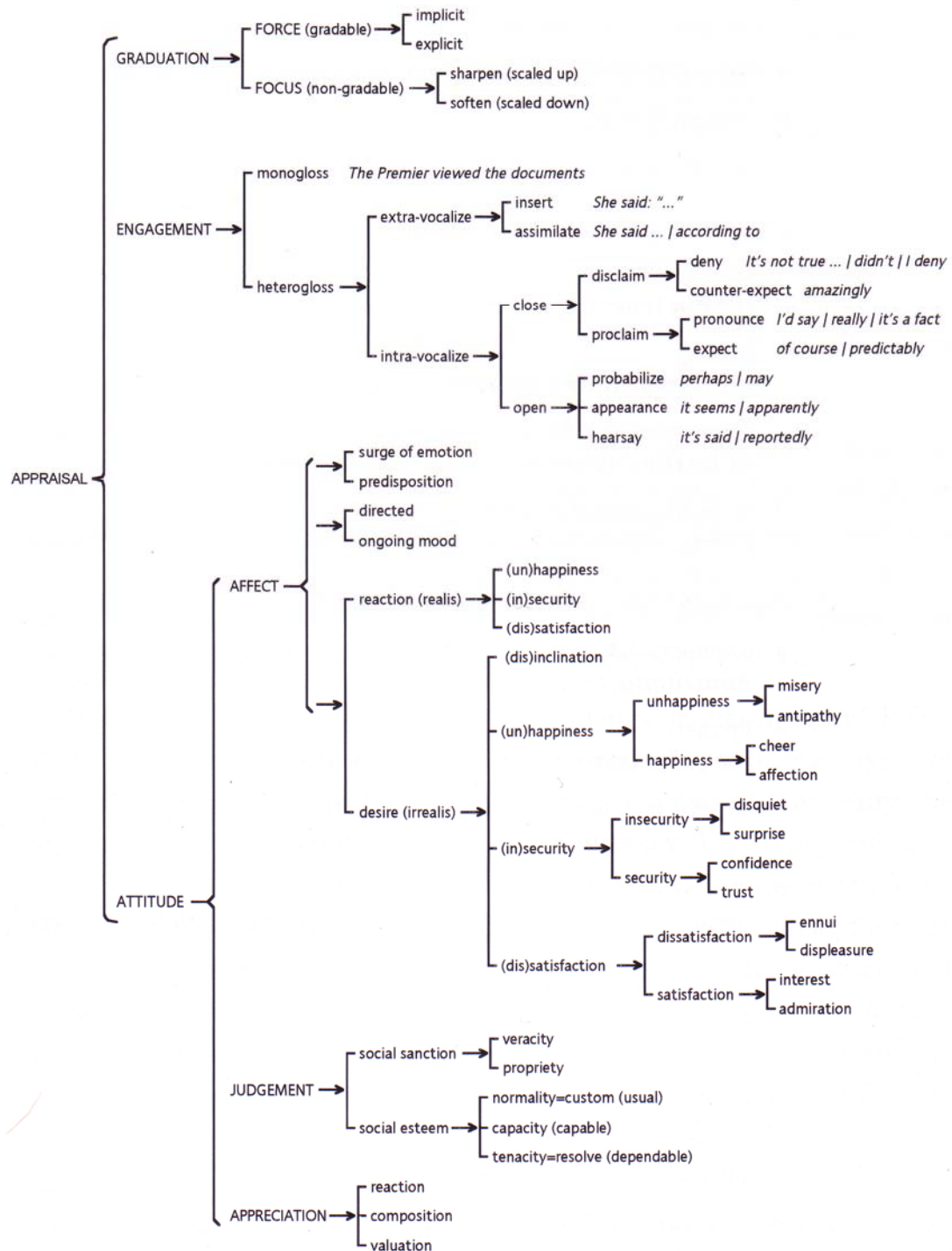
Figure 4.1 Appraisal network (based on Halliday & Matthiessen 1999, p. 67)

Under the label 'entertain'[16], Martin and White include a semantic domain which has conventionally encompassed epistemic modality, evidentiality, and modals of probability and certain kinds of interpersonal metaphors in SFL terms. The authors define 'entertain', as "those wordings by which the authorial voice indicates that its position is but one of a number of possible positions and thereby, to greater or lesser degrees, makes dialogic space for those possibilities". Martin and White then go on to say that expressions like *I think, it's possible* and modal verbs and modal adjuncts like *may, might, perhaps, possibly* not necessarily indicate a lack of commitment to the truth-value of proposition from the part of the speaker/writer; they suggest that under a dialogic perspective these locutions may be used

> to actively construe a heteroglossic backdrop for the text by overtly grounding the proposition in the contingent, individual subjectivity of the speaker/writer and thereby recognizing that the proposition is but one among a number of propositions available in the current communicative context.

Deontic modals (or modulations in SFL) like *must* and *should* are also included under the label 'entertain' in Martin and White's forthcoming book. The authors suggest that these modals construe the situational context "as heteroglossic and as opening up dialogic space to alternatives". They suggest that when speakers opt out of a bare imperative (monoglossic option), which does not allow for dialogic space, and choose a modal verb, this may be seen as an heteroglossic strategy since "[t]he 'directive' is […] construed as contingent, as individually based and accordingly the speaker's role as a participant in a dialogic exchange is acknowledged". Martin and White's dialogic view on epistemic and deontic modality will be considered in Chapter 7 as a means to complement the view of modality proposed by M.A.K Halliday discussed in Section 4.2 below.

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[16] Martin & White (in press) have changed the label 'open' in Figure 4.1 to 'entertain' in their forthcoming book.

Finally, it is mandatory that I refer to two outstanding studies which have been carried out at the Departamento de Pós-graduação em Letras/Inglês here at the Universidade Federal de Santa Catarina. The first, Heberle (1997), investigates textual and contextual features of editorials in women's magazines published in Britain. Among other features, Heberle analyzes lexicogrammatical exponents of modality. Her results suggest that these texts qualify as a type of hortatory/persuasive and advertising discourse and that through the use of modality editors establish a degree of intimacy with readers as a discursive strategy to win their consent and trust to read the magazine. The second, Vasconcellos (1997), compares two novels written by James Joyce (*Araby* and *Eveline*) with translations published in Brazil. Both the original and the translated texts are described in terms of systemic choices with a special focus on ideational and interpersonal meanings. Vasconcellos argues that the SFL framework provides a sound referential for evaluating the quality of literary translations.

We have seen so far that there is a growing body of research showing that modality in English is employed by speakers to achieve rather diverse social functions: a politeness/face-saving function, the function of constructing one's authority or the relevant discourse statuses of participants, the function of achieving certain conversational actions within certain sequential environments, the function of regulating aspects of interaction (like topic transition), the function of opening up dialogic space, the function of expressing a myriad of types of evaluation, or simply the function of displaying (true or "fake") uncertainty. What is common to the more recent body of work is that they focus *not* on the speaker's expressed commitment or attitude towards knowledge as such (as a cognitive phenomenon), but on the interactional use that such expressions and attitudes have in actual social contexts, and what kinds of interactional effects and consequences they may have on the recipient(s) and on the interaction process. Keeping the aforesaid in mind, I now proceed to detail the view on modality to be employed to analyze the

data – that of M.A.K Halliday.

4.2   The Hallidayan approach towards modality

Throughout his work, Halliday stresses the importance of the interpersonal function of language use, and argues that modality is not a minor or marginal element in language use but is, rather, one of its most important functions. He comments further on a seminal paper (Halliday 1970) that modality is:

> concerned with the establishment of social relations and with the participation of the individual in *all kinds* of personal interaction. Language, in this function, mediates in all the various role relationships contracted by the individual, and thus plays an important part in the development of his personality. (p. 335; emphasis added)

A brief illustration of how this type of language functions in a naturally occurring text might be appropriate here. The excerpt below was extracted from the musicology defense:

EXCERPT 20 [50:25 – 52:13]

Examiner: so uh when you say that, Paul Bley's influence uh on on Jarrett has been underestimated, uh **i think you might want to probe a little deeper into this**, [S2: mhm] because Bley is also a kind of chameleon-like figure. [S2: mhm] he has this, uh this uh, uh romantic uh tr- standard side, and as well as, uh, as as this free jazz im- free improvisation side. and, an- an- and also a cantankerous uh <LAUGH> [S2: yeah] self uh um, sort of uh presentation side to him which, in many ways parallels Jarrett of course, [S2: right which i address actually] yes. well in his case it's sort of slightly uh colored by a kind of bitterness of lack of recognition [S2: mhm] rather than overexposure but [S2: yeah] um, but y- y- **you might want to, expand that a little bit** because **i think** you you lean towards it but you don't, re- de- dig, deep into it. the other thing **i, would suggest** um, remember i mentioned to you that uh, when you talk about, Braxton solo work, i- i i'm, a- a- as the background for for for for for for Jarrett **i i wonder if you wouldn't want to um, s- locate it historically just a little, more precisely** that is, the influence that Braxton seems to have had, not just on Jarrett but on others, instrumentalists of the time that is, when this whole, s- this whole uh, fashion for solo recordings started, uh, practically everyone acknowledges Braxton when you uh jus- uh Evan Parker uh Steve Lacy all these people say that they, started doing this because, they heard Braxton doing this. and it's not only in recordings it was Braxton's solo concerts.

In its crudest form, the content of excerpt 20 might be interpreted as something like: "reconsider your argumentation". However, stripping down the text to such basic propositional

information involves removing important – indeed, essential – aspects of language use. These aspects of language, which are central to the general tone and rhetorical objective of the message, are primarily *interpersonal* in orientation. The excerpt above is permeated with expressions that open up dialogic space (White, 2003). Note, for instance that the examiner modifies what could have been purely modulated clauses of the type *I want you to...* by redressing them with interpersonal metaphors, such as *(I think) you might want to..., (I wonder) if you wouldn't want to*. He also makes use of devices that generally scale propositions down, such as *kind of, just, practically, sort of, a little bit, slightly*). It seems that such interpersonal tone may be motivated for several reasons, a topic which will be more fully explored in Chapter 7. As regards the excerpt under discussion, the basic message could have been stated more bluntly, one may argue. However, to do so would probably risk jeopardizing the "social relations" referred to by Halliday in his remark above. It could also have led to a less favorable evaluation of the academic persona of the examiner by the other committee members, the advisor and also the candidate. (Whether or not the amount of modality in this text is in proportion to the rather complex task the participants are engaged in is, of course, another matter).

As it has been mentioned earlier on in the chapter, in many linguistic approaches to modality attention is focused on two major subtypes: *epistemic* and *deontic* modality (formal linguistics), or, respectively *modalization* and *modulation* in Hallidayan terms. Halliday and Matthiessen (2004) argue that modality "construes a region of uncertainty where I can express, or ask you to express, an assessment of the validity of what is being said" (p. 116). Such region or semantic domain is represented diagrammatically in Figure 4.2.
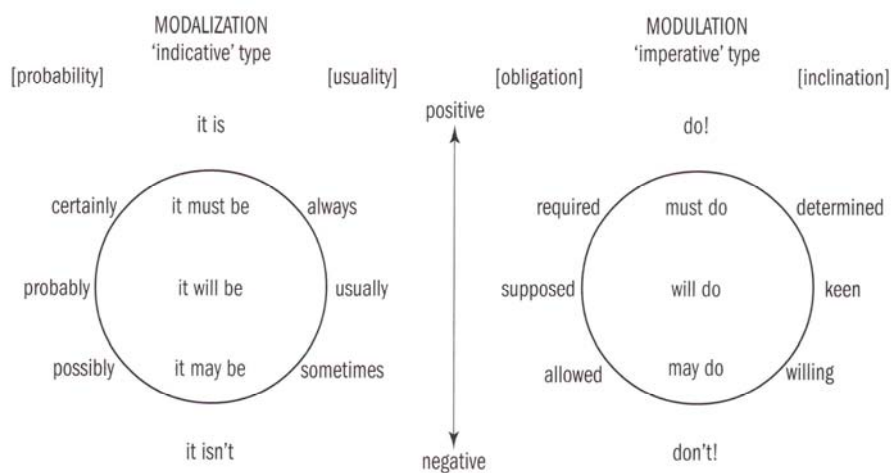
Figure 4.2 Relation of modality to polarity and mood (reproduced from Halliday & Matthiessen, 2004, p. 619)

By carefully looking at Figure 4.2, we see that between the *it is – it isn't / do! – don't!* poles there are various intermediate degrees such as *probably*, *usually, supposed* and *keen*, which, in turn, indicates that modality is a matter of degree and is thus a 'scalar' phenomenon.

Figure 4.2 shows four kinds of modality: *probability, usuality, obligation* and *inclination*. Halliday and Matthiessen (2004) refer to probability and usuality together as *modalization*, which they associate with propositions (statements and questions); they refer to obligation and inclination as *modulation*, which is associated with proposals (offers and commands).

Halliday and Matthiessen (2004: Chapter 4) maintain that modality concerns the participants' relation in a verbal interaction and that modal exponents are the traces of the speakers' activity in a social context. They describe the clause as exchange. According to them, the clause is organized as an interactive event involving the speaker and the hearer. An act of speaking is in fact an interact: an exchange. The semantic function of a clause in this exchange of information is a *proposition*; the semantic function of a clause in an exchange of goods-and-services is a *proposal*.

In relation to dissertation defenses, both modalization (of propositions) and modulation (of proposals) are effective discursive strategies in at least two senses: they help the social construction of knowledge systems and of discourse statuses between the participants.

For Halliday and Matthiessen, modality is also distinguished in terms of *orientation* and *manifestation*, that is, the way in which speakers negotiate propositions or proposals. Hence, the speakers' orientation may be *subjective* or *objective* and their manifestation *explicit* or *implicit*.

Under the heading *explicit subjective*, Halliday and Matthiessen (2004) situate clauses which normally contain first person, present tense, mental processes:

EXCERPT 21 [recording unavailable] **Sociology defense**
Chair: … I think she's learned something about the kinds of questions ... **(modalization)**

EXCERPT 22 [23:00 – 23:03] **Biology defense**
Candidate: … this is a really busy graph but I want you to concentrate on these blue Xs here. **(modulation)**

In explicit subjective modalities the source of the assessment normally comes from the speaker and he/she uses the clause to encode the modalization and/or modulation.

Implicit subjective judgments are often realized through modal verbs. According to Martin (1995, p. 43) "modal verbs implicitly construct the speaker as the source of the assessment". Excepts 23 and 24 show how implicit subjective orientation might be used to modalize and to modulate respectively:

EXCERPT 23 [recording unavailable] **Sociology defense**
Candidate: uh the only explanation I could offer is that there might be a correlation between the legitimation of the issue vis-a-vis the broader society's response to it … (**modalization**)

EXCERPT 24 [00:22:59 – 00:23:08] **SNRE defense**
Chair: … and just like other groups that are competing for scarce resources and are players in the political system so too must social movements be considered like that. (**modulation**)

Implicit objective modalities are conventionally realized via modal adverbs (for modalizations) or periphrastic verbal groups (for modulations). Martin (1995) maintains that this type of orientation has the effect of "dissociating the speaker from the assessment" (p. 44), for example:

EXCERPT 25 [1:48:22 – 1:48:29] **SNRE defense**

Candidate: … they were the first community in the nation to ever be given the right to eminent domain which is <u>usually</u> a right reserved for the government … **(modalization)**

EXCERPT 26 [01:03:55 – 01:04:04] **EECS defense**

Candidate: … um you <u>have to</u> be able to detect and react to important unplanned-for states as they occur. **(modulation)**

Under the heading *explicit objective*, Halliday and Matthiessen (2004) place examples where the source of modality is usually encoded through an impersonal clause with *it* as Subject and the verb *to be + adjective of modality*.

EXCERPT 27 [recording unavailable] **Sociology defense**

Chair: … <u>it's quite clear</u> that social psychological variables will probably explain that remaining ten or twelve percent of the variance left … **(modalization)**

EXCERPT 28 [08:03 – 08:08] **EECS defense**

Candidate: … <u>it's necessary</u> to be able to identify and react to other states as they happen. uh ... **(modulation)**

Martin (1995, p. 44) comments that explicit objective modalities "make use of nominalization to dissociate the speaker from the assessment, which is reconstrued as an aspect of ideational, rather than interpersonal reality".

Finally, in addition to the orientation of modalized and modulated clauses, Halliday and Matthiessen (2004) indicate another variable attached to modal judgment: *value*. The system of value is related to the strength of a modalized clause. Modalizations and modulations can all be

scaled according to whether their value is low, median or high. *Implicit objective* realizations of

modality are deployed in Table 4.1 to display the respective scales.

Table 4.1 The values of modality (after Halliday & Matthiessen, 2004, p. 620)

Value	Probability	Usuality	Obligation	Inclination
High	certain	always	required	determined
Median	possible	usually	supposed	keen
Low	probable	sometimes	allowed	willing

The broad outline of Halliday and Matthiessen's system of modality can be seen in Figure

4.3 below. The system includes the major dimensions of *value* (how we grade our assessment),

orientation and *manifestation* (how we assign responsibility for our assessment and how explicit

we are about doing so) and *type* (how we assess propositions in relation to probability or usuality

and our proposals in relation to obligation and inclination)
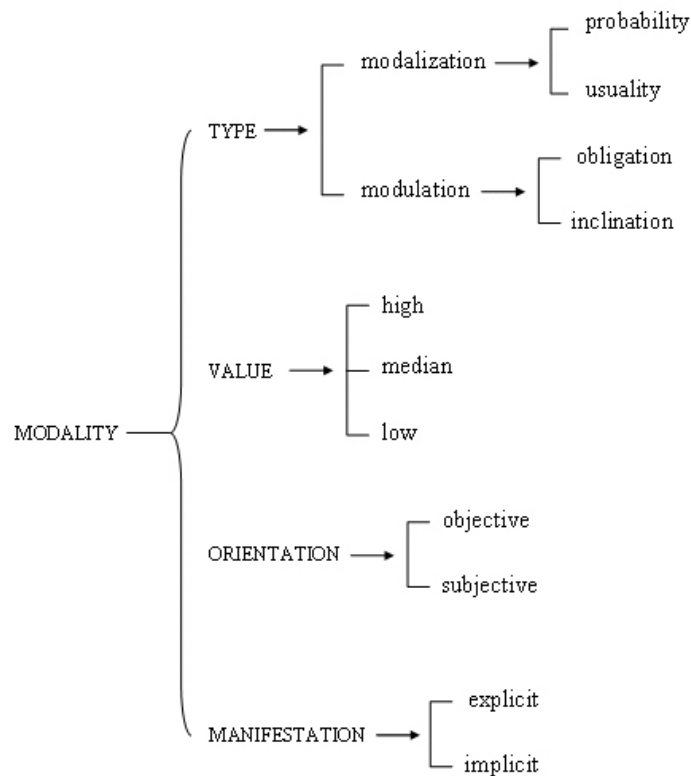
Figure 4.3 Overview of the modality system in SFL

4.2.1 Interpersonal Metaphors

It should be clear by now that the semantic domain of modality is construed in several places in the grammar; for instance, it is construed by clauses such as *I guess* and *it is possible*, by verbal groups with finite modal operators such as *might,* and by adverbial groups with modal adverbs such as *maybe*, to name but a few. According to Halliday and Matthiessen (2004) these modal exponents are not simply interchangeable; they have discrete values within the overall semantic system of modality. While the forms above may be taken to express 'low value', *I guess* is explicitly subjective, *it is possible* is explicitly objective, *might* is implicitly subjective and *maybe* is implicitly objective. This means that the semantic system of modality is very complex; it is realized not by a single grammatical form but by a range of forms. These forms of realization are not, of course, analogous, so the effect is one of expanding the meaning potential of the language. Hence, in modalized clauses we may have one grammatical structure standing for another. For example, consider excerpt 29 below extracted from the EECS defense:

EXCERPT 29 [41:30 – 41:37] **EECS defense** 🗣
Candidate: <u>I'm sure</u> the, members of the committee have, seen most of the set of equations in the thesis …

if the candidate says *I'm sure the members of the committee have, seen most of the set of equations …*, he means, epistemically, that there is a very high probability that the committee members have indeed seen the set of equations – that the committee members *must have seen the set of equations*, as opposed to *would have seen* (median probability) or *might have seen* (low probability). In other words, the projecting, first person, present tense clause, *I'm sure*, stands for a high valued modalization, which might have been more directly encoded as a finite modal operator (i.e. *must*); and it can stand for the high valued modalization because it is similar enough to it to be so deployed. One grammatical structure (involving *projection*) is used to stand for

another (*modalization*). Thus the more likely tag for this example is *haven't you*, not *aren't I*, even though the main grammatical Subject is *I*, not the *committee members*.

Excerpt 29 represents a fairly common type of METAPHOR OF MODALITY, based on projection. According to Halliday and Matthiessen (2004) "[p]rojection is […] manifested interpersonally as modal assessment of the presupposition type; but it extends beyond presupposition to cover several other types of modal assessment as well" (p. 605). Two possible interpersonal projecting clauses include:

a) *Projecting mental clauses*: mental clauses are capable of projecting "another clause or sets of clauses, giving them the status of ideas or of content of consciousness" (Halliday & Matthiessen, 2004, p. 199). These mental clauses may be considered interpersonal in orientation because, according Halliday and Matthiessen, they *explicitly* project the content of "thinking, believing, presuming, and so on" (ibid, p. 206), where the projected clause is labeled *idea clause*. Corpus examples are given below:

EXCERPT 30 [56:09 – 56:17] **Musicology defense** 🗣
Candidate: … uh I I <u>I guess</u> I was very greedy <u>I guess</u> I wanted, more I wanted free improvising but I also wanted tonality I also wanted uh …

EXCERPT 31 [recording unavailable] **Sociology defense**
Examiner: … <u>I think</u> uh I <u>I suppose</u> my more general point is uh that uh uh given this set of indicators and given the set of findings uh uh one has to guard against the possibility of …

EXCERPT 32 [01:21:36 - 01:21:39] **SNRE defense** 🗣
Candidate: … well, <u>I know</u> first of all what we shouldn't do, which is, which is, bomb Afghanistan …

b) *Projecting relational clauses*: to assert *explicitly* that the modality is objective speakers may construe the proposition as a projection and encode the objectivity in a projecting clause (e.g. *it is possible*). Halliday and Matthiessen (2004) maintain that relational clauses can construe both

outer and inner experience, suggesting that inner experience may be construed not only subjectively but also objectively as *macro-* or *metathings* (p. 223). Hence, with the Attributes *true*, *clear*, *important*, *interesting*, in excerpts 34 to 38, the Carrier has to be a metathing symbolized by a fact clause. In the corpus examples below, the attributes assigned to the Carrier are semiotic ones (not material ones).

EXCERPT 33 [recording unavailable] **Sociology defense**

Examiner: <u>it is true</u> that in this literature the class variable is interpreted as a socialization variable but that's not necessarily the case if you

EXCERPT 34 [recording unavailable] **Sociology defense**

Examiner: <u>it's quite clear</u> that uh you would have to have some uh means of separating the racial variable and the value variable before you could test the …

EXCERPT 35 [24:15 – 24:25] **Biology defense** 🗣

Candidate: <u>it's important</u> that any regression equation or other method of determining temperature that i use to determine paleotemperature of the Nabon Basin, takes into account, uh,

EXCERPT 36 [01:06:50 – 01:07:01] **Musicology defense** 🗣

Candidate: <u>it's interesting</u> that uh, that um, Gary Bergman said that he never transcribed a single solo and he never, uh uh, encourages anyone to, transcribe a solo.

Table 4.2 displays other examples of Attributes within the semiotic domain:

Table 4.2 Examples of Attributes within the semiotic domain (after Halliday & Matthiessen, 2004, p. 223)

Type	Attribute
Emotion/attitude	sad; tragic; delightful; good; a good thing; bad; a bad thing
Cognition/probability	doubtful; certain; likely; unlikely; probable; possible; a question
Desideration/obligation	desirable; acceptable; appropriate; important; justified

Halliday and Matthiessen hold that "there is a fundamental relationship between modal assessment, including modality, and projection" (p. 626), and postulate that

a modal proposition or proposal is realized, as if it was a projection sequence, by a nexus of two clauses, rather than by a single clause. Here modal assessment itself is given the status of a

proposition in its own right; but because the projecting clause of the nexus is metaphorical in nature, standing for an interpersonal assessment of modality, it is also, at the same time a modal Adjunct in the clause realizing the proposition/proposal. […] it construes additional layers of meaning and wording. (ibid, p. 626)

Halliday and Matthiessen state that interpersonal metaphors of modality rank shift the interpersonal assessment from group to clause, which, in turn, systematically leads to an expansion of the meaning potential, i.e., they create "new patterns of structural realization" and "open up new systemic domains of meaning" (ibid, p. 626). Because of the great diversity in explicit expressions of modal meanings, Halliday states "[i]t is not always possible to say exactly what is and what is not a metaphorical representation of modality" (1994, p. 355).

In addition to interpersonal metaphors based on projection, Halliday and Matthiessen also describe METAPHORS OF MOOD in a similar way: in this type of interpersonal metaphor, a mood meaning is not expressed in the clause, but rather as an explicit element outside the clause. Typical examples of mood metaphors are "speech-functional formulae" (1994, p. 365), which I use the following examples drawn from the corpus to illustrate:

EXCERPT 37 [48:23 – 48:31] **Psychology defense** 🎤
Examiner: that might be worth pursuing [S2: yeah, right] and that's sort of tried and true, sort of paradigms [S2: right] for pursuing those kinds of issues, you know, that might be worth looking at.

EXCERPT 38 [50:32 – 50:35] **Musicology defense** 🎤
Examiner: I think you might want to probe a little deeper into this …

EXCERPT 39 [1:47:43 – 1:47:47] **EECS defense** 🎤
Examiner: but I think it would be worth your while to put a a fair bit of time into this.

EXCERPT 40 [27:43 – 27:52] **EECS defense** 🎤
Examiner: so, so sketch a scenario ca- could you sketch a scenario where, this would be a very wr- a very wrong kind of way to …

EXCERPT 41 [XXX] **Musicology defense** 🎤
Examiner: so, would you like to, talk about that, [S2: yeah] very, briefly?

The starting point in the analysis of the sets of variant expressions such as the ones found in the excerpts above is the observation that a 'command' (congruently realized by an imperative clause) is being incongruently realized either by a 'declarative' or an 'interrogative' clause. If we also take into account the semantic effect of incongruent realizations, it is possible to recognize that metaphorical expressions have two meanings, a congruent one (in this case a command) and an incongruent one: in excerpts 38-40 the congruent meaning is statement, in 41 and 42 it is question. Hence an expression such as *could you sketch a scenario* has two interpersonal interpretations which can be taken in the speech interaction: it can be interpreted in terms of its face-value meaning, as a simple question; or it can be interpreted in terms of its metaphorical meaning, as a command. In the first case, what is negotiated is information, in the second case, it is goods and services.

Depending on the level of delicacy of the analysis, the semantic value of the metaphorical expression may then be further specified in terms of more delicate types of speech functions. These more delicate speech functions are regarded as more specific sub-types within the category of command. This is the approach taken by Halliday and Matthiessen (2004) where they discuss the notion of grammatical metaphor. In this view, then, only the primary types of speech functions have a congruent realization in the lexicogrammar, while more delicate types of speech functions are expressed through interpersonal metaphors. These metaphors, according to Halliday and Matthiessen (2004, p. 632), expand the potential for negotiation. The full functionality of these metaphors in the context of doctoral defenses will be discussed in detail in Chapter 7 (Section 7.2).

4.3   Summary

This chapter has provided a review of part of the vast literature involving the concept of modality. It has been delimited that the Hallidayan approach will be employed in the analysis of modality in the corpus of dissertation defenses. The next chapter will describe the origin and rationale behind creating the MICASE as well as its structure and the transcription conventions adopted by the ELI researchers. Chapter 5 will also provided details on the corpus of dissertation defenses used in the analysis, discussing the advantages of using a corpus-based methodology for the investigation of naturally occurring discourse.

CHAPTER 5

Corpus & Computational Tools

> Work based on corpus studies has already begun to modify our thinking about lexis, about patterns in the vocabulary of languages; and it is now beginning to impact on our ideas about grammar. In my view, this impact is likely to be entirely beneficial. Corpus linguistics brings a powerful new resource into our theoretical investigations of language. (Halliday 1993/2005, p. 130)

5   Introduction

This chapter has four objectives. The first objective is three fold: a) to briefly describe how and why the ELI researchers compiled the MICASE (Section 5.1); b) to provide an overview of the structural organization of the corpus (Section 5.1.1); and c) to describe the transcription conventions utilized in the corpus (Section 5.1.2).

The second objective of the chapter is to describe the corpus employed in this study. Hence, Section 5.2 details each one of the eight defenses analyzed here in terms of time-length, number of words, gender and nationality of candidates and committee members, and the segments discussed in Section 3.5 included in the transcriptions.

Thirdly, the chapter aims to provide an account of how three other defenses were collected by this researcher to supplement the other four MICASE defenses already available. Thus, Section 5.3 describes: a) the project submitted to the University of Michigan's Institutional Review Board of Behavioral Sciences in order to obtain consent to record human subjects; b) the process of data collection; and c) an overview of the situational context pertaining to the three subsequent defenses added to the corpus.

Finally, Section 5.4 considers the scope of corpus-based research as a source for deepening our awareness and understanding of the workings of the human language, and Section 5.5 describes the range of computing resources which were used to handle the data under scrutiny. Two software are discussed: a) *Systemic Coder* (O'Donnell, 2002); and b) *WordSmith Tools* (Scott, 1996).

5.1   The MICASE

In late 1997, the ELI at the University of Michigan started a major research project to create a resource for studying academic speech. The goal of the first phase of the project was to record and transcribe close to 200 hours (approximately 1.7 million words) of academic speech from across the university. In June 2001, the ELI research team finished the recording goal, with over 190 total hours recorded. In April 2002, the transcribing and proofreading of all the transcripts was completed.

Currently, the analysis of the corpus is supported by a customized search engine developed for the ELI by the Humanities Text Initiative Section of the University Library. The entire corpus is now available on-line at www.hti.umich.edu/m/micase. This search engine is noteworthy for the large number of speaker and speech-event categories that can be selected, and the user-friendly interface (see Appendix A).

The MICASE corpus is a spoken language corpus focusing on contemporary university speech within the microcosm of the University of Michigan, in Ann Arbor, Michigan. This is a typical large public research university with about 37,000 students, approximately one-third of whom are graduate students. Speakers represented in the corpus include faculty, staff, and all levels of students, and native, near-native and non-native speakers.

The ELI has committed resources to MICASE for a series of reasons. First, before this project, there was no database of this kind available. Second, it was strongly suspected that once they were able to examine the corpus for recurrent grammatical and phraseological patterns, they would find many divergences from those described in current grammar and vocabulary books, which have largely relied on introspection or on features of written texts. MICASE thus provides authentic material in sufficient quantity to reassess some of the concepts of academic speech. Third, the ELI research team eventually hopes to be able to track generalized changes in speech patterns as people gain experience of university culture. Fourth, with all this new information, it is hoped that teachers and material designers will be in a better position to develop more appropriate ESL and English for Academic Purposes teaching and testing materials, and to evaluate how best to incorporate corpus work into EAP programs (Simpson et al. 2002).

5.1.1 The structure and content of the MICASE

Academic events vary widely in their tone, substance, and length. The MICASE corpus includes speech events that range in length from 19 to 178 minutes, with word counts ranging from 2805 words to 30,328 words. In the MICASE corpus, academic speech is defined as that speech which occurs in academic settings. In other words, it is not pre-defined as something like "scholarly discussion." In academic settings, we might, for example, find such speech acts as jokes, confessions, and personal anecdotes, as well as definitions, explanations and intellectual justifications. Therefore, the MICASE researchers have come a long way in recording a wide variety of academic speech events. Most speech events are fully recorded, from beginning to end, because the beginnings and ends of academic speech events may be of particular interest to researchers (Simpson et al. 2002).

Each speech event in MICASE is categorized according to various contextual at-

tributes, and these attributes can be found in the header of each transcript. Speech event

attributes include the type of event, the subject area of the event, the extent to which an event

is monologic or interactive, as well as the academic role or level of the majority of

participants (e.g., whether the class was a graduate or an under-graduate class, or whether a

meeting was primarily of senior faculty members). A description of all the speech event

attributes and their corresponding codes, as well different demographic variables (e.g., gender

and   age)   related   to   the   speakers   in   the   corpus   may   be   found   at

http://www.lsa.umich.edu/eli/micase/ATTRIB.html.

Table 5.1 provides an overview of the 152 speech events included in the corpus:

Table 5.1 The MICASE: breakdown of speech events

Lectures	(62)	Lab group and other meetings	(08)
Colloquia	(13)	Advising consultations	(03)
Student presentations	(11)	Dissertation defenses	(04)
Discussion sessions	(09)	One-on-one tutorials	(03)
Seminars	(08)	Interviews	(03)
Undergraduate lab sessions	(08)	Campus / museum tours	(02)
Office hours	(08)	Service encounters	(02)
Study groups	(08)		

5.1.2 Transcription conventions

The MICASE orthographic transcription conventions and mark-up system are in-

tended to allow for ease of readability, while including enough detail to ensure adequate

comprehension from the text of the transcript alone. To this end, the ELI research team used

standard orthography in the case of most words, except for selected situations where standard

conventions may cause confusion, and for a limited number of lexicalized abbreviations and

grammatical constructions (e.g., *cuz, gonna, hafta, sorta*, and several others). They do not use

standard punctuation, but instead mark pauses of varying lengths with commas, periods, and

ellipses. They also use question marks to identify phrases that function pragmatically as questions.

All backchannel cues and hesitation or filler words were transcribed using a set number of normalized orthographic representations that disregard minor phonetic variations. These, like overlaps and interruptions, are transcribed in a way that illustrates their sequential occurrence, but still indicates which speaker holds the floor. A complete description of the spelling, transcription, and mark-up conventions is found in Appendix B.

5.2   The corpus of dissertation defenses

The data analyzed in the present study consists of eight dissertation defenses: four which had been previously collected by the ELI team in the initial phase of MICASE; three which were subsequently recorded by me during the second term of 2003 in Ann Arbor, Michigan; and one which was kindly made available by Professor Allen Grimshaw (Indiana University) and was recorded at Indiana University in 1975 as part of the MAP project previously discussed. The data available is as follows (Grimshaw et al's. 1994, four segments have been used to indicate unrecorded segments in the *Missing* column on Table 5.2 below):[17]-[18]:

Dep/Field	Candidate	Committee	Length min.	Missing segments	Words	Clauses	Words p/ minute
Psychology	Male Korean	4 Males	76	3 & 4	12,398	1573	160
Musicology	Male German	1 F, 4 M	91	3	15,612	1571	165
EECS[17]	Female US	5 Males	113	3 & 4	21,422	2316	190
Biology	Female US	1 F, 6 M ?	57	2, 3 & 4	10,105	691	169
SNRE[18]	Male US	3 M, 1 F	112	3 & 4	18,511	2048	165
Immunology	Male Virgin Islands	2 F, 2 M ?	62	2, 3 & 4	9,146	942	147
Mech. Eng.	Male US	4 Males	123	3 & 4	20,824	2548	169
Sociology	Female US	4 Males	126	-	23,734	1817	187

Table 5.2 Information on the eight defenses used in this study

[17] SNRE → School of Natural Resources
[18] EECS → Electrical Engineering and Computer Science

5.3   Collecting additional dissertation defenses

This section briefly delineates the process of data collection I went through while I was carrying out research as a visiting scholar at the ELI under the supervision of Professor John Swales (from July to October 2003). It also provides an epigrammatic ethnographic view of the conditions where the dissertations were recorded.

Given that the MICASE team already had a great deal of experience regarding the nuances involved in the process of obtaining consent from the University of Michigan Institutional Review Board of Behavioral Sciences to use human subjects in research, I was extremely well-guided and instructed on how to write a project to be submitted for my data collection. In addition to the dissertation defenses I wanted to record, Professor Rita Simpson was also seeking to obtain consent to extend the MICASE data by recording 40-50 hours of additional speech in classes and office hour meetings involving graduate student instructors. Thus, I set out to write a project that could be incorporated to the one Professor Rita Simpson had already started.

The detailed description of all the aspects involved in collecting and manipulating data imposed by the University of Michigan's Institutional Review Board of Behavioral Sciences required hard and fast work to write a sound project proposal so that we did not run the risk of failing to obtain consent[19] (For an overview of the project submitted to the University of Michigan's Institutional Review Board of Behavioral Sciences to obtain consent to collect data refer to Appendix C).

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[19] I could not afford to be denied the chance to record data given that I was coming back to Brazil in the beginning of November 2003. When we finally got the consent from the Institutional Review Board of Behavioral Sciences it was already mid August and another stage of my data collection was about to begin – that of actually convincing doctoral candidates to grant me the possibility to record their dissertation defenses, which, by the way, may be considered tense enough without the presence of an eager intruder hoping to obtain data for his research.

After consent was granted from the Institutional Review Board of Behavioral Sciences, I embarked on the second stage of the process of data collection: that of convincing doctoral candidates to give consent to my tape-recording of their dissertations defenses.

My initial step was to check names of candidates and their respective academic divisions to find out about the future dissertation defenses dates. This was a straightforward process since the date, time, place, faculty, and names of the candidates who are to defend within the next fifteen days are posted on a website (http://www.rackham.umich.edu/OARD/Defdate.html). After discussing with John Swales and Rita Simpson what would be the best way to contact likely subjects to inquire about the possibility of tape-recording their defenses, we opted for the electronic medium – via email. Another stage of the process started there: finding out the email of subjects who were to contribute data. Once again, due to the university's very well-organized and structured website I was able, through the webpage search engine, to locate the email of most of the candidates found in the list of future defenses.

I initiated, then, a new step: to write the most convincing email I ever had to write in my entire life; after all, I had to be persuasive enough to encourage PhD candidates on the verge of their defenses to allow the presence of an extraneous researcher and all his recording paraphernalia in what may be considered the most important day of their entire academic lives. Given that I wrote over a hundred emails and only received three positive answers, I suspect three things: a) my email was not convincing enough; b) candidates were already too busy and too nervous to have another "detail" to worry about; or c) they did not feel okay with the idea of having their defenses recorded. Most candidates did not even bother to answer to my email; some were honest and said they did not feel conformable with it; some made up diplomatic excuses for the sake of politeness; and others just said "no" (the email I sent to all prospective subjects can be seen in Appendix D).

Provided with the verbal consent from the candidates (and their committees), the exact location and time of the defenses, appropriate guidance as to how to handle the equipment, and carrying a heavy worn out ocher suitcase filled with MICASE recording equipment, for three times I found myself walking on campus perhaps feeling as nervous as the candidates themselves.

I shall not describe in detail here how each recording went about. Nonetheless, it is necessary to comment that naturally there was a great deal of variation in terms of receptivity, candidate performance, length, academic conventions and so forth in each of the three defenses recorded.

In the first defense, recorded at the School of Natural Resources (09/22/2003), the candidate was already an experienced teacher in his late thirties working at the University of California (Berkley). An interesting aspect of this defense was the fact that two of the examiners were participating through phone conferencing from different places in the UK. The candidate had a smooth run and everything followed what could be expected of a PhD defense. The defense was held in a very small room, and there were about fifteen people including colleagues, examiners and me.

In the second defense, recorded at the Department of Mechanical Engineering (10/03/2003), the candidate had already worked in projects for prominent car industries such as Ford and Chevrolet and had won the Outstanding Graduate Student Instructor Award; "a unique record" according to his adviser. The defense was held in a very large room with as many as 70 people including the usual audience: colleagues, family, friends, and examiners. After two hours and six minutes the defense was over and the candidate invited the audience for snacks and drinks at a local Ann Arbor bar.

I consider the third defense, recorded at the Department of Microbiology and Immunology (10/12/2003), somewhat traumatic, and I shall explain why. After having

obtained consent from the candidate to record the defense on the previous week, and feeling more confident since it was the third time I would be tape-recording a defense, I arrived on the spot, as I usually did, about 60-45 minutes prior to its beginning. The place set for the defense was a large auditorium, which could easily accommodate 200 people. As I entered the room I saw only one person walking about very nervously – I immediately recognized he was the candidate. I then introduced myself and asked him if he remembered that he had granted me permission to record his defense, to which he responded he had completely forgotten. What is even worse, he had also forgotten to tell his adviser that a "stranger" would be tape-recording the whole defense. As the minutes passed more and more people started to arrive, until, very soon, the auditorium was completely full. By this time, I had already set up all the recording equipment and was just waiting for his adviser who was apparently busy with some of the bureaucratic aspects of the ceremony. The already tense atmosphere was amplified when the candidate's father was brought into the room on a wheelchair with serum attached to his arm (later on in the ceremony the audience learns that he had just been re-born after a stroke). When the candidate's adviser finally arrived she looked at me and all my recording gear and said something like "*and who the hell are you?*". The candidate, then, told his adviser he had forgotten to mention he had granted me the chance to record his defense for research purposes, to which she responded "*oh yeah, great!*". I told them that I could leave if they wanted me to, that I was not there to disturb in any way, and that the only thing I needed to do was to tell the audience who I was, why I was there, and that the people who had spoken during the defense could withdraw their participation if they so wished by talking to me at the end[20]. The defense began with the

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[20] As a matter of fact, I had memorized this introductory speech that went more or less like this:
"My name is Leonardo Recski and I'm here on behalf of the English Language Institute, we have gotten preliminary consent from XX and his/her adviser to do the recording of this dissertation defense for the purposes of a large project that is going on at the ELI to collect over two hundred hours of samples of academic speech, and dissertation defenses are just one those kinds of examples. I don't wanna take up too much time, but I wanna make sure that if anybody has any objections to the recording, that you are free to say so now and we would then

adviser giving a little background on the candidate's involvement with the department and the topic. When she finally finished this preliminary part she said: "*so um before I introduce Ian I have um a person here who needs to make a comment so why don't you get up and do that quick and then um...*". So there I was, in front of almost 200 people, with an adviser who was obviously not very pleased with my presence, and a candidate who, in addition to being a nervous wreck, was very emotional because of his father's condition and presence. I cannot say that my memorized speech came out as planned, neither that my non-native English sounded crystal clear – I was petrified, but somehow managed to put things across as quickly as I could.

All along the defense many times the candidate lost his reasoning, and, at the end, when he was acknowledging those who had somehow contributed to his reaching that very unique academic moment he cried (see excerpts 42 and 43):

EXCERPT 42 [00:52:57 – 00:53:10] 🔊

Candidate: … I would like to thank the members both past and present of the Kirschner lab, the present members are shown here, you have become like my brothers and sisters away from home and <p:04> [candidate gets very emotional and starts to cry] it will- it'll <p:04> it will be really hard to miss uh when I leave not having to see you uh further

EXCERPT 43 [00:54:27 – 00:54:39] 🔊

Candidate: …thank you to my family, they're sitting in the back, uh to my dad, he recently suffered a stroke, he nearly died [candidate starts to cry] but through the grace of God he's here with me <p:05>

The underlying motivation for this brief ethnographic account was to reinforce the fact that there will always be specific conditions unique to particular types of situations or settings. These, in turn, inform the reader and probably sharpen his/her grasping of the context of situation. These emotional contours do not normally transpire in a crude appendix containing the transcribed material. I do believe, although I do not prove

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not do it if you didn't feel comfortable, or if you have any questions about it and if you decide at the end of the defense that there is any part, or all of your speech that you don't feel comfortable having be a part of this project then you can also state that at the end. Are there any questions why I am here?"

analytically throughout the dissertation, that the academic background as well as the state of mind of the candidates during their defense *will* influence their modal choices.

5.4   A corpus-based approach to the investigation of modality

Corpus linguistics may briefly be described as the study of language on the basis of text corpora. There now exists a large number of computerized corpora varying in size, design and research purposes and new ones are under constant development to suit individual researcher's needs (the case here). The great research potential offered by these corpora has given rise to a dramatic expansion of corpus based-research that few could have foreseen thirty or so years ago.

Computerized corpora have proved to be excellent resources for a wide range of research tasks. In the first place, they have provided a more realistic foundation for the study of language than earlier types of material, a fact which has given new impetuous to descriptive studies of English lexis, syntax, discourse, and prosody. Secondly, they have become a particularly fruitful basis for comparing different varieties of English, and for exploring the quantitative and probabilistic aspects of language.

Made possible by the development of powerful yet relatively inexpensive PCs, corpus analysis is changing our view of what language is and how it is used. Researchers, teachers, and students have been able to explore large collections of texts consisting of thousands or even millions of words to discover such facts about language as which words are commonly used together with others, what grammatical patterns are associated with a given word, which words are used more frequently than others, which meanings of a word are most frequently invoked, and so on. Information such as this has not only changed the way dictionaries are made and used, but has also made important contributions to language teaching and to understanding the way language is used in a range of social contexts.

In all these respects, the availability of corpora has expanded the domain of linguistic inquiry in significant ways. At the same time, this expansion has led to the development of more sophisticated research methodologies and new linguistic models (Sinclair 1991). Many tasks which previously had to be done by hand can now be achieved automatically or semi-automatically by means of computer programs and other kinds of software. Nevertheless, the central goal has remained the same: to reach a better understanding of the workings of the human language.

I am in agreement with Halliday and Matthiessen (2004) when they say that "[t]he corpus is fundamental to the enterprise of theorizing language" (p. 34). There are many ways in which a corpus can be exploited, of which the one considered here – by no means the only one – is that of providing evidence of relative frequencies in the lexicogrammar, from which I was able to draw initial conclusions about some of the interpersonal rhetorical strategies employed by candidates, adviser and committee members in the dissertations[21].

5.5 Computational tools used for handling the corpus of dissertations

5.5.1 The *Systemic Coder*

Systemic Coder is a software that facilitates the linguistic coding of texts. Linguistic categories chosen to be scrutinized are organized in terms of a systemic network, which is employed to code the text(s). First, the analyst must define her/his taxonomy, and then code the segments of the text according to it. The codings can then be statistically analyzed.

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[21] It is important to emphasize that I have attempted to establish a dialectical complementarity between theory (the study of modality under the SFL prism) and data (my corpus): complementarity because some phenomena are best observed if lightened up by from the 'system' side, while others are best observed from instantiation side (see Halliday and Matthiessen, 2004, pp. 19-29), i.e. the text itself; dialectical because both perspectives are interspersed. This is the kind of reasoning I have tried to follow along the present work.

The tool consists of five interfaces: (1) *Text Segmentation* - for marking the segments to be coded; (2) *Scheme Management* - where the analyst specifies and/or modifies his/her taxonomy, i.e., the system network; (3) *Coding* - where chosen categories are assigned to text segments; (4) *Review* - an interface which allows the analyst to explore and select out those codings which contain certain features in the coded text(s); and (5) *Statistics* - an interface allowing the analyst to retrieve descriptive statistics about the text(s).
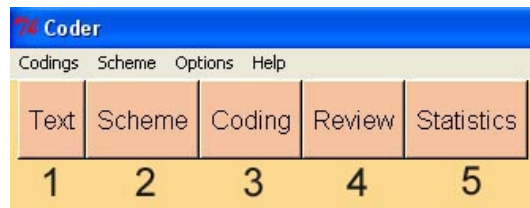
Figure 5.1 - Systemic Coder's five major interfaces

After saving the texts to be analyzed in "*.txt" format and loading them into the *Systemic Coder*, it is necessary to segment the corpus so as to isolate stretches of text which contain the linguistic features to be analyzed. This process is done manually by the analyst who must decide how much textual information each segment must encompass (in my case the unit of analysis was the clause). A screen shot of part of one of the segmented dissertation defense transcripts is shown in Figure 5.2 below:
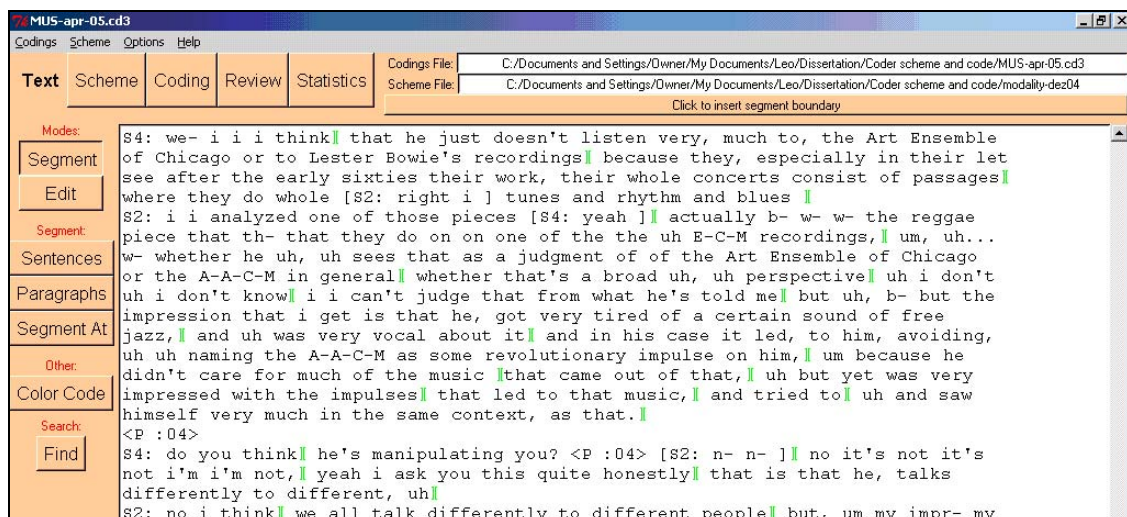
Figure 5.2 - The *Text* segmentation interface

The next stage consists of creating a taxonomy to code the segments which contain modal features. This was done by adapting Halliday and Matthiessens' (2004) modality network into the software (the analytical scheme is displayed in Figure 5.3 below). After all the texts have been completely segmented, it is necessary to code each segment according to the taxonomy adopted.

Figure 5.3 - The *Scheme* management interface
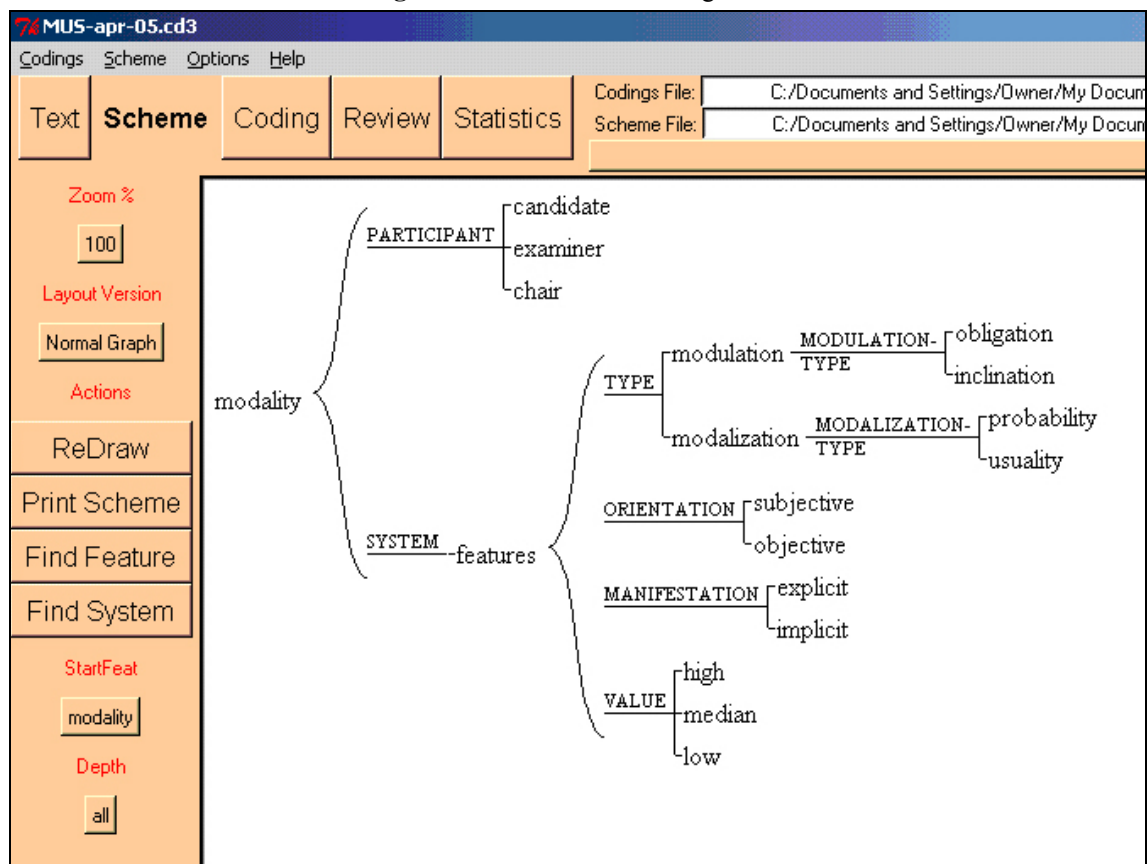
When coding a segment, the coding interface will look something like Figure 5.4, where the segment to be coded is shown (in red) in the *Text Box*. There is a box on the left hand side labeled *Select*. This holds the features selected for this segment so far. At the start of the coding of a segment, this will hold only one feature (in our case *modality*). As we assign other features to the segment, they will appear under the label *modality*. To the right of the *select* box, a number of systems from which the analyst needs to select for the segment he/she is coding will be displayed (in our case PARTICIPANT, TYPE, ORIENTATION,

MANIFESTATION and VALUE). In case the analyst wants to associate a comment to the segment being coded, she/he may do so in the *Comment Box* below the *Text Box*. The analyst can also change existing comments in the same way.
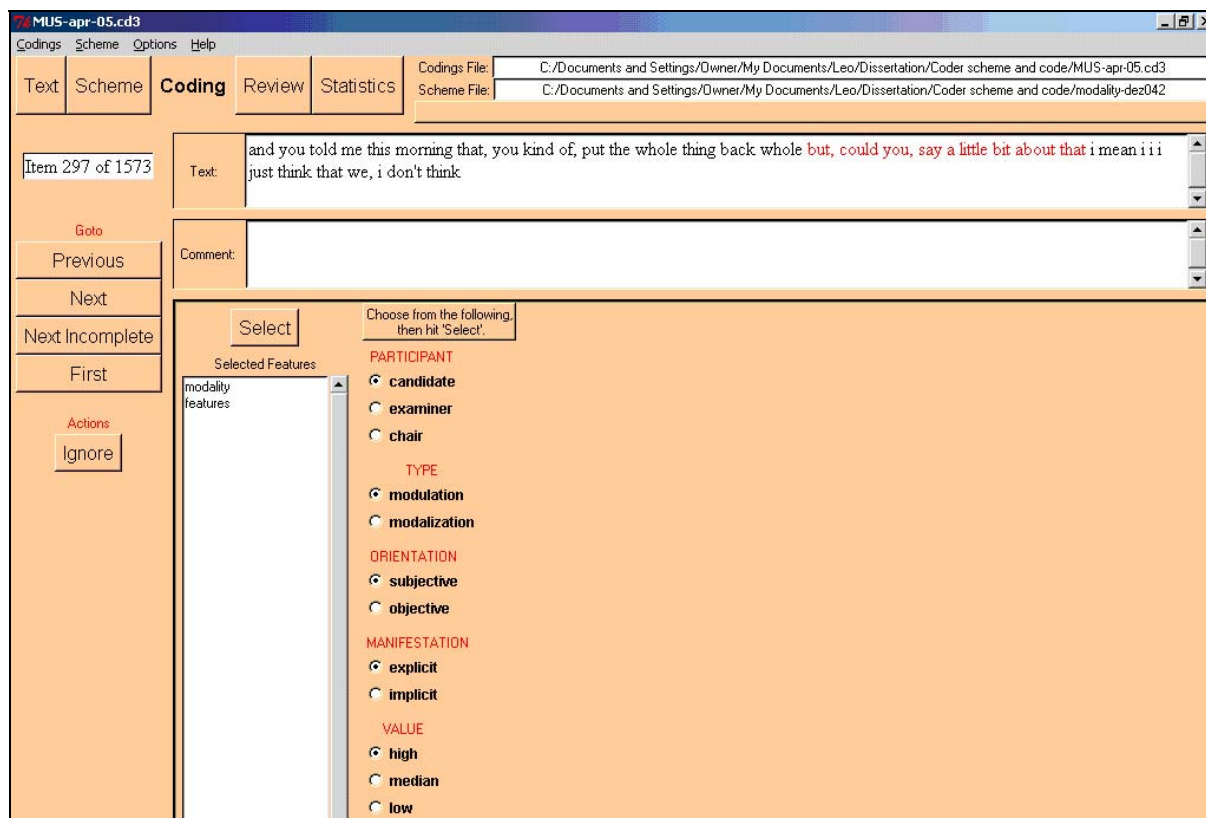
Figure 5.4 – Coding options based on the modality network

Figure 5.4 shows the first layer of codes available to the analyst for coding the segment in red (*but, could you say a little bit about that*). First, the analyst should identify the participant (by choosing the adequate participant under the column PARTICIPANTS). Next she/he decides whether the segment being analyzed is a modalization or a modulation, subjective or objective, explicit or implicit, and finally if the value is high, median or low. The choices will continue to appear until the analyst reaches the very end of his/her system network. Thus, the clause *but, could you say a little bit about that* would eventually be classified as having being uttered by the examiner, representing a low valued explicit subjective modulation of obligation (see Figure 5.5 below).
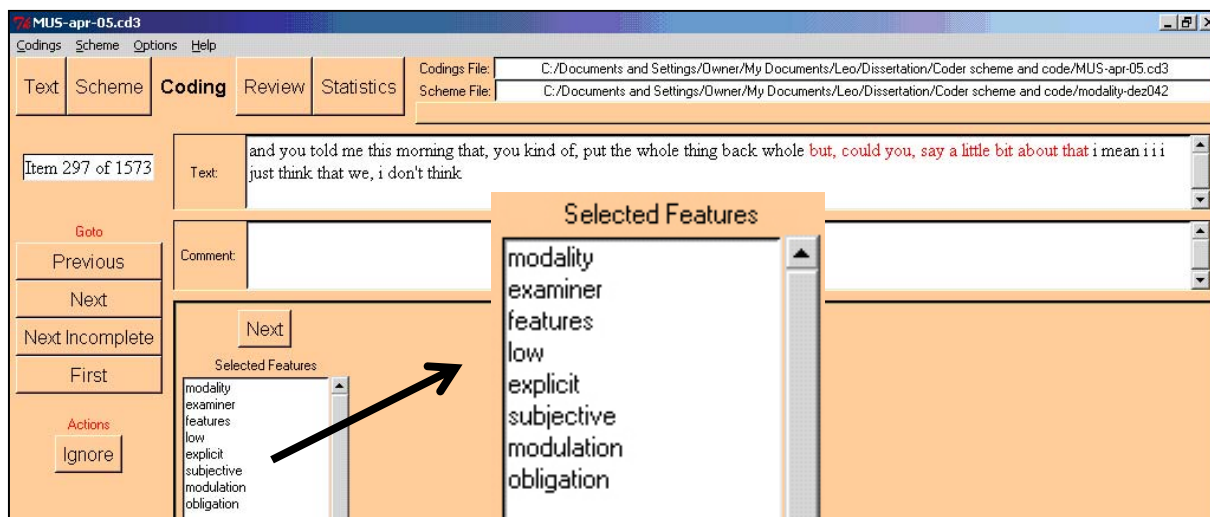
Figure 5.5 - The clause *but, could you say a little bit about that* after the coding has been completed

Another useful option provided in the coding interface is the *Comment* box. Since it is very likely that the analyst will have classificatory doubts along his/her coding of the texts, this is the place he/she may choose to add comments. In addition, codes which might be of particular interest for further discussion might be highlighted here.
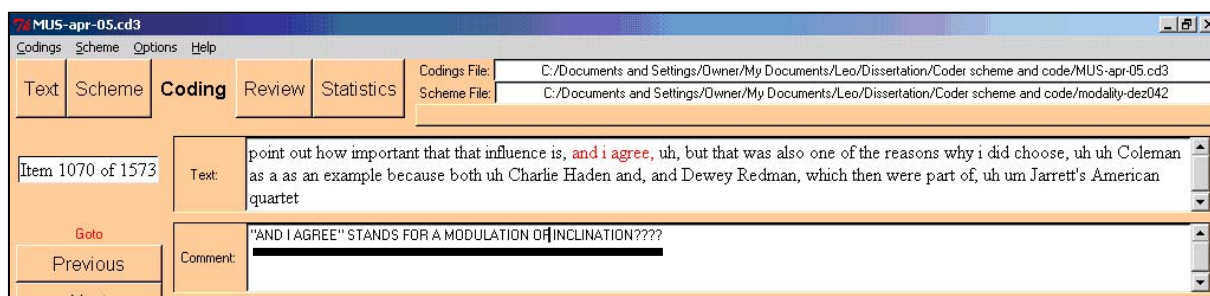
Figure 5.6 - The *Comment box*

After every single clause has been assigned a code, it is possible to review all of the codings. Once every clause is coded, all together they represent a tagged corpus - each modal clause is tagged with a set of features. The main purpose of the *Review* interface is to allow the analyst to do limited corpus search – the analyst can select out sub-sets of his/her coded text(s), on the basis of the codes he/she has assigned to them. Used in this way, the *Review* window allows us to locate quickly only those text-codes which are of interest. For instance,

let us assume that we are interested in retrieving only those instances where the examiners are using explicit subjective modalizations. By typing "candidate *and* modalization *and* subjective *and* explicit *and* median" in the filter box at the bottom of the *Review* window, these instances crop up immediately.
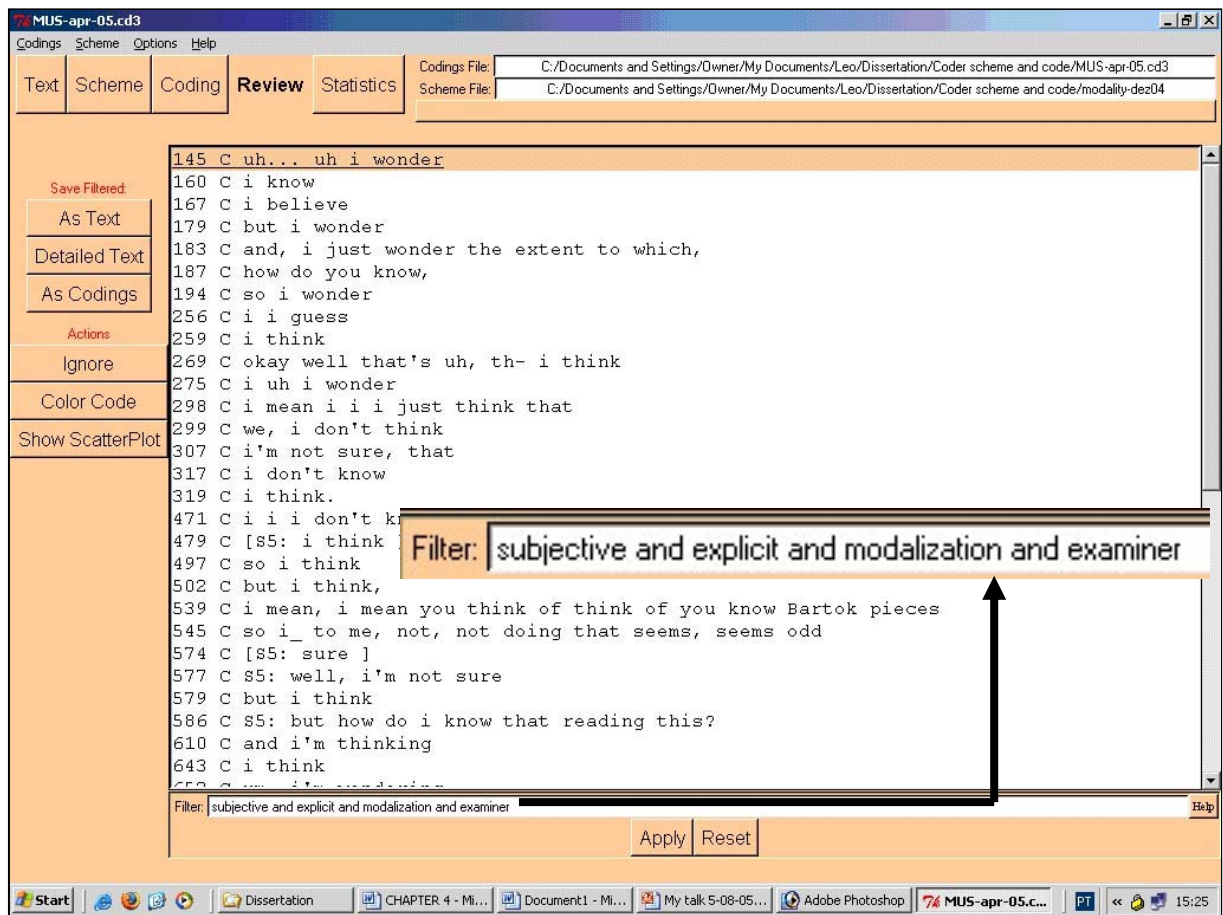
Figure 5.7 – The *Review* interface

Finally, as shown in Figure 5.8 and 5.9, the *Systemic Coder* allows some basic statistics (*Statistics* interface) to be performed, mainly descriptive statistics (reporting the means, etc., of each feature), and comparative statistics (comparing two or more texts, and reporting significant differences between them).

Figure 5.8 – The basic *Statistical* interface

Figure 5.9 – The comparative *Statistical* interface

This Section has offered a concise description on how the *Systemic Coder* is operated. For further details access www.wagsoft.com./Coder/ or email the software developer Mick O'Donnell at micko@wagsoft.com. I now turn to the description of the software *WordSmith Tools* (Scott 1996).

5.5.2 WordSmith Tools

A number of routine procedures are used to search a corpus, to recover information or to organize, catalogue or display the facts about language which are under investigation. The most basic format used in displaying information about the linguistic elements in a corpus is generated by means of listing and counting. The lists produced by *WordSmith* can be of a number of different kinds ranging from simple wordlists to more sophisticated analyses including the classic concordance format. In this Section, I will consider examples of some of the formats I employed to search my corpus.

5.5.2.1 Using WordSmith's Worlist

A wordlist helps the researcher identify the common words in a corpus, information which is useful for example when determining which lexical items to prioritize and which to disregard. Typically, a small number of words will be of very high frequency, the most extreme case being *the* at around 5% of the running words of a corpus of English (Sinclair 1991). At the other extreme there are always a large number of words which occur once only (*hapax legomena*). Let us begin with a wordlist obtained from the transcripts of the eight dissertations under investigation.

The most frequent 25 words in the list displayed in Table 5.3 take up 36,45% of all (over 110 thousand) running words in the corpus. It is also evident that most of them are either function words or fillers (*uh* rank 9 and *um* rank 16), and hence unattractive for the

study of modality. The first content word to appear in the list is the verb *know* (rank 33),

followed by *think* (rank 39), the first unambiguous noun is *people* (rank 63). Notice also the

very frequent use of discourse markers (*okay, right, well, yeah, now*). *Hapax legomena* start at

rank 3.999 with the word *aah* (out of 7.086 words). That is, 44% of the whole list is

comprised of words which occur once only.

Table 5.3 - The 120 most frequent words in the corpus of dissertations

N	Word	Freq.	%	N	Word	Freq.	%	N	Word	Freq.	%
1	the	4.687	4,28	41	or	412	0,38	81	those	191	0,17
2	that	3.191	2,91	42	well	407	0,37	82	them	190	0,17
3	and	2.917	2,66	43	mean	397	0,36	83	up	189	0,17
4	**I**	2.912	2,66	44	**would**	390	0,36	84	get	187	0,17
5	of	2.699	2,46	45	**he**	384	0,35	85	now	185	0,17
6	to	2.556	2,33	46	right	370	0,34	86	been	184	0,17
7	**you**	2.340	2,14	47	re	366	0,33	87	also	183	0,17
8	a	2.087	1,91	48	**just**	363	0,33	88	has	183	0,17
9	uh	2.011	1,84	49	these	361	0,33	89	**could**	176	0,16
10	in	1.879	1,72	50	then	360	0,33	90	things	174	0,16
11	s	1.612	1,47	51	were	347	0,32	91	mhm	171	0,16
12	it	1.586	1,45	52	all	316	0,29	92	into	164	0,15
13	is	1.407	1,28	53	because	314	0,29	93	who	163	0,15
14	so	1.124	1,03	54	when	309	0,28	94	**ll**	162	0,15
15	this	1.037	0,95	55	**some**	306	0,28	95	yuh	162	0,15
16	um	933	0,85	56	don	302	0,28	96	where	161	0,15
17	**we**	911	0,83	57	an	290	0,26	97	something	159	0,15
18	t	806	0,74	58	how	285	0,26	98	did	156	0,14
19	have	771	0,70	59	**very**	276	0,25	99	way	156	0,14
20	but	750	0,68	60	m	272	0,25	100	different	154	0,14
21	**they**	693	0,63	61	like	270	0,25	101	two	154	0,14
22	what	693	0,63	62	from	266	0,24	102	**she**	149	0,14
23	was	671	0,61	63	people	265	0,24	103	go	147	0,13
24	for	663	0,61	64	more	259	0,24	104	first	146	0,13
25	with	587	0,54	65	**really**	257	0,23	105	yes	146	0,13
26	not	581	0,53	66	your	256	0,23	106	**will**	144	0,13
27	as	571	0,52	67	**my**	251	0,23	107	**actually**	141	0,13
28	there	563	0,51	68	**me**	237	0,22	108	going	141	0,13
29	are	554	0,51	69	out	237	0,22	109	**their**	141	0,13
30	be	547	0,50	70	okay	236	0,22	110	thing	140	0,13
31	at	530	0,48	71	here	234	0,21	111	point	138	0,13
32	on	530	0,48	72	by	233	0,21	112	our	136	0,12
33	**know**	491	0,45	73	had	233	0,21	113	**any**	135	0,12
34	do	487	0,44	74	no	231	0,21	114	than	131	0,12
35	about	483	0,44	75	say	220	0,20	115	why	127	0,12
36	if	476	0,43	76	yeah	220	0,20	116	didn	126	0,12
37	one	461	0,42	77	time	217	0,20	117	question	124	0,11
38	which	440	0,40	78	see	214	0,20	118	**many**	123	0,11
39	**think**	438	0,40	79	other	204	0,19	119	**much**	121	0,11
40	**can**	433	0,40	80	ve	201	0,18	120	**his**	119	0,11

Table 5.3 also reveals that among the 120 most frequent words there are certain items

which appear to be of particular interest for the study of modality. These include: (i) first and

second person pronouns *I* (rank 4) and *you* (rank 7) as well as other pronouns (*we, he, she, me, my, them,* etc); (ii) modal auxiliary verbs (*can, would, could* and *will*); (iii) intensifiers and downtoners (*very, really, just, actually*); (iv) quantifiers (*many, some, much*); and (v) mental processes (*know, think*).

Nevertheless, frequency counts need to be interpreted with some care. Word-form types displayed in wordlists are not generally considered to be the best format for studying the lexicon in a corpus for the obvious reasons that they lack context, and that polysemy and word-class ambiguity are not able to be distinguished. In addition, single-word wordlists fail to capture one extremely important feature of any language: the use of formulaic expressions. Thus, by looking at the word *mean* (rank 43 in Table 5.3) one has no idea if it is being employed as a noun, verb, or adjective. For this reason, the procedure known as concordancing, providing the context in which each word token appears has been the major tool used for accessing corpora.

5.5.2.2 Using WordSmith's Concord

A concordance is a formatted version or display of all the occurrences or tokens of a particular word in a corpus. The word is usually referred to as a target item, node word or search item. The *Concord* tool is used to search the text and find every occurrence with a predetermined amount of context.

A concordance can thus provide information on the company words keep in a corpus. Another good example is the verb *think,* which occurs 438 times in the corpus. In the dissertations, *think* is predominantly employed to mark parenthetical insertions of the speakers, with the bigram *I think* occurring 336 times (77% of the occurrences). In case the analyst wishes to inspect other common cognitive processes employed by the participants, he/she can do so in a matter of seconds. A search for *guess, wonder, suppose,* and *believe* in

the dissertations yielded 33 occurrences of *believe*, 35 of *guess*, 14 of *wonder*, and 16 of

suppose (see Figure 5.10).

Given that all of the dissertation transcripts have also been syntactically

annotated[22], it is also possible to employ the concordancer to quickly search for specific

collocations of parts-of-speech. Figure 5.11 displays the result of a search for the string

"***_VM *_RR**", where *_VM means any modal auxiliary verb, and *_RR means any

adverb.

Figure 5.10 - Partial concordance of *believe, guess, suppose* and *wonder* in the corpus of dissertations

```
 ly the answer to your question is I believe in both, I believe [S4: bu-] in the d
   came to this uh this   portion, i believe you were talking about a concert that
 e that the movement can go? and i I believe that there is, and and i believe ther
     LAUGH> (xx) uh issue    because i believe that uh his having played all these o
        ting together account for I believe roughly forty two per cent of the var
 sort of [in between kind of thing I believe the major was history    P: [specia
   name then from the Ohio valley I guess uh ((L: yuh)) because the name sounds f
     [S1: right ] and and and what, i guess one of the issues    that i'm interested
   ated with it is less valuable I I guess what I'm saying is that framing a quest
 dgment on on anybody else uh i i i guess i was    very greedy i guess i wanted, m
       byn for that introduction. um, guess i hafta, for the first time, <TURNS MIC
   wanna draw about science. um so i guess, he- i'm just, curious if you thought
       s uh well natural scientists i guess, um, i think it's equally true of on,
 my work ((pause)) S:I think uh I I suppose my more general point is uh that uh u
     nd to not offend, um, and, and i suppose another way you can get at the same p
   ou're reading it differently i i suppose S3: oh no i'm reading exactly what he
 cal background of his work, and, i suppose that part of this would_ one would've
   ot in that sense S2: yeah SU-1: i suppose you S4: un- unless un- unless you un-
   F-A-A, in ten, twenty years let's suppose you know, S1: well they don't like, <
     ple of of details here uh... uh i wonder if you'd comment, uh uh d- page one-si
   ing to catch you on anything but i wonder if you'd just comment on it was th- th
 for for for for for for Jarrett i i wonder if you wouldn't want to um, s- locate
     not (xxx) the population which I wonder why the bacteria will hold on to somet
 you  S6: no that's alright um, so i wonder if maybe we could s- shift a little bi
     f it as a more global issue so i wonder if you'd just   talk about that.  S2:
   ay ready and became radical but I wonder if they'd be able to identify I mean i
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[22] Leech (1993, p. 275) defines corpus annotation as "the practice of adding interpretative (especially linguistic) information to an existing corpus of spoken and/or written language by some kind of coding attached, or interspersed with, the electronic representation of the language material itself".
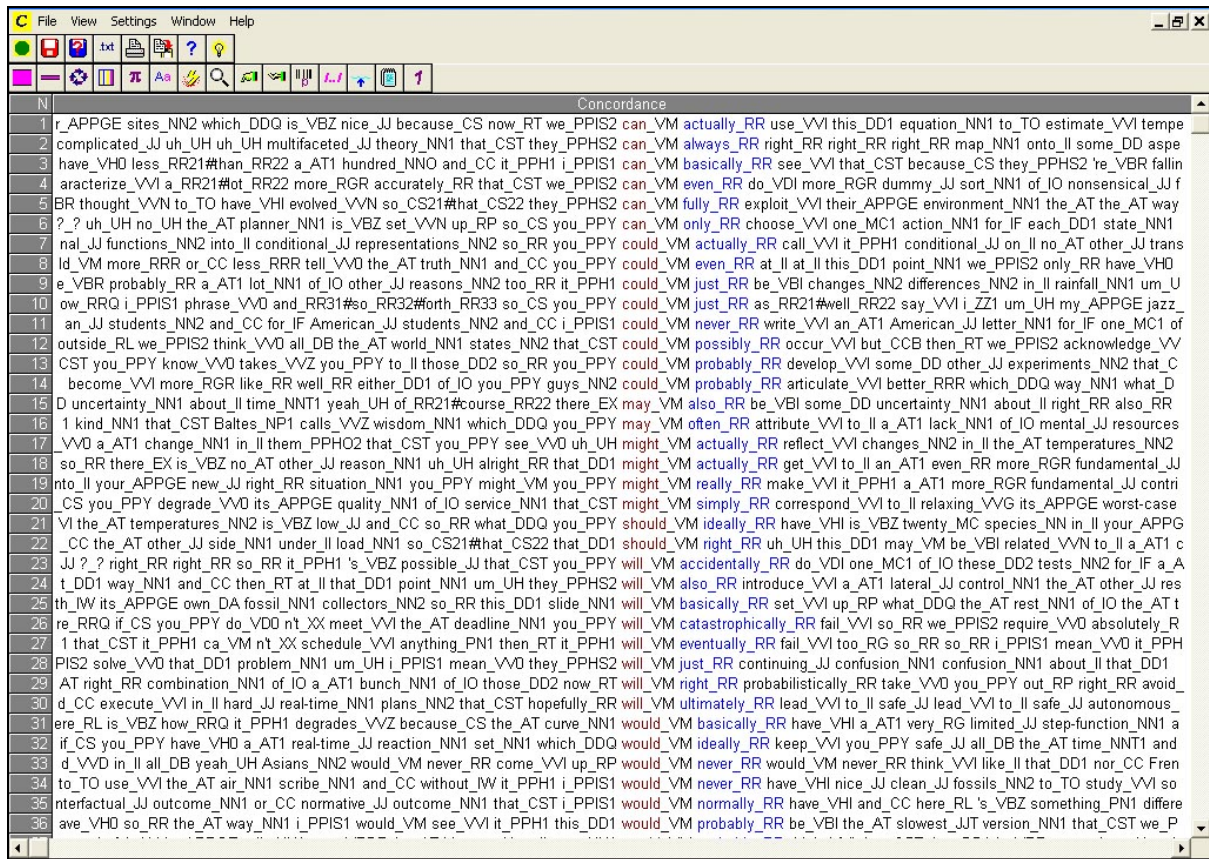
Figure 5.11 - Example of a concordance of the annotated dissertation transcripts

The usefulness of the analytical procedures described in this section is three-fold. First, they show that research can be hypothesis-based or hypothesis-finding. Using a traditional hypothesis-based approach, the analyst starts from a hypothesis (normally) based on the literature and uses the corpus to test it. The advantage of this approach is that the researcher knows where she/he is going, which greatly facilitates interpretation of the results. The disadvantage is that the scope of the research may be limited by the scope of the research question(s).

In the other approach, the researcher may simply decide to gather data, e.g. transcriptions of dissertation defenses, and quantify a particular feature of interest (in our case modal features). This particular approach may be considered very powerful since it can help us gain totally new insights into natural language. However, it is potentially a very dangerous

one. With no particular hypothesis in mind, the analyst may limit his or her investigation to frequency counts without providing an interpretation for them.

There is no way however, in which one approach is better, in absolute terms, than the other. In this study, I am in agreement with Stubbs (1996, p. 47) when he rightly points out that "the linguist always approaches data with hypothesis and hunches, however vague". Therefore, the aims of my dissertation (see Introduction) have stemmed from both the literature and the hypothesis I was able to formulate after the corpus had been segmented, and modal linguistic features had been subsequently quantified and preliminarily investigated.

The second reason why the method described here should be of interest to other researchers is because one major requirement of any process rigorous enough to be called an *analysis* is that the results should be verifiable by other scholars using the same procedures. This is exactly the methodological underlying principle adopted in this study. It should make it possible for different researchers to produce analogous analyses.

Thirdly, the advances in text analysis software for the investigation of natural language have introduced incredible speed, accountability, accurate replicability, statistical reliability and the ability to handle huge amounts of data. In addition to greatly increased reliability in such basic tasks as searching, counting and sorting linguistic features, text analysis software can show accurately the probability of occurrence of linguistic features in text. They have thus brought to linguistic studies a high degree of accuracy of measurement which is important in all sciences.

5.6   Summary

This chapter has described in detail why the MICASE was compiled, how it is structured, and the transcription conventions adopted by its compilers (ELI researchers). It has also provided details on the dissertation defenses that form the corpus of analysis in the

present study and the process of collecting three additional defenses that supplement the other four defenses collected between 1998-2001 by the ELI research team. Finally, the chapter has discussed the advantages of using a corpus-based methodology for the investigation of naturally occurring discourse, and has demonstrated the significant benefits of employing both the *Systemic Coder* and *WordSmith Tools*.

CHAPTER 6

Probabilities in the system of modality:
Overall patterns across the corpus

> Frequency in text is the instantiation of probability in the system. A linguistic system is inherently probabilistic in nature. (Halliday, 1991/2005, p. 45)

6   Introduction

In this chapter, I report the results of a quantitative investigation of the associations which hold between modal clauses across the corpus of eight defenses. The quantitative as well as qualitative results involving individual differences, i.e., differences between the participants (candidates, examiners, and chairs), will be the subject of the next chapter. Here, I am concerned to reveal the relative frequency of occurrence of the different types of modalities in the corpus as a whole, the patterns of occurrence or distribution of associations and how these associations can be located with respect to the grammar as a whole. The quantitative analysis of grammar and discourse patterns has hardly begun (Halliday, 2005), but since language itself consists of patterns which can only be quantitatively delineated, findings such as the ones presented in this chapter are central to the core questions of linguistics and important for many applications of the study of language as a whole.

The chapter examines how the patterns of choice observed in the corpus may be represented in terms of the grammatical system. It inspects how certain choices in the networks may be weighted so as to represent their actual frequency of occurrence in text. In line with Halliday (1991/2005), it is suggested that the incorporation of information on the actual patterns of choice realized in the corpus is a motivation for working towards the

probabilistic modeling of language. This chapter, then, may be seen as a further step in this direction.

The chapter is organized as follows. Section 6.1 discusses how a paradigmatic grammar such as SFG may be enhanced if probabilities are ascribed to every feature of a system or a system network. Section 6.2 describes what is understood here as a probabilistic method for handling the corpus and the benefits such methodology may entail. Section 6.3 reports on the overall quantitative and probabilistic findings that have emerged after the data had been tabulated, discussing their implications for this study and for SFG in general. Finally, Section 6.4 provides a summary of the chapter and reiterates the need to work towards the probabilistic modeling of language.

6.1   A grammar of choice and probability

In chapter 4, I have briefly described some of the tenets of SFG. At this point though, it is necessary to *increase the level of delicacy* to describe what is understood in SFG as CHOICE. In SFG, choice is the basis for the modeling of the language. Systemic theory is in fact a theory of language as choice. Priority is given to paradigmatic relations, recognizing them as the underlying organization of language. Paradigmatic relations are relations of 'either/or'; this is the meaning of choice with respect to the grammar. And it is this notion of choice, paradigmatic relations of 'either/or', which is at the heart of SFG.

With choice as the basis of a theory of language, grammar can be modeled as sets of possibilities, as a potential for creating meaning. Choices of paradigmatic relations are formalized through the notion of SYSTEM. A system is defined as "any set of alternatives, together with its condition of entry" (Halliday & Matthiessen, 2004, p. 22). The entry condition of a system is itself an option in a prior system. It follows from this that the

environment for choice is always that of choices already made. In this way, systems form networks of systems organized according to the priority of certain options over other options.

This ordering of systems into system of systems or a system network is related to the notion of DELICACY. Since a system, as the quote from Halliday and Matthiessen above indicates, is a set of mutually exclusive options, these options give rise to further sets of mutually exclusive options. Delicacy accounts for this relation of priority between systems (ibid, p. 22). The options of a particular system only become available once the entry condition of that system is satisfied, which is itself an option in a prior, less delicate, system of options. Delicacy, then, is a scale of differentiation; it is a matter of degree to which distinctions are made, from primary delicacy (*is a kind of*) to the most delicate of distinctions (*is a kind of a kind of a kind of …*) (ibid, p. 22).

To illustrate this concept, I present a highly simplified picture of the Mood system in English in Figure 6.1. We have here three systems constituted by the options indicative/imperative, declarative/interrogative and WH/polar arranged according to the relative delicacy of distinctions. The choice between the feature WH/polar only becomes available given the selection of the feature interrogative. Likewise the choice between interrogative/declarative is only available given the selection of indicative in detriment of imperative. The logical priority of certain systems in detriment of others is related to the relationship of delicacy which holds between them.
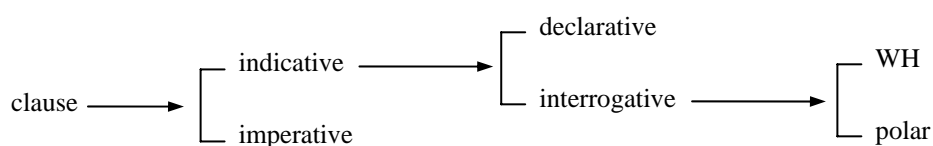
Figure 6.1 Simplified relative delicacy in the system of Mood in English

In a theory of language that has choice as the organizing principle, the meaning of probabilities comes into focus. Of central importance for the 'probabilization' of grammar is the notion of system and the concept of delicacy discussed above. It is because the organizing principle of SFG is a multilayering of choices that the probabilization of grammar appears to be the natural step leading to the enhancement of our understanding of language (Halliday, 2005). To reiterate, the basic organization of language is systems of choices; and it is through the probabilistic modeling of grammar that we may investigate the relation between systems of choice and patterns of typical choice.

Systems of choice are relations of the type 'either/or'; patterns of choice are relations of the type 'more likely/less likely' (Halliday, 1995/2005). Recognizing that language is based on paradigmatic relations of 'either/or' leads us to recognize that these are defined by relations of 'more likely/less likely'. It is in the description of these relations of 'more likely/less likely' that probabilities enter grammatical description. Such position is stated clearly by Halliday (1991/2005, p. 45): "[f]requency in text is the instantiation of probability in the system. A linguistic system is inherently probabilistic in nature. […] Obviously, to interpret language in probabilistic terms, the grammar […] has to be paradigmatic: it has to be able to represent language as **choice**, since probability is the probability of "choosing" […] one thing rather than another" (emphasis in original).

To deepen the grammar in this way, we need to correlate relations of 'either/or' to relations of 'more likely/less likely'. This might be achieved by ascribing probabilities to features in systems. The probabilities ascribed to the features in a system describe the pattern of typical choice. For example, let us suppose we have a system b/c with an entry condition a. This can be read as follows: if feature a is present, then either b or c is also present with b more likely, equally likely, or less likely to be present than c.

Thus, it may be argued that 'either/or' are the qualitative aspect of grammar while the relations of 'more likely/less likely' are the quantitative aspect. Probabilization of the grammar "is the incorporation of the quantitative aspect of grammar into grammatical description" (Halliday, 1991, p. 37). Language, then, is at the same time a system of quantitative difference and a system of qualitative difference. While it is a system of choice, it is also a system of variation. From the perspective of the system, systems of choice and patterns of choice are not essentially different.

In summary, the linguistic system as a system of paradigmatic oppositions is a system of possibilities. Using Halliday parlance: *choosing a particular feature in a system means what it does because of the features that were not chosen but could have been chosen*. This is the qualitative aspect of the system, the system of 'either/or' relations. But the system is not only a system of possibilities; it is also a system of probabilities. The linguistic system as a system of probabilities is also a "potential to mean" (Halliday, 1991, p. 43). The choice of a particular feature also means what it does against the background of what are more likely or less likely choices. What is said is not only interpreted against the background of what could have been said but was not; it is also interpreted against the background of probability, against the background of what was more likely and what was less likely to be said. Hence, the grammar of a language is not only the grammar of choice but also the grammar of probability.

6.2   Probabilistic method

The analysis of language as a probabilistic system is an empirical study which rest on the quantification of data. Quantification involves the stages of classification, counting, tabulation and ultimately the interpretation of the patterns of occurrence. Classification is the process of deciding how and what to count. This was achieved by defining the variables of interest in and identifying the categories or variants of the variables (see Chapter 4, Section

4.2). The definition of the variables cannot be *ad hoc* but must be motivated by linguistic theory (in our case SFG). The system network defines the set of possible variables (Chapter 4, p. 88). It is in the system that we have the context of qualitative difference in which we investigate the patterns of quantitative difference – a search for patterns of 'more likely/less likely'.

The relationship which holds between a variable and its categories or variants is a relationship of delicacy. The variable is defined as the entry condition to a system and its categories of variants as the feature choices in that system. For the counting to be statistically interpretable, the classification must meet certain criteria: the categories of the variable must be mutually exclusive and exhaustive (Halliday, 1991).

The variables I have investigated are: TYPE OF MODALITY with its categories of modalization and modulation; ORIENTATION with its categories of subjective and objective; MANIFESTATION with its categories of explicit and implicit; and VALUE with its categories of high, median, and low. Each modal clause in the corpus was coded in relation to its type of modality and their respective subcategories – whether they were probability/usuality (modalization) or obligation/inclination (modulation); orientation; manifestation; and value[23].

Based on the above classification, the frequency of the variables was measured, tallying the number of relations that fell into each category of the classification. The data was analyzed by means of percentage tables to investigate the patterns of choice involving modality in the corpus. The counts were tabulated individually for each variable and cross-tabulated for the cross-classification of modalization and modulation with orientation, manifestation, and value.

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[23] I have also coded the clauses for participant, i.e., candidate, examiner, and chair but these will be discussed in Chapter 7.

6.2.1 What does probabilization of the grammar mean?

In assigning probabilities to the features in a system we seek to model the likelihood of one feature being selected over other features in the system. For example, given that we have entered the system of type of modality, what is the likelihood that modalization will be chosen over modulation?

In probability theory, we speak of processes which can result in different outcomes as *experiments* (Oakes, 1998). The possible outcomes of an experiment are referred to as *events*. For example, an experiment might consist of tossing a coin. We seek the probability of obtaining a head. Assuming the coin is unbiased, the probability of obtaining a head is 0.5 and the probability of obtaining a tail is 0.5. The set of possible outcomes or events in this example consists of either a head or a tail. The set of possible outcomes is referred to as the *sample space*. A total probability of 1.0 is distributed over the set of possible outcomes, i.e. over a sample space, which in this example is the probability of getting either a head or a tail.

Returning to our example of type of modality, entering this system constitutes an experiment, which must result in either the choice of modalization or modulation. If the system is unbiased, i.e. the features are *equiprobable*, then the probability of modalization being chosen is 0.5 and the probability of modulation being chosen is 0.5. While we might assume that a coin is unbiased, we cannot assume that such is the case with grammatical systems. The probability of a grammatical event can only be determined empirically, that is, by observing its relative frequency of occurrence in authentic texts. By the probability of a grammatical event I mean the proportion of times it occurs in the long run, employing the statistical definition of probability as the limit of relative frequency. Keeping with the example of type of modality, this means in practice that the relative frequency with which modalizations occur in the corpus is used as an estimate of the probability of the choice of the feature 'modalization' in the system.

While probabilization of the grammar can only proceed by being empirically based on the corpus sample, the statistical validity of the probabilistic modeling of patterns of 'more likely/less likely' choice rests on the validity of the definition of the sample spaces. First, a sample space must be exhaustive, delimiting the complete set of possible outcomes and second, each outcome must be mutually exclusive of all others (Halliday, 1991, p. 34). As we saw above, the definition of a system – as an entry condition together with an exhaustive set of mutually exclusive options, one of which must be chosen – meets these criteria. Because the system is the organizing principle of the SFG, the integration of probabilistic modeling of grammatical variation is theoretically grounded and linguistically meaningful (Halliday, 1991/2005).

6.3   Results and discussion

The overall distribution of modal features in the corpus is presented in Table 6.1. This table presents the univariate distribution of the variables of clause type, type of modality (and their subsystems), orientation, manifestation, and value. Sketching the overall distribution of frequencies in general terms, we have, on the one hand, the skewed distribution of all variables with the exception of manifestation and value which tend to be more balanced. In relation to value, if we group the outer values, i.e. high and low, we have an equiprobable distribution where median value accounts for 52 per cent of the modal clauses whereas the outer values account for the remaining 48 per cent.

Using the percentage of frequencies in Table 6.1, we estimate the probabilities needed to weight the relevant features in the system network of modality to describe the univariate distribution of the data. We use the observed frequency of the variables in the corpus to estimate the probabilities of feature selection in the system. Figure 6.2 presents the primary

options in the system network for modality with probabilities assigned to the features on the

basis of their relative frequency in the corpus.

Table 6.1 Distribution of the variables of modality

	Frequency	Percentage
TYPE OF CLAUSE		
Non-modal	11,349	84%
Modal	2,159	16%
Total	**13,508**	**100%**
MODALITY TYPE		
Modalization	1,450	67%
Modulation	708	33%
Total	**2,158**	**100%**
MODALIZATION TYPE		
Probability	1,307	90%
Usuality	143	10%
Total	**1,450**	**100%**
MODULATION TYPE		
Obligation	499	70%
Inclination	209	30%
Total	**708**	**100%**
ORIENTATION		
Subjective	1,731	80%
Objective	427	20%
Total	**2,158**	**100%**
MANIFESTATION		
Explicit	867	40%
Implicit	1,291	60%
Total	**2,158**	**100%**
VALUE		
High	483	22%
Median	1,110	52%
Low	565	26%
Total	**2,158**	**100%**

In Figure 6.2 we have the initial assignment of probabilities to the system to represent

the actual frequency of occurrence of modal features in the corpus. While the system models

the primary oppositions which account for modal features, the probabilities on the features model the patterns of occurrence of these modal features. By weighting the features in the system network we are modeling the typical patterns of choice, modeling the relations of 'more likely/less likely'.
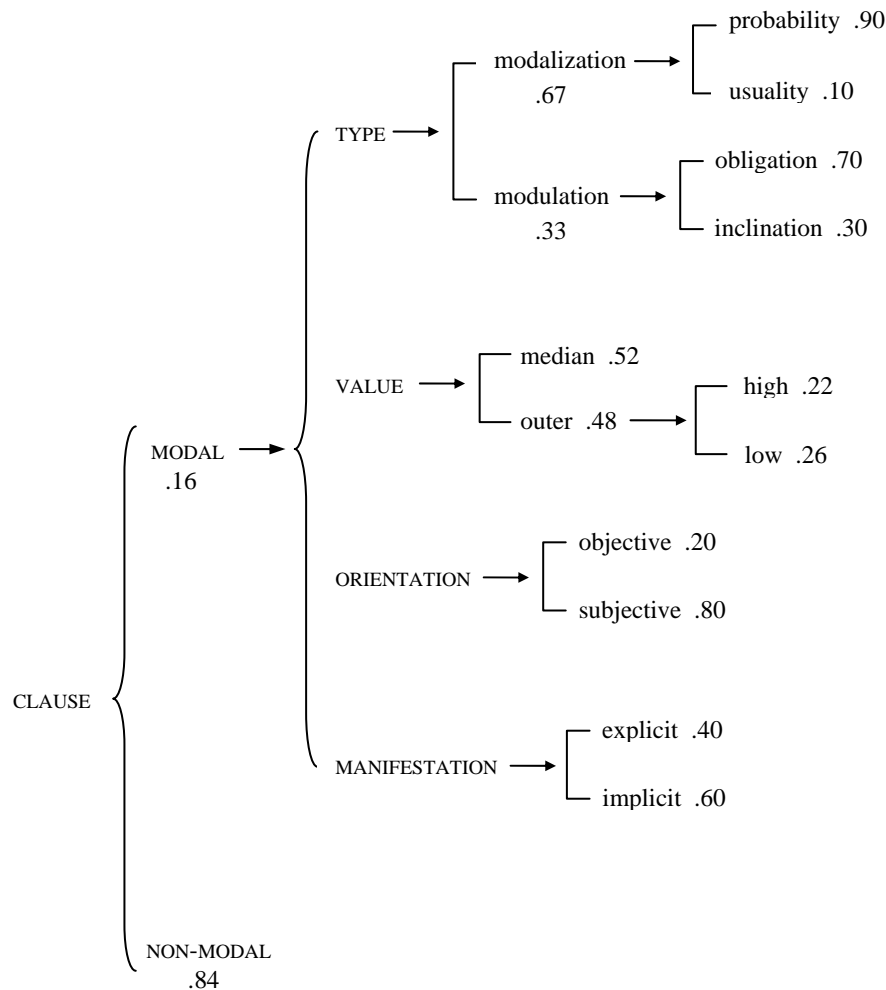
Figure 6.2 Primary choices in the modality network with initial ascription of probabilities to the features

For example, taking the system of modalization, we could read it as follows: entering the system of modalization, there is the choice among *probability* and *usuality*, with the probability of choosing 'usuality' being 0.10 and the probability of choosing 'probability' being 0.9. Turning to the system of type of modality, there is the choice between *modalization* and *modulation*, with the probability of selecting modalization being 0.67 and the probability

of selecting modulation being 0.33. By weighting the system network, the system not only captures the patterns of grammatical oppositions but also the typical patterns of grammatical choice.

Based on figures he had arrived at in the 1960's, by counting manually 2000 instances each of a number of sets of systemic options across texts of different genres in modern English, Halliday suggested that systems normally have a bimodal distribution. The hypothesis he formulated was that systems tended towards one or other of just two types: (i) equiprobable (0.5 / 0.5) and (ii) skewed, with the skew tending towards a ratio of one order of magnitude (i.e. 0.9 / 0.1). According to Halliday this corresponds to one interpretation of the concept of marking: type (i), the equiprobable, has no unmarked term, i.e., each term would occur at roughly the same frequency, while type (ii), the skew, has one of their terms unmarked, i.e., one term would be significantly more frequent than the other. Halliday (1991/2005, p. 48) suggests that expected examples of each type, in English, would be:

(i) equiprobable (0.5 / 0.5)
> Number: singular / plural
> Non-finite aspect: '*to*' / '*ing*'
> Process type: material / mental / relational
> Nominal deixis: specific / non-specific

(ii) skewed (0.9 / 0.1)
> Polarity: positive / negative
> Mood: indicative / imperative
> Indicative mood: declarative / interrogative
> Voice (verbal group): active / passive
> Declarative theme: Subject-theme / other theme
> Verbal deixis: temporal / modal

In other words, the prediction was that general grammatical systems would not be distributed evenly across the probability scale, with all values from 0.5 / 0.5 to 0.99 / 0.01, but that they would be distributed bimodaly into these two probability profiles – with some

approximation of these two values[24]. Halliday also predicted a similar pattern for ternary and

quaternary systems, except that it should be possible to find more than one type within the

skew (see Halliday, 1992/2005 for possible insights into why this pattern should exist).

The picture painted in Figure 6.2 does not diverge from that painted by Halliday 40

years ago. We see that the variation is not random, and that, in principle, any set of system

will probably be either equiprobable or skewed. Halliday (1991, p. 69) argues that since we

are considering semiotic systems, which are systems of a particular kind, "[w]e know they are

unlikely all to be equiprobable; such grammar would have no redundancy at all, and no

human semiotic could work with such restraint". The reason this appears to be so is because

"there is too much noise" (ibid, p. 74). Halliday comments that "no system which persists

through constant perturbation from its environment could remain in a state of almost zero

redundancy" (ibid, p. 74). On the other hand, he suggests that it is equally unlikely that

skewed system could spread over all possible values because "a semiotic system of this kind

would be virtually impossible to learn".

The system of type of modality and the systems of orientation, manifestation, and

value are independent systems. This signifies that the choice of features in one system does

not affect the *possible* choice of features in the other system. Thus they are modeled as

simultaneous systems. Statistical independence on the other hand signifies that the choice of

features in one system does not affect the *probable* choice of features in the other system. The

statistical independence of the system of orientation, for example, would mean that the overall

observed 0.8 / 0.2 ratio of subjective to objective would hold within each of the categories of

the variables of the other systems. Thus 80% of the modalities would be subjective and 20%

would be objective in each of the categories of modalization (probability and usuality),

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[24] Halliday (1991, p. 70) defines the following limits for bimodal systems:

    (i)   equiprobable – 0.5 : 0.5 ~ 0.65 : 0.35
    (ii)   skewed – 0.8 : 0.2 ~ 0.95 : 0.05

modulation (obligation and inclination), manifestation (explicit and implicit), and value (high, median, and low).

The statistical independence of two variables signifies that there is no association between the two variables, while the absence of statistical independence signifies some degree of association. Is it the case that the choice of orientation and manifestation and the choice of type of modalization are statistically independent or is there an association between them? We will investigate this by examining the distribution of orientation, manifestation, and value within the categories of modalization and modulation. Within probability, usuality, obligation, and inclination, we compute the percentage of subjective-explicit, subjective-implict, objective-explict, and objective-implicit realizations jointly with their three possible values (high, median, and low). Thus controlling for varying totals associating categories, we can validly compare the percentage of relations across the categories of modalization and modulation. The results are presented in Figure 6.3.

The data clearly reveals that for the most part no association exists between the categories of modalization and modulation and the orientation, manifestation, and value variables. The choice of type of modalization and modulation appear to be statistically independent. The 0.8 / 0.2 ratio of subjective to objective, the 0.6 / 0.4 ratio of implicit to explicit, and the ratio 0.5 / 0.5 of median to outer value that was observed overall turns out to be representative for most of the distribution of probability, usuality, obligation and inclination.

Within the category of PROBABILITY, we see that the ratio of orientation subjective/objective is 0.84 / 0.16 (skewed), and that the ratio of manifestation implicit/explicit is 0.54 / 0.46 (equiprobable). Interestingly, the choice of value does not appear to be statistically independent when we associate orientation, manifestation, and modalizations of probability. Thus we find it to be equiprobable (median to outer value ratio

is balanced) for the subjective-implicit, objective-explicit, and objective-implicit associations but skewed towards median value for the subjective-explicit association.

	high	.13
sub:exp	median	.74
.44	low	.13
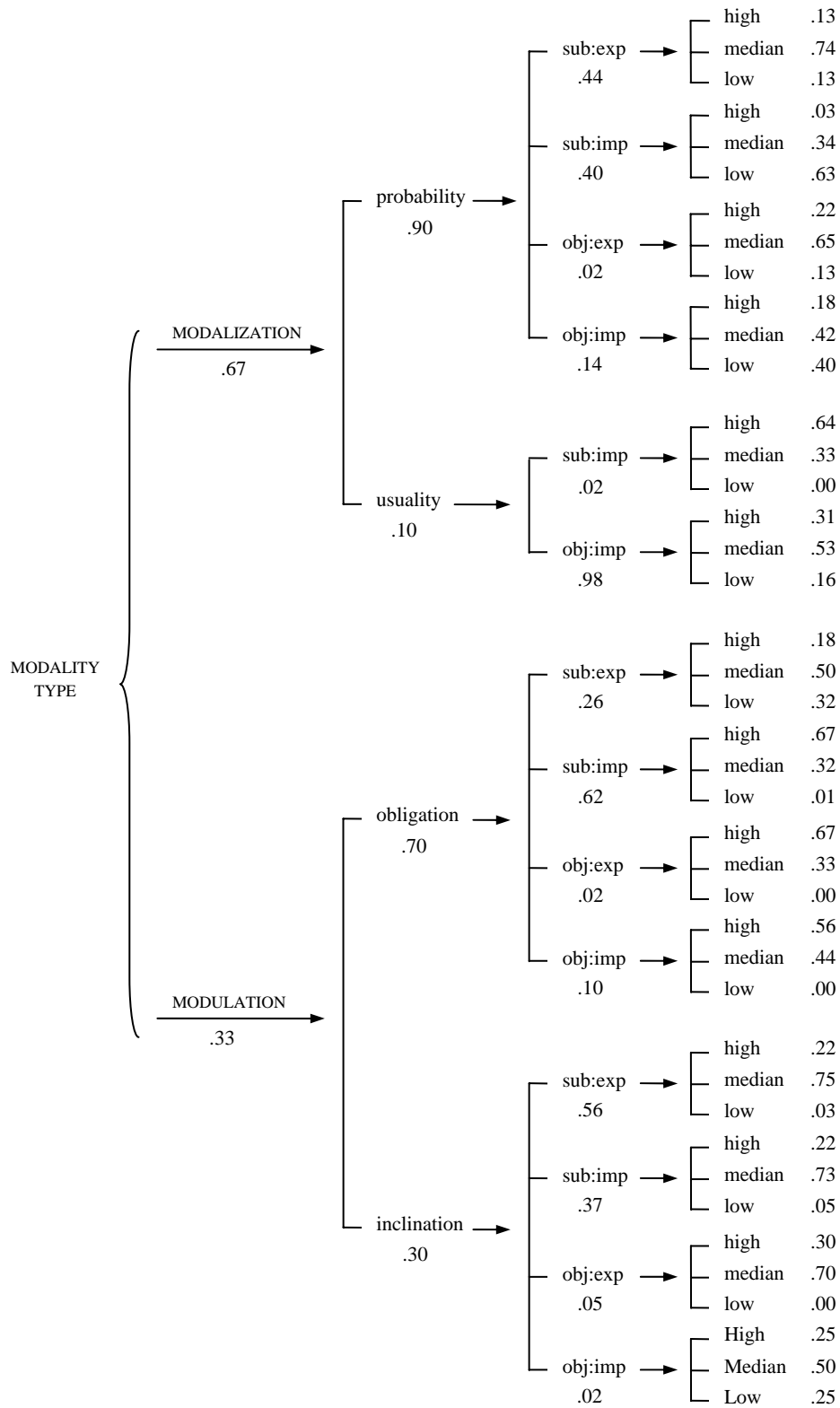
Figure 6.3 Association of types of modalization and modulation with respect to orientation, manifestation and value

In relation to OBLIGATION, a similar picture emerges. The system is skewed towards subjective orientation, the ratio of subjective-objective being 0.88 / 0.12. The manifestation, on the other hand, is skewed towards implicit (0.72 / 0.28), which shows that the system of manifestation might not be statistically independent from modulations of obligation. As regards the system of value, the figures reveal that the distribution remains equiprobable between median and outer values for all four possible associations of orientation and manifestation.

With respect to INCLINATION, once again we note the same probabilistic patterns appearing. There is a skew (0.93 / 0.07) towards subjective orientation, the ratio of implicit to explicit manifestation remains equiprobable (0.61 / 0.39). Once more the system of value does not appear to be statistically independent and is skewed towards median value for the subjective-explicit, subjective-implicit, and objective-explicit associations but remains equiprobable for the objective-implicit association.

Finally, a completely different pattern of association is found for modalizations of USUALITY. First of all, we note that there are not explicit manifestations for usuality (e.g., *it is unusual for him to …*). Secondly, when we consider the system of orientation, we find a sharp skew towards objectivity reflected in the subjective-objective 0.02 / 0.98 ratio. Thus, differently from probability and from the types of modulation, usuality almost uniquely associates with objective-implicit realizations. One probable reason for this sharp association between usuality and objective-implicit orientation/manifestation lies in the fact that the lexicogrammatical resources available for the expression of usuality are limited and tend to cluster around one specific grammatical class, that of adverbs (e.g. *always, never, sometimes, usually, frequently, rarely*, etc). Table 6.2 shows the range of possible realizations for types of modalization and modulation in English.

Type of MODALITY	Congruent realization			Metaphorical realization	
	Finite Implicit subjective	**Adjunct** Implicit objective	**Predicator** Implicit objective	**Mental clause** Explicit subjective	**Attributive clause** Explicit objective
probability	Modal auxiliary verbs	certainly probably possibly …		I am sure I know I believe I guess …	it is certain it is probable it is possible
usuality		always usually sometimes never …			it is unusual it is uncommon it is atypical (?) (for her to…)
obligation	Modal auxiliary verbs	necessarily unavoidably inevitably …	be allowed to be supposed to be obliged to	I am willing I expect I want (her to …)	it is necessary it is permitted it is expected it is unavoidable (for her to …)
inclination	Modal auxiliary verbs	willingly eagerly keenly	be willing to be keen to be determined to be inclined to	I'd like to I want to	it'd be nice to it'd be good to it'd be lovely to it'd be interesting

Table 6.2 Congruent and incongruent realizations of modality (after Martin et al., 1999)

After this initial characterization of the probabilistic patterning across the systems here investigated a question comes to mind: to what extent do the quantitative patterns observed in the corpus as a whole, the probabilistic properties of the corpus, explain qualitative linguistic choices? In the remainder of this section I will attempt to provide appropriate answers to the above question.

Up to this point, Halliday's hypothesis of equiprobable and skewed systems has been retained, with the values lying within the limits predicted. Based on Figures 6.2 and 6.3, I would like to propose the following functional interpretations for the probabilities revealed in the analysis:

1.   VERBAL DEIXIS - temporal (0.86) vs. modal (0.14)

The results found here confirm previous findings (Halliday & James, 1993/2005; Plum & Cowling, 1987) that such system is skewed towards temporal deixis. The ratio

temporal/modal found by Halliday and James' analysis of primary tense and polarity using the

COBUILD corpus (18 million words) was 0.88 / 0.12. Using a corpus of interviews from the

Sydney Social Dialect Survey, Plum and Cowling examined 4,436 clauses and found that 83

per cent selected temporal deixis and 17 per cent modal. The analysis reported here yielded a

ratio of 0.84 to 0.16 (see Figure 6.2). Taken together these findings suggest that the

probability profiles are not simply appendages to an existing network, but they may play a

part in the construction of the network as a theory of how the grammar works. As EFL

professionals we will, at some point, have to teach verbal deixis to our pupils; so why not

provide networks with probability ascribed to each feature? For verbal deixis we could

present something like Figure 6.4 (probabilities for present, past and future are derived from

Halliday & James, 1993/2005):
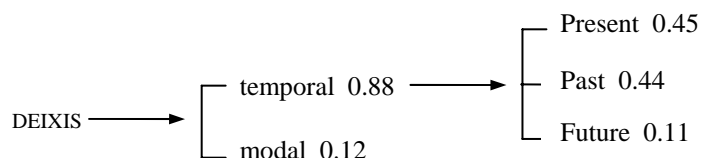
Figure 6.4 Simplified system network for verbal deixis with probabilities ascribed

Halliday (1993/2005, p. 135) makes the point that when learning a language children

tend to respond to more frequent options in the grammar and use these first, bringing in the

less frequent ones at later stages. In other words, he is suggesting that children (and why not

EFL learners as well) learn language as a probabilistic system; they are exposed to perhaps

thousands of clauses a year, and are "sensitive to relative frequency as a resource for

ordering" what to learn. He goes on to argue that

> From this point of view, one could hypothesize that a semiotic in which the probabilities
> associated with various sets of options, or systems, were distributed randomly all the way
> from 0.5 : 0.5 to 0.99 : 0.01 would be virtually impossible to learn. One in which there was
> some kind of bimodal distribution, would be much accessible to a learner. This does not in
> itself favour one profile over another, for systems of the type which are skew; but it does
> suggest that they might very well tend to cluster around just one set of values (Halliday,
> 1993/2005, p. 136).

The significance of Halliday's argument above is that the semantic features involved in learning a language are realized, non-arbitrarily, through grammatical systems to which probabilities can be ascribed; they affect the potential to learn.

2.   TYPE OF MODALITY - modalization (0.67) vs. modulation (0.33)

The system is on the fringe of the maximum limit (0.65 to 0.35) suggested by Halliday for equiprobability. More importantly though, is to ask what might be motivating the skew towards modalizations. I would like to suggest that the predominance of modalizations may be ascribed to the main business at hand in doctoral defenses, i.e., the exchange of information. In dissertation defenses, among other things, we find a candidate involved in negotiating his/her findings, which oftentimes are tentative; in describing the state of the art in his/her macro/micro-fields of inquiry - knowledge is not static and definitive, and hence usually needs to be qualified; and in acknowledging that his/her interpersonal positioning may be seen as one within a diversity of positionings operating in that specific discourse community. Likewise, we might find examiners who will 'academically' (or not!) problematize certain aspects of the candidates' dissertation, but who are wide aware of how much time and effort he/she has committed to it, who know how to soften criticism (by modalizing it), and who oftentimes will be capable of recognizing that in the end of such a demanding academic endeavor the candidate probably has exceeded their expertise on "that specific topic". Hence, the 'main business' may be taken to be a highly intellectual exchange rather than a 'normative top-down inquisition'.

2.1   TYPE OF MODALIZATION – probability (0.9) vs. usuality (0.1)

Here we find Halliday's classic skew value towards probability. The foregrounding of modalizations of probability (specially from the part of the candidates) seems to reflect the fact that propositions which contribute to the extension of scientific knowledge are rarely

expressed categorically but invariably include epistemic devices that indicate the participants'

caution to firmly commit to the truth of a proposition or of a debatable argument.

Modalizations of probability appear to be critical in conveying the appropriate weight to

scientific claims (Hyland, 1996b). They also contribute to the creation of what Myers (1990,

p. 142) calls a "narrative of science" which shapes events and entities according to the

theoretical expectations of the field.

Hence, modalizations of probability indicate an important distinction between

propositions and how the participants want the audience to understand their relationship to

them and to the scientific community. They seem to be crucial for gaining acceptance of

claims because they signal the participants' assessment of the propositions in terms of the

field's standards of evaluation.

Table 6.3 displays the most frequent linguistic resources employed by the participants

to express modalizations of probability. Table 6.3 reveals that formulae involving the mental

process *think* (e.g., *I think, I don't think, I do think, do you think*) and modal auxiliaries verbs

account for over 64% of the total number of modalizations of probability in the corpus (833

occurrences). Such high frequency indicates that despite having at their disposal a wide range

of lexicogrammatical choices for the expression of probability, participants are nevertheless

extremely selective in their preferences.

Table 6.3 Linguistic resources employed in the expression of probability

Type of linguistic resource (and realizations)	Frequency
A) MENTAL VERB PROJECTIONS	**571**
I think	259
I know / we know	47
I don't know / we don't know	37
I guess	32
I wonder / I'm wondering /I was wondering	29
I don't think	26
I believe / we believe	25
I'm not sure	23
Do you think	13
I do think	12
I'm sure	9

Table 6.3 continued

we assume	7
I suppose	5
I presume	2
I'm confident	2
Others	43
B) MODAL AUXILIARY VERBS	**523**
might	122
may	109
would	92
could	83
can	61
will	43
must	8
should	5
C) MODAL ADJUNCTS	**190**
probably	71
maybe	66
certainly	33
possibly	11
perhaps	9
D) MODAL ATTRIBUTES	**23**
it's possible that	12
it's (un)likely that	6
it's true that	3
it's conceivable that	2
TOTAL	**1307**

2.2   TYPE OF MODULATION – obligation (0.7) vs. inclination (0.3)

Modulations are skewed towards obligation in the corpus. Although modulations of obligation account for just 23% of the modal clauses in the corpus, they play a crucial role in the exchange of meanings – they encourage the participants to act or refrain from acting in certain ways in specific generic phases along the defenses (e.g., giving advice, demanding answers). Similarly, despite their limited use (10% of the modal clauses) modulations of inclination may be employed for a range of purposes: to express gratitude (e.g., *I'd like to thank* …), in metalinguistic comments (e.g., *I'd like to draw your attention to* …), and for rebuttals (e.g., *I wouldn't say that* …). As it will become clear in Chapter 7, chairs and examiners make use of modulations of obligation and inclination in completely different ways and for completely different purposes than do the candidates.

3.   TYPE OF ORIENTATION – subjective (0.8) vs. objective (0.2)

One of the basic distinctions that determine how each type of modality will be realized

is the orientation, i.e., how speakers assign responsibility for their assessments. Thus, when

expressing a proposition a speaker may choose to gloss it subjectively or objectively (see

Chapter 4, pp. 85-87). As most modal systems investigated in this studied, here too we find

that orientation is skewed towards subjectivity. It may be suggested that one of the reasons

why subjective orientation is favored by the participants of dissertation defenses is related to

the nature of face-to-face unplanned discourse. In fact, in her analysis of spoken American

English conversations, Scheibman (2001, p. 70) notes that first person singular followed by

mental processes is the prototypical site for expression of speaker point of view in face-to-

face interaction. The high frequency of *I* with mental processes is attributable, according to

Scheibman, to the high frequency of "routinized expressions that personalize the speaker's

contribution" (e.g., *I think*). She goes on to add

> Given the role of frequency in the emergence of conventionalized structure in interaction,
> **subjective patterning** manifests uniquely in different contexts. With first person and second
> person singular subjects we find highly frequent lexical collocations with pragmatic import, in
> particular with **verbs of cognition** (e.g., *I guess, I don't know, I think*). Moreover, text counts
> indicate the high use of these conventionalized 1s and 2s expressions is in large part
> responsible for the frequency of this category as a whole (e.g., 1s and 2s, verbs of cognition),
> as well as for the individual verb lexemes (e.g., *know* and *think* are the second and fourth most
> frequent lexical verbs, respectively, in the database). (Scheibman, 2001, p. 85; emphasis
> added)

Thus, it becomes evident from Figures 6.2 and 6.3 that the scalar nature of

modalizations and modulations both typically combine with a common semantic feature, that

of 'subjective', in the sense of representing the speakers' judgments; and this is symbolized

by the recurrent use of mental processes and modal auxiliary verbs as typical forms of the

realization of modalizations and/or modulations. As it will be discussed in Chapter 7, this

particular semantic configuration is an essential element in the exchange of meanings in the

defenses.

4.   **TYPE OF MANIFESTATION – implict (0.6) vs. explicit (0.4)**

As we have seen above, speakers may construe their propositions and proposals as subjective or objective in order to assign responsibility to their assessments. Correspondingly, they may also choose to construe such propositions and proposals in an explicit or implicit manner. Thus, when a speaker says *I think John is sick*, he/she is being explicitly subjective in relation to his/her judgment of the probability of John being sick; if he/she, on the other hand, opts for construing his/her assessment of probabilities with a clause such as *Perhaps John is sick*, he/she is being implicitly subjective. All in all, explicit and implicit manifestation show an equiprobable distribution (0.40 / 0.60) which is associated with the high frequency of both projections involving metal processes (explicit) and modal auxiliary verbs and modal adverbs (implicit) as favored linguistic devices for the expression of modality. While explicit orientation normally constructs the speaker as the source of judgment, implicit orientation has the effect of distancing speakers from the assessment, which has been removed from the verbal part of the MOOD function. Thus, in the invented example above - *Perhaps Johns is sick*, the speaker invites negotiation of polarity (*isn't he?*), nudging aside the negotiation of the modality (*Perhaps*).

5.   **TYPE OF VALUE – high (0.22) vs. median (0.52) vs. low (0.26)**

As has been described in Chapter 3, the system of value focuses attention on the strength of modal assessment. Setting aside ability which is not gradable in verbal form[25], modalizations and modulations can be scaled according to whether their value is low, median, or high. Halliday (1994) makes the point that, interpreted in this light, modality can be seen to open up a semantic space between *is* and *isn't* for propositions and *do!* and *don't!* or *will* and *won't* for proposals – in other words, it establishes the potential for degrees of polarity in both

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[25] Nominalized objective forms of ability do open up the possibility of grading, via nominal group resources, for instance *a low ability...*, *a median ability...*, *a high ability to conduct electricity*. Other types of objective realizations also allow for grading, e.g., *great ability*, *quite able*, etc.

the indicative and the imperative realms of negotiation. Similarly to type of modality and manifestation, the system of value also displays an equiprobable distribution if we group the high and low values under the label 'outer'. One possible reason for the clustering of modal choices around median value is that outer values may be risky from a discursive point of view, i.e., they may jeopardize the interpersonal relations at stake in ceremonies like defenses. From the part of the candidate, he/she will probably want to convey an image or knowledgeability and reliability, so the choice of low values may not contribute to the desired interpersonal impact. The choice of high values indicates that the candidate is endowed with the confidence and the power of being in control of his/her knowing; it may, nevertheless, be an inadequate interpersonal choice depending on the stage of the defense: it may narrow down dialogic space, and it may even make the candidate sound overconfident, which, in turn, can be perceived as arrogance from the part of the examiners.

On the same token, it may be expected for the examiners' values to cluster medially since they probably wish to establish a symmetrical relationship with the candidates. In fact, 'new knowing', which many times extends quite beyond the first-hand knowledge of examiners, may lead them to open their expertise to negotiability, and in so doing, rely on a more neutral value such as median. As it will become clear in Chapter 7, examiners' use of median and low value modalities fulfills an important rhetorical role, especially when questions and/or suggestions/recommendations are being made.

6.4   Concluding remarks

This chapter has attempted to provide evidence that in order to understand some of the properties of grammatical systems, and especially of modal systems, it is necessary to show that such systems can be represented in probabilistic terms. It seems to be clear that the significance of such probabilities is not that they predict single instances. What is predicted is

the general pattern. We might establish that, for any clause in English, the probability of its being modal is (say) one in ten; but that will not enable us to specify in advance the deixis of any particular clause. However, this is not to say that probability has no significance. It has; but its relevance lies not in predicting but in interpreting. Part of the meaning of choosing any feature is the probability with which that feature is chosen; thus the meaning of temporal deixis is not simply 'not modal' but 'not modal', against odds of nine to one. This is one of the reasons, according to Halliday (1991, p. 68), why "grammatical choices may mean different things in different registers, where the odds may be found to vary".

At this point, the reader may raise the following objection: while it can be perfectly possible to establish frequencies of occurrence of grammatical features in the current corpus, these cannot be interpreted as overall probabilities of the system because every text will be related to a particular register[26]. I would like to suggest that this may be a wrong way of looking at the probabilities reported here. Certainly every text belongs to a particular register. This means that the greater the corpus and the variety of texts it encompasses, the more accurate the picture will be. Halliday (1991, p. 82) uses a weather metaphor to explain why the investigation of frequencies (or instances of the system) may illuminate systemic patterns:

> [T]here is language as a system, an abstract potential, and there are spoken and written texts, which are instances of language in use. But the "system" and the "instance" are not two distinct phenomenon of language: what we have are two different observers, looking at this phenomenon from different depths in time. If I may use once again the analogy drawn from the weather: the instance-observer is the weatherman, whose texts are day-to-day weather patterns displaying variations in temperature, humidity, air pressure, wind direction and so on, all of which can be observed, recorded and measured. The system observer is the climatologist, who models the total potential of a given climatic zone in terms of overall probabilities. What appears to the former as a long-term weather pattern becomes for the latter a defined climatic system. There is only one set of phenomenon here: the meteorological process of precipitation, movement of air masses and the like, which we observe in close-up, as text, or else in depth, as system. **But one thing is clear: the more weather we observe, as instance-watchers, the better we shall perform as system-watchers when we turn to explaining the climate**. (emphasis added)

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[26] Halliday (1991, p. 66) maintains that "*a register* is a tendency to select certain combinations of meanings with certain frequencies, and this cam be formulated as the probabilities attached to grammatical systems" (emphasis in original). I shall use the term register here analogously.

Hence, according to the quote above, it is plausible to treat frequency as probability. By making use of larger corpora to investigate frequencies we may progressively offer more accurate accounts of the system. Since, to the best of my knowledge, there are no probabilistic studies involving more delicate systems such as subcategories of modality, I cannot contrast the findings reported here and empirically argue that these are *deviations* or reflect global systemic patterns[27]. In other words, could there be a single pattern of probabilistic distribution for subcategories of modality regardless of register? At this point, I definitively have no answer for this question; nevertheless, I think it is just by interrogating corpora (which stand for authentic instances of the system) that we may sharpen the picture of the complex semiotic system that is language.

Another question to be raised is related to the degree of association of simultaneous systems such as the ones described here. The results show that (i) in modalizations of probability, the value seems to be conditioned by the association of subjective orientation and explicit manifestation skewing it towards median; (ii) modulations of obligation seem to be statistically associated with implicit manifestation; (iii) modulations of inclination seem to statistically associated with median values; and (iv) modalizations of usuality are extremely associated to objective-implicit realizations. Hence, simultaneous systems can be statistically associated, that is, only partially independent, their intersection being governed by probabilities which are not simply the product of the separate probabilities of each. In this way, one system seems to condition the choice for the other. I should make it clear that, up to this point, I have no idea if there is a way of knowing how far these systems condition each other[28].

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[27] It should be noted that my findings for verbal deixis have matched Halliday and James (1993) study on tense and polarity where it was found that the ratio of temporal deixis to modal deixis was 0.89 / 0.11. The ratio in the present corpus was 0.86 to 0.14.

[28] I have thoroughly discussed possible associations between these simultaneous systems with Jim Martin and Chris Cleirigh. We came to the conclusion that we barely know about general probabilities in the system and that any attempt to explain associations between simultaneous systems would be a 'shot in the dark'.

Table 6.4 shows that even though there are sixteen possible associations between orientation, manifestation and both types of modalization and modulation (excluding the system of value), the participants cluster most of their choices in just eight types (for examples of the patterns below refer to Table 6.2).

Table 6.4 Most recurrent modal associations in the corpus

Modal features	Number of clauses	Percentage of total
(a) probability + subjective + explicit	571	26%
(b) probability + subjective + implicit	523	24%
(c) obligation + subjective + implicit	309	14%
(d) probability + objective + implicit	190	9%
(e) usuality + objective + implicit	136	6%
(f) obligation + subjective + explicit	130	6%
(g) inclination + subjective + explicit	118	5%
(h) inclination + subjective + implicit	77	3%
(i) other	104	7%

Thus, in the corpus of defenses a participant entering the system of modality has 64 per cent of probability of choosing either (a), (b), or (c) above. This is significant probabilistic information which may be specifically linked to this particular corpus, or may stand for other spoken genres as well. Certainly, for other written genres we should expect subjective explicit modalizations of probability (primarily realized through first person mental processes) to turn up with a much smaller frequency[29].

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[29] In order to inspect the possible association of explicit subjective modalizations of probability with different genres I searched for the mental process *I think* across four corpora: a) Ken Hyland's corpus of published research articles, representing written academic English consisting of 30 texts each from 8 disciplinary areas (biology, engineering, mechanical engineering, linguistics, marketing, philosophy, sociology, physics), totaling 1.3 million words; b) the Freiburg-Brown Corpus of American English (FROWN) consisting of 1 million words representative of the 1990's (http://khnt.hit.uib.no/icame/manuals/frown/INDEX.HTM); Switchboard Corpus (SWB) which is a corpus of over 240 hours of recorded spontaneous (but topic-prompted) telephone conversations (2,438 conversations averaging 6 minutes in length each) recorded in the early 1990's; consisting of 3 million words (3,044,734) of text, spoken by 543 unique speakers (302 males and 241 females) from most major dialect groups of American English; and d) the MICASE in its entirety (see Chapter 4, Section 4.1). The results show a remarkable difference between the written and the spoken corpora. Whereas the average frequency of *I think* per 10,000 words for Hyland's corpus of published research articles and the FROWN corpus was 1,70 and 1,89 respectively, in the SWB and MICASE the average per 10,000 words was 37,74 and 28,05 respectively. These results indicate that it is probably safe to generalize the probabilities reported here as being representative of spoken genres; however, they do not seem to hold for other written genres.

Whether or not there is any 'real significance' in the particular quantitative results reported in this chapter, with the potential for quantitative research opened up by corpus linguistics our understanding of language, and hence of semiotic systems in general, seems likely to undergo a qualitative change.

CHAPTER 7

The art of arriving at a consensus:
Participants' use of modality in the dissertation defenses

> *Well I'm not sure that that's necessary, but I think it is necessary.* (Examiner - Musicology Defense)
>
> *I think I might wanna want clarification and or comment on some things* (Examiner – Psychology Defense)

7   Introduction

Discourse analysts interested in the investigation of written texts or the study of face-to-face interaction (the case here) are continually troubled by how to present their data and reveal the logic of their analyses, when the former consists of a large corpus of complex discourse material and the latter a very small fraction of the data collected. The analysis of modality in the dissertation defenses that follows can only be a partial attempt to say something substantive about the multiplicity of meanings the participants are engaged in. My goal is to describe some of the more global interpersonal aspects that have emerged in my analysis so that the type of analysis provided here can be contrasted and integrated with others working on the same type of material from a different perspective. At the same time I would like this chapter to stand as an account of how discourse analysts might pursue the study of academic discourse by using fairly detailed aspects of both discourse and theory.

Thus, taking into account the probabilistic findings reported on Chapter 6 (see Table 6.4, p. 145), this chapter reports on the qualitative results found in relation to some of the modal choices employed by the participants. The chapter examines the functionality of some of these interpersonal choices and attempts to explicate some of their possible motivations.

This chapter is organized as follows. Section 7.1 examines the participants' use of *I think* in the corpus of dissertation defenses. On the basis of three samples of 50 instances each from the dissertation defenses, the expression is looked at from the points of view of syntax, the semantics of the proposition, and the wider context of the interaction taking place. It is shown that the expression has a complex of meanings which cannot simply be labeled uncertainty or lack of commitment. It is further argued that an understanding of the cultural meanings of the genre, including power and status of the participants, is essential if one wishes to interpret the selection of *I think* in individual instances.

Section 7.2 investigates the use of metaphors of mood suggesting that such metaphors make it possible for the semantic system of speech function to be further elaborated in delicacy, which, in turn, increases the meaning potential available to the participants for negotiation in the interaction.

7.1   Explicit subjective modalizations: the case of *I think*

In the corpus of dissertation defenses, the use of explicit subjective modalizations of probability accounted for 26 per cent (571 clauses) of all the modal clauses. In proportional terms, the participants do not differ significantly in their use of explicit subjective modalizations. Thus, we find that these modalizations account for 25%, 30%, and 28% of the modal clauses produced by candidates, chairs, and examiners, respectively. Since *I think* (and its variations, e.g., *I don't think*, *I do think*, *I + modal adverb + think*) is by far (69% of all explicit subjective modalizations) the most common choice of explicit subjective modalization used by the participants, this section will take a closer look at its functions in the corpus of dissertation defenses.

7.1.1   Previous studies on *I think*

Before embarking on the analysis, it is appropriate to look briefly at previous research on *I think*, both to delimit more clearly the type of expression under consideration and to survey the explanations that have been given in the literature.

The uses of *I think* which form the topic of this section have been labeled 'parenthetical' by a number of linguists, who have adopted the term from the philosopher Urmson's 1952 article "Parenthetical verbs". The point Urmson wanted to make was that, contrary to what philosophers always believed, there is at least one clear class of verbs which do not report or describe 'goings on'. This class of verbs includes *believe, think, guess, suppose*, etc, which can be used 'parenthetically', meaning that in the first-person simple present tense they can take initial, medial and final position in the clause as in:

I suppose that your house is very old.
Your house is, I suppose, very old.
Your house is very old, I suppose. (Urmson, 1952, p. 481)

Such parenthetical verbs, Urmson argues, do not give psychological descriptions but have a signaling function, i.e., they "signal what degree of reliability is claimed for, and should be accorded to, the statement to which they are conjoined" (p. 485). Urmson further states that these verbs make an implied claim to the truth of the proposition, which may not be very strong but nevertheless commits the speaker to the truth of the proposition.

From a syntactic point of view, parenthetical verbs received further attention from other linguists. In Hooper's account (1975), *think,* along with other verbs such as *believe, expect, suppose,* belongs to what the author calls the subclass of weak assertives. Assertive predicates have the syntactic characteristic that they allow "complement preposing", which can be explained from the fact that the complement is the "semantically dominant proposition in the discourse context" (Hooper, 1975, p. 97). Weak assertives are weak in two senses:

because they have a reduced semantic content and "do not make an assertion independent of the complement assertion" and because in addition, "the complement is only weakly asserted" (1975, p. 101). The latter characteristic means that the main predicate (i.e. *I think, I suppose,* etc.) serves to weaken the claim made in the complement. Syntactic characteristics of weak assertives (in their parenthetical readings) which are directly relevant to *I think* are the following: (a) they allow tag questions to be formed from their complement clauses (as in *I think it's going to rain, isn't it?*); (b) they allow negative raising, so that *I think it's going to rain* is synonymous with *I don't think it's going to rain;* (c) the sentence pronominal used with weak assertives is *so* (as in *I think so*) (Hooper, 1975).

The semantics of *I think* and similar verbs has been noted in accounts of modality and evidentiality. Palmer (1986, p. 126) for instance points out that certain verbs in the first person "can be used performatively to indicate (not report) the opinions and attitudes of the speaker", and he further states (p. 168) that *I think that's a good idea* is an expression of the speaker's epistemic judgment. In Halliday (1994, p. 354), *I think* is analyzed as an interpersonal metaphor of modality, more specifically of probability. The expression is metaphorical or 'non-congruent' because, as Halliday puts it, the speaker's opinion regarding probability is not coded within the clause but is "being dressed up as a proposi-tion" (p. 355). An account of *I think* as an evidential expression is given by Chafe (1986). Chafe states that the expression refers to the 'mode of knowing' which is belief, but does not elaborate the point and restricts himself to saying that it is more typical of conversational English than of academic writing, the two text types which he compares for the use of evidential expressions.

Detailed semantic analyses are provided by Persson (1993) and Aijmer (1997), which both distinguish different meanings of *I think.* The major distinction made by Aijiner is between belief (as in *I think he's at home now)* and opinion. Persson refers to belief as

'probability-based opinion', which he distinguishes from what he calls 'pure opinion'. The latter accompanies propositions expressing "some kind of obligation or necessity" (Persson, 1993, p. 7), as in *I think you should work harder.* A third meaning is that of 'subjective evaluation' in the case of impressions or attitudes (as in *I think you look great in that dress*).

The need for a pragmatic study of modality was emphasized by Stubbs (1986). Stubbs points out that what he calls 'private verbs', such as *believe, think, suspect* and *guess*, can have both a psychological and a modal interpretation, so that in principle they are ambiguous. One rule of interpretation, though, according to Stubbs, is that "if the proposition is not empirically verifiable, then the utterance will be given a psychological interpretation" (p. 6). This means that *I think they left* will normally be interpreted as modal, while *I believe God exists* is given a psychological interpretation.

The pragmatic function of I *think* has further been referred to in a number of studies on gender differences (e.g. Preisler, 1986; Holmes, 1990) and social class differences (Huspek 1989; Macaule, 1995). Turnbull and Saxton (1997) examine the role of modality in facework, more specifically in refusals of compliance with requests. It appears from this study that *I (don't) think,* which the authors call an 'epistemic probability modal expression', is frequently used to do facework. Studies focusing on the pragmatic function of the negative *I don't think* are Bublitz (1992) and Simon-Vandenbergen (1998). The most extensive analysis of *I think* to date, however, is Aijmer (1997), which examines the occur-rence of the expression, which she terms a 'modal particle', in the London-Lund Corpus. Aijmer's findings will be compared with my own further in Section 7.1.3.

Relying on the now influential view of verbal communication propounded by Bakhtin, White (2003, p. 260) proposes that when we use wordings such as *I think*, we act "first-and-foremost to acknowledge, to engage with or to align […] with respect to positions which are

in some way alternatives" to those we are advancing. White suggests that we should no longer see truth-value as the primary motivation for modal expressions such as *I think*. Rather, he advocates, "we should see modality as a semantics by which the textual voice maps out its relationships with the various value positions brought into the communicative play by the text". (p. 281). In simpler terms, to see modality as a dialogic or interactive interpersonal strategy.

In conclusion, the literature on *I think* has raised a number of questions which are particularly intriguing with regard to its function in different types of discourse. For instance, it is unclear whether *I think* expresses lack of commitment to save the speaker's face, or is a device for avoiding straightforwardness and hence a device for saving the hearer's face; whether it is an expression of uncertainty and tentativeness, whether it expresses authority, or lack of it; whether it is used to open up dialogic space, or all of them depending on the situational context. In Sections 7.1.2 and 7.1.3 I shall try to throw further light on some of these issues.

7.1.2   An analysis of *I think* in the corpus of dissertation defenses

For a detailed analysis of *I think* in the corpus of dissertation defenses I have collected a random sample of 50 instances from each participant (candidates, chairs, and examiners). The samples include instances with emphatic *do* (*I do think*), with negated *do* (*I don't/do not think*), with a preceding modal verb (e.g., *I should think*), and with an intervening interpersonal adverb (e.g., *I certainly think*).The sample has been studied from the points of syntax, nature of the argument, the context of the interaction, and the wider academic context creating the genre.

7.1.2.1 Syntax

In terms of position in the clause, a distinction can be made between initial, medial and final *I think*. These three possibilities are illustrated by excerpts 44-46, respectively, from the dissertation defenses.

EXCERPT 44 [52:18 – 52:40] **Psychology defense**

Candidate: <u>I think</u> that's why, Joe and I think that we needed to distinguish, confidence from, uncertainty... so in, uh, overconfidence, is a measure of confidence. (just) <u>I think</u> it's a statistical term (it's) a technical term not an everyday life term. right is overconfidence.

EXCERPT 45 [1:21:20 - 1:21:33] **Mechanical Engineering defense**

Candidate: I have an insulation equation which they don't have and so these little differences can be inferred <u>I think</u> from the differences between (xxx) model

EXCERPT 46 [23:04 – 23:47] **Musicology defense**

Examiner: I'm not sure, that in any of your, comments on specific pieces, that I take away an impression, of your, saying, this is fantastic this is really, <*Candidate* LAUGH> this is great <LAUGH> I mean you know I, I mean you you, you sa- you say this is the process that's going on and so forth but I'm I'm not looking for, (uninterpretable) anything smarmy or sentimental or whatever, but, it's like you're really on guard, to show that, I don't know what exactly it's a it's a vexed, it's a slightly vexed position, <u>I think.</u>

A count of the relative frequency of these positions in the two corpora yielded the results displayed in Table 7.1.

Table 7.1 – Relative frequency of syntactic positions

	Initial	Medial	Final
Candidates	39	9	2
Chairs	42	7	1
Examiners	37	11	2

The most obvious conclusion must be that the prototypical position of *I think* is initial for all participants. First, the high frequency of initial *I think* in my data is in line with the findings reported by Aijmer (1997), viz. that in the London-Lund corpus *I think* occurs typically at the beginning of an utterance. Furthermore, Kärkkäinen (2003) found that *I think* in American conversational discourse occurs overwhelmingly at the beginning of turns as well

as at the beginning of intonation units. Kärkkäinen explains this by claiming that turn-initial epistemic markers signal the speaker's qualification where it is likely to have the greatest effect. Similarly, Halliday (1994, p. 49-50) points out that interpersonal elements typically occur in thematic position in the clause, because if speakers wish to express their attitude towards the proposition in the clause, it is normal that they should do so right at the beginning.

Second, there is a reason why final position appears to be scarce in the defenses. Putting *I think* at the end, as in excerpt 46 above, gives it the function of an afterthought: after having stated something, the speaker adds his or her reservations, thus weakening the force of the assertion. At the same time, final position gives the item end focus (Aijmer, 1997), which means that in this case the speaker's doubt is highlighted. Finally, as shown in Stubbs's example quoted above (*?God exists, I believe*), final position seems to favor a 'modal' (probability) as against a rational interpretation (Stubbs, 1986, p. 19). The participants seem to avoid these meanings. It is interesting to note that a corpus of parliamentary debates showed distributions for *I think* which are very similar to those reported here: 81% initial position, 13% medial position, and 6% of final position (Simon-Vandenbergen, 1998). It is therefore plausible to hypothesize that the meaning conveyed by final *I think* is not compatible with the communicative goals of political speakers and scholars in their institutional and academic contexts.

With regard to medial position, it appears from the corpus material that *I think* can be inserted in various places in the clause. In most cases, however, it signals the wish of the speaker to express reservations about the truth of (part of) his or her statement. Two types are particularly worth exploring. In the first type *I think* occurs just before or after the element the speaker is unsure about, so that the meaning conveyed is that of real doubt:

EXCERPT 47 [1:30:16 – 1:30:30] **SNRE defense** 🗣

Examiner: Several years ago I- I talked to Jean Sharp over the phone and one of the things that I was really intrigued about was and that is that he said that he had a contract to train the <u>I think</u> <u>I think</u> it

was the Swiss army [S1: wow] in non-violence okay.

While in this case the uncertainty in excerpt 47 is boosted by iteration, in other cases *I think* is accompanied by self-repair, creating the same effect of doubt

EXCERPT 48 [recording unavailable] **Sociology defense**
Examiner A: yeah she has- they teach I think nine hours, no eight hours
Examiner B: yeah they really work over there

A second type of medial *I think* which is striking in the corpus is inserted in clauses which are thematically marked. This means that, for reasons of emphasis, the speaker puts an unexpected element in initial position in the clause. This is, for instance, the case with thematic equatives (Halliday, 1994, p. 42). The effect appears to be one of rhetorical strength, which is then as it were counteracted by *I think*. In other words, the speaker seems to refrain from rhetorical certainty. Excerpt 49 illustrates this:

EXCERPT 49 [recording unavailable] **Sociology defense**
Chair: what she does I think is kind of provide um a summary of contributions

In other instances, medial *I think* appears between theme and rheme, so that the former is given extra focus, as in the following example:

EXCERPT 50 [recording unavailable] **Sociology defense**
Candidate: using canned data out of the uh computer banks I think takes two-thirds of what you're doing away from you.
Examiner: uh-uh doesn't it really depend on what you find to be the fascinating problem?

In summary, we can say that final and medial *I think*, which tend to express tentativeness (Aijmer, 1997), are less frequently employed by all participants. Final position in particular is avoided, while medial position is typically opted for where it gives emphasis to the theme by separating it from the rheme and/or where any possible weakening effect of its insertion in the middle is counteracted by other lexicogrammatical choices (see further

below).

7.1.2.2   Nature of the argument

As pointed out earlier, Stubbs (1986) suggests that the potential ambiguity with 'private verbs' can be resolved if we look at the nature of the argument: *I think* followed by a verifiable argument will have a modal meaning, while an unverifiable argument will lead to an interpretation of the verb as having a psychological meaning. I find it useful to adopt the semantic distinctions made by Persson (1993), viz. 'belief' or 'probability-based opinion' (for cases where *I think* is followed by verifiable arguments and where it can be replaced by *probably*)*,* 'pure opinion' (for places where the proposition has expressions of (moral) obligation or necessity) and 'subjective evaluation' for impressions.

An examination of my data suggests two major conclusions in this respect. The first is that, while there are clear instances of the different types, there are also many cases where the distinction between verifiable and non-verifiable is not clear-cut because the argument refers partly to a probable fact and partly to personal opinion. In the data, there are many cases where modal qualifications of modal statements are mixed with speculations about possible explanations in terms of people's reasons and motivations.

The second conclusion is that, while in the data there are clear instances of 'belief' or 'probability-based opinion', i.e. of verifiable propositions following *I think* (of the type *right, so... in terms of, calculating probability accuracy I think that the answer to that is to actually, implement the, Markov decision process planner in CIRCA and let it run and see what happens with all the complexity that it has*; Candidate – EECS Defense), the data also shows instances where *I think* typically precedes judgments and evaluations. In other words, the typical meanings are 'pure opinion' and 'subjective evaluation'. This means that *I think* may not be used to qualify the truth of the argument and hence does not serve as a marker of the

speaker's lack of knowledge.   Furthermore, it is striking that the subclass also contains grading terms of the maximizing type or inherently graded words, which render a proposition unverifiable in any case. The explanation is that the speakers wish to come across as committed and self-assured while actually talking about controversial issues which are not certain at all. This strategy is illustrated in excerpts 51-53:

EXCERPT 51 [55:11 – 55:15] **EECS defense**

Candidate: … I think that was *obvious* from the pages and pages I had at least talking about it in the thesis.

EXCERPT 52 [1:21:35 – 1:21:40] **Mechanical Engineering defense**

Candidate: but overall I think it it (an equation) captures the results *quite well*.

EXCERPT 53 [recording unavailable] **Sociology defense**

Candidate: it's *much easier* to be in a in a rally in the meadow about the Vietnam War than going over and joining an organization an- uh
Examiner A: mm
Examiner B: going out and participating actively
Candidate: *I think* it's a *pretty mundane* type of explanation but *I'm sure* it has something to do with it

The other frequent pattern is where *I think* is followed by a clause expressing a modulation: the speaker thus conveys his/her opinion on what needs to be done, using *I think* to qualify a proposal rather than a proposition. Such instances can be paraphrased as *In my opinion this is what needs to be done*. Excepts 54 and 55 illustrate this obligation type:

EXCERPT 54 [24:15 – 24:32] **Biology defense**

Candidate: I think *it's important* that any regression equation or other method of determining temperature that I use to determine paleotemperature of the Nabon Basin, takes into account, uh, sites at all elevations so that I can, predict temperature at these low-elevation sites as well as the high-elevation sites.

EXCERPT 55 [1:28:53 - 1:29:08] **Musicology defense**

Examiner: … I think that *needs to be* in the abstract [*Candidate*: uhuh] and as well as in the introduction that, that uh, this is, is a dual perspective on Jarrett because the German perspective is very very important throughout, [*Candidate*: mhm mhm] throughout yeah, and it's not, exactly the same as the, American perspective.

From the examples above, it seems that *I think* does not serve the purpose of

qualifying the truth of the argument but is used primarily to focus on the speaker's personal

position with regard to value judgments and proposals regarding action to be taken.

7.1.2.3   The context of neighboring clauses and the speaker's turn

Neighboring clauses

In the dissertations defenses, speakers sometimes express their lack of certainty that

the proposition is true in the immediate linguistic context of *I think* clauses. Excerpt 56

illustrates this:

EXCERPT 56 [38:49 – 39:27] **Psychology defense** 🗣

Examiner: and and wouldn't that often be the case for surprise I mean, that *somehow*, it's only once a counterfactual comes to mind that you're surprised about the current outcome and that *may* not necessarily, be a function of how well-articulated your theory is but of how, accessible the (counterfactual) would be. I think I can be surprised about things for which I, *I I may be wrong* I mean I haven't_ but I it *seems* that I I can be surprised about things for which I do not have a well-articulated theory, but only a highly accessible, uh, counterfactual outcome, or normative outcome that I *would normally have*.

In contrast, there are other instances where the context tends to contain expressions of

certainty. This is illustrated in excerpt 57. Here the candidate is responding to one of the

examiner's question about the criteria for choosing some of the variables in her research on

female radicalism:

EXCERPT 57 [recording unavailable] **Sociology defense**

Candidate: I think *what you have to ask yourself* is what kinds of socialization experiences among these kinds of people lead to this characteristic and then *you would have to ask yourself* are these socialization experiences uniquely found among the whites as opposed to among the blacks and I- see *I'm not in any way saying that* your questions aren't extremely relevant to the to a research program of trying to get at a greater explanation of the whole process *but I can't see where* it would be involved in the explicit testing of the hypothesis.

The context in excerpt 57 reveals that *I think* does not really express doubt: the

meaning is not 'it is probably the case that' but 'it is my opinion that'.

Speaker's turn

Frequently the speaker's turn contains other modal expressions qualifying the truth value of propositions related to the same topic. Together these create a macro-modality (Recski, 2005), which may range from uncertainty to certainty. Lemke (1992, p. 93) refers to "global value-orientational patterns in text", and there are clear indications that these patterns, prosodically present in the texts, tend to construct both 'uncertainty' and 'knowlegeability'. Excerpt 58 illustrates 'uncertainty'. The excerpt contains many expressions contributing to a tone of careful statement of opinion and avoidance of authoritative pronouncements which renders it as 'one possible explanation' and thus opens up space for more interaction or other viewpoints.

EXCERPT 58 [54:12 – 55:27] **Biology defense**

Member of the audience: I have [*Candidate*: yes] one question um, y- you have three, stratigraphic levels in the El Salado that are, different in temperature and I'm wondering if you think that those are, if that's a true reflection of, temperature change or what what you think about those three sites that are_ or three stratigraphic levels in the El Salado.
Candidate: I- I think actually that they *probably* are um, *mostly* reflective of, ta- actual temperature change and I_ and part of the reason is one, they're in similar environments that *you would expect* the types of species to be in, say, river environments versus um, forest environments to be, similar, of similar morphologic, um composition so I I think, a change in them, that you see, uh *might* actually reflect changes in the temperatures of those areas. um and, secondly I think that the amount of time that you see in those, in the El Salado member is much greater than you see higher up in the section say in the ash bed sequences and I think, what's happening is you're getting, small amounts of sedimentation or periodic sedimentation all the way through there, so that, so that the amount of time, represented between those layers is, is great, and that you could see indeed, temperature changes through those, that period.

Let us compare this with excerpt 59 from the SNRE defense where the candidate, who has written his dissertation on social justice and non-violence social change in the Environmental Justice Movement, advances his view on how a United States leader should react to attacks against the US:

EXCERPT 59 [1:24:45 – 1:25:09] **SNRE defense**

Candidate: And I do think that if the United States, if we had *any* leader, who um had the *moral courage* to stand up and say we have been attacked but we *wanna* show how much we *believe* that these attacks are *reprehensible* by resisting to resort to the same type of behavior, I really do think that

that would make a *major* transition in terms of the sympathy of the world.

The candidate uses *I think* twice in this short excerpt, but the overall tone is one of certainty and authority. Note that emphatic *do* accompanies both instances of *I think*, and in the second, the candidate has chosen to boost his point of view with *really*. In addition, in this excerpt evaluative lexis (*moral courage, reprehensible, major, believe*) creates a semantic prosody of negative attitude towards the current stance taken by US leaders in relation to its military actions.

In conclusion, the linguistic context provides clues as to whether *I think* primarily expresses doubt or the speaker's commitment to the truth value of a proposition. These two aspects of the meaning are always present in the expression, but the context may foreground one or the other. In the corpus material we find instances of either type, but there seems to be a preference for certainty. In the defenses, situations which lead to the use of *I think* in a context of uncertainty are, for instance, those in which questions are asked which are felt to be face-threatening and where the candidates are led to accept something that goes against what they have argued. In the following excerpt, the candidate, from the Mechanical Engineering defense, avoids saying anything which may possibly threaten another researcher's face and so he refuses to commit himself to firm statements. The topic is gas dynamics and the candidate claims that his model of gas dynamics is an improvement of another researcher's model.

EXCERPT 60 [01:57:41 - 01:59:07] **Mechanical Engineering defense** 📢

Examiner: (xxx) this question also there's (xxx) ask you about Bauman uh because of all these names in here the only person I really know [*Chair*: yeah] is Bauman and uh I know that he's perfectly familiar with gas dynamics and he is uh he is uh a very capable person, so the_ you were indicating that he did not use gas dynamics he must have a reason not to use not to consider gas dynamics [*Candidate*: uhu] so uh in how way would your calculation be an improvement over what he has done that wasn't clear to me
Candidate: I wasn't I wasn't I wasn't saying that mine was an improvement <u>I think</u> <u>I would think</u> I was saying that mine was another avenue that you *can* use to model these industrial power plants and if there's a situation that uh the gas dynamics *maybe* gets complex and uh you need to use it then you *can* actually use my gas dynamics with detailed kinetic mechanisms to model (xxx) and I remember when I worked at a power plant actually in Jacksonville Florida, I mean these were huge devices and the they had a huge fan and and blowing and uh blowing air up the stack and *I was just envisioning*

that as a gas dynamic process but from what professor (xxx) says is really uh it it *might* be just more of resonance time issue is that if you know the resonance time in the stack then you *may never* have to deal with the gas dynamics.

This excerpt illustrates the 'hedging' candidate, and in such contexts *I think* does indeed take on the value of a hesitation marker (note also the false starts *I wasn't* at the beginning of the candidate's answer).

7.1.2.4   **Interactional context**

In the dissertation defenses, the participants tend to emphasize agreement. Nevertheless, depending on the context, the discussion may be adversarial in the sense that examiners put to candidates opposing viewpoints which they have to reply to. This difference between a co-operative type of discourse in which agreement is the preferred option and an adversarial type of discourse in which disagreement is unavoidable is reflected in the differential use of *I think*. The following excerpt extracted for the Mechanical Engineering defense shows how the participants work towards agreement and build up certainty together:

EXCERPT 61 [01:06:30 – 01:07:30] **Mechanical Engineering defense**

Examiner A: well I'm bit confused [*Candidate*: yes] because it seems that what Bolmann did was the more physics of the kinetics [*Candidate*: yes] right and what you did is you provided a code and the framework to put some physics in there [*Candidate*: yes] but you did not really have your own piece of evidence so how can you say that with your code you reproduced the same thing that Bolmann
Candidate: I only used his his his kinetic mechanism, I did not use his uh I don't uh he just used basically uh Chemkin along with this kinetic mechanism in order to reproduce and to get these results. So what I did is I actually put the Chemkin mechanism along with the gas dynamics in the residence time reenter
Examiner A: you used his physics into your model
Candidate: yes
Examiner B: so it's actually a validation of his results, cuz he only use some kinetic rules whereas [*Candidate*: yes] you're using full gas dynamics [*Candidate*: yes]
Examiner C: this is a humble (xxx)
Examiner B: so he should be glad
Chair: yeah, I think so
Candidate I think so

In the defenses, questions and hence answers typically have to do with viewpoints of

the participants, so that inevitably talk sometimes will center on what they and others think.
The frequency of *I think* is thus partly to be explained from the purpose of the interaction,
which should warn us against an automatic interpretation of this expression as a hesitation or
uncertainty marker. Excerpt 62 clearly illustrates this type of interaction:

EXCERPT 62 [44:06 – 45:11] **Psychology defense**

Examiner A: alright th- that might actually get to an even more fundamental issue which I'd be
interested in hearing your your thoughts about, which is, in day-to-day life what actually is the point,
of even considering questions like this i mean so, [*Examiner B*: right] why would you even need to
worry about stuff like that? uh, I mean to get back to Gordon's thing. you know I just go to work every
day work in a factory and go back home. why the hell do I need a theory? I mean in order to do that.
so, these issues would never arise. I mean so what kind of a society, would even think that you'd need
to have stuff like, physical theories, about which you could become surprised?
Candidate: w- well <u>I don't think</u>, everyday-life theory is articulated as, theory in physics I mean the
simplistic people have, their, theories but they_ sometimes they don't, realize they do have theory. so,
<u>I don't think</u> many people are bothered to have their own theory explicitly ...

7.2   Examiners' use of Metaphors of Mood

As noted in Section 3.2.1, speech functions such as statements, commands and
questions have both congruent and metaphorical realizations. With metaphorical realizations
the grammar works as a metaphor for the relevant meaning. For example, questioning
(demand for information) may be realized in three different ways (invented examples):

Realized congruently
What is your name?   [interrogative: wh mood]

Realized incongruently
And you are …   [declarative mood]
Tell me your name   [imperative mood]

Similarly, commanding (demand for goods or services) may also be realized in three
alternative ways (invented examples):

Realized congruently
Tell me the answer   [imperative mood]

Realized incongruently

Could you tell me the answer please?   [interrogative: polar mood]

I wonder if you could tell give me the answer   [declarative mood]

The mappings between speech function and lexicogrammar which are referred to in trying to explain such metaphors of mood are visualized in Figure 7.1.
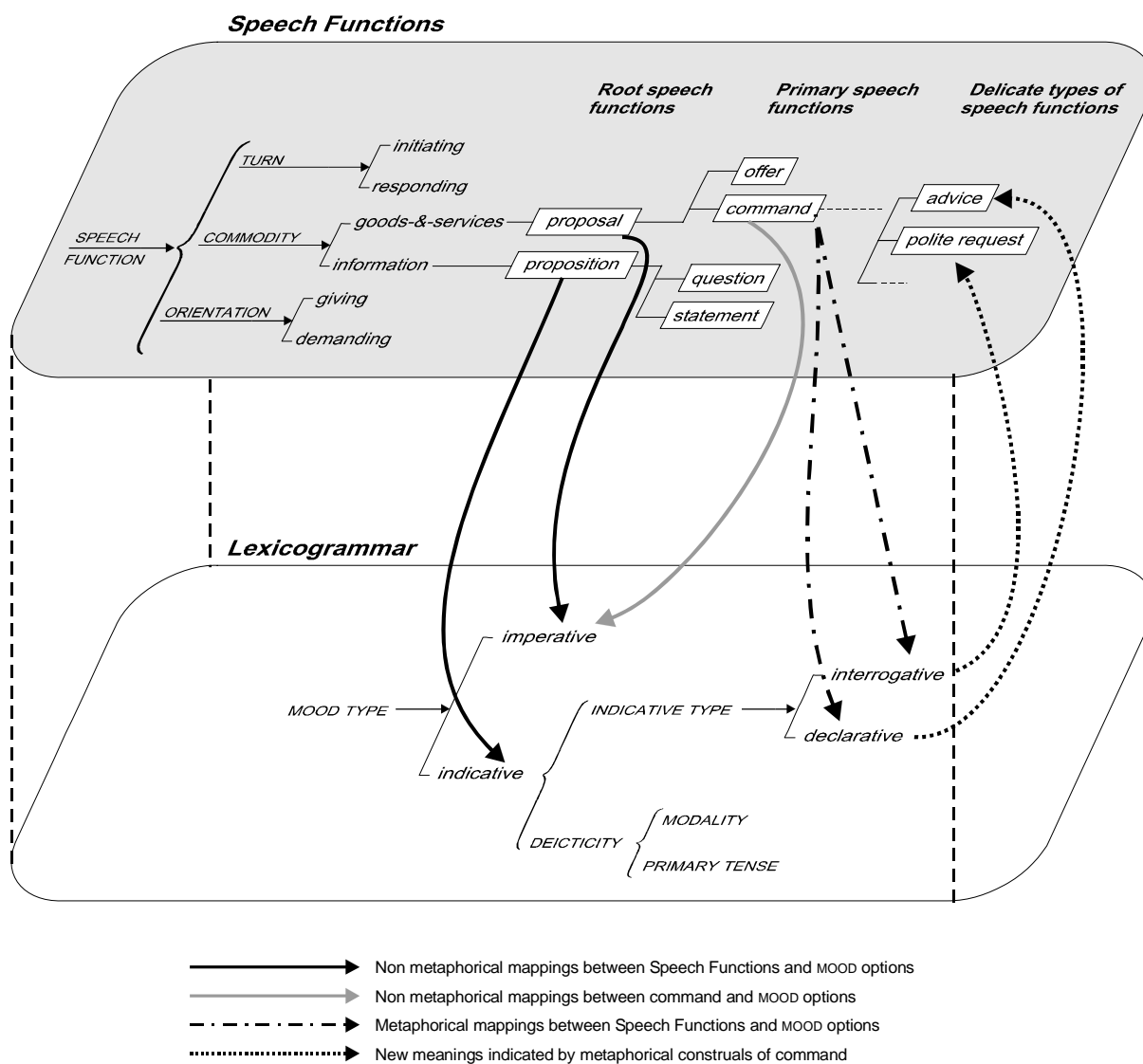
Figure 7.1 – Mappings between Speech Function and Lexicogrammar

We can see from Figure 7.1 that the relationship between speech function and lexicogrammar is one of variation in two directions, i.e. lexicogrammatical expressions can be instantiated in various ways through speech functions, whereas speech functions can be

construed in various ways through lexicogrammatical expressions[1]. In this perspective, then, the inherent variation which is involved, both lexicogrammatically and semantically may be explained as follows: the metaphorical and non-metaphorical expressions are alternative construals of the speech function command; conversely, in a speech interaction, an expression such as *Could you tell me the answer please?* can be instantiated or actualized in two alternative meanings, either command and/or statement**.** Thus, metaphors of mood make it possible for the semantic system of speech function to be further elaborated in delicacy.

In the corpus of dissertation defenses, examiners stand out in relation to the other participants in their use of explicit subjective modulations (metaphors of mood). Graph 7.1 shows the distribution of metaphors of mood per participant in the corpus of defenses (frequency of occurrence is given in parenthesis).

Graph 7.1 – Distribution of Metaphors of Mood per participant
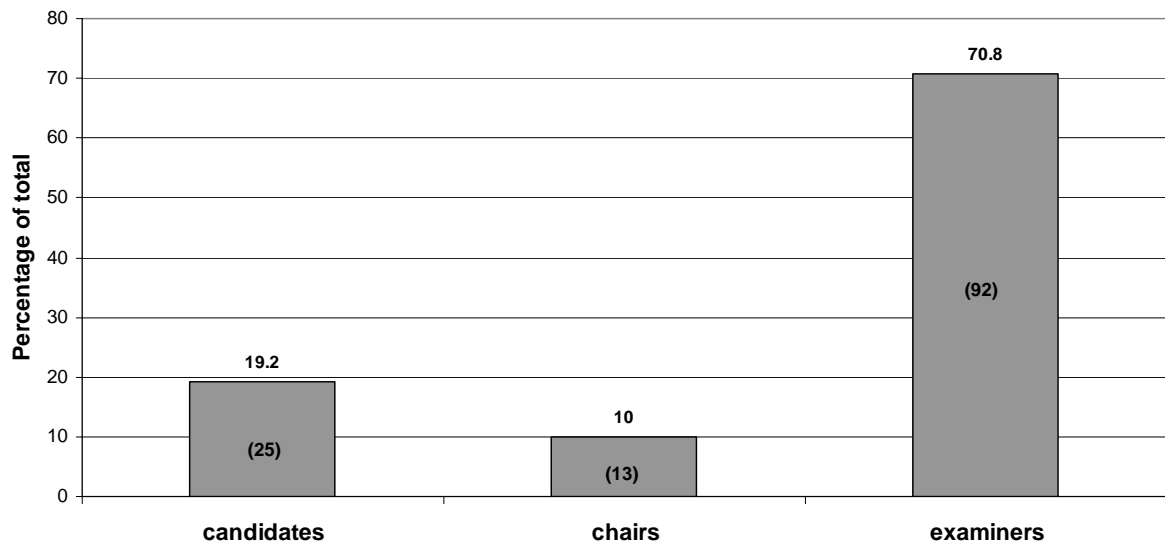
In the defenses, examiners frequently make use of these metaphors to redress commands either as declaratives or interrogatives. This linguistic strategy is normally

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[1] I use the term *construe* to mean the converse of realization.

employed to request information from the candidates and to frame suggestions and/or recommendations.

The excerpts below show how requests for information, which could have been realized as imperatives are elaborated in delicacy:

EXCERPT 63 [44:06 – 44:20] **Examiner Psychology defense**

alright th- that might actually get to an even more fundamental issue which <u>I'd be interested in hearing your your thoughts about</u> …

EXCERPT 64 [1:38:10 – 1:38:22] **Examiner EECS defense**

<u>I'd like to understand how</u>, I- in one particular application [*Candidate*: mhm] if it's more rudimentary than your [*Candidate*: yeah] most rudimentary one, [*Candidate*: mhm] how we can assess the goodness or the badness of the design decisions that you've made …

EXCERPT 65 [1:06:29 – 1:06:36] **Examiner Psychology defense**

and I'm not entirely convinced and <u>I'm I'm hoping you can</u>, [*Candidate*: I mean if] <u>explain it to me</u> [*Candidate*: if the the s- the s-] how your experiments allow you to tell the difference …

Why does the speech functional system need to be expanded in this way; why has it been expanded beyond the primary speech functions laid out in Figure 6.1? The basic principle appears to be that the development of the speech functional system has increased the meaning potential available to participants for negotiation in the interaction.

The ideal reply for a command is to attend it, but as Halliday and Matthiessen (2004) put it, "metaphorical realizations give more discretion to the addressee" and "create a greater distance between meaning and wording, and this enacts a greater social distance between speaker and addressee" (p. 631).

Another interesting elaboration in the delicacy of requests for information involves the metal process *wonder*. Here the interpersonal distance is manifested directly in the lexicogrammar as a syntactic elaboration. For example, in the following excerpts, examiners make use of the metal process *wonder* using a two-clause complex (α → β) *I wonder / I'm wondering* → β.

EXCERPT 66 [20:56 – 21:48] **Examiner Musicology defense** 🗣

now, another one uh, and this your, your opening statement, uh addressed quite, quite nicely I thought but since you and I talked about this, this morning, among other things I uh <u>I wonder if you could just say a bit</u>, in this form about the subject of_ uh which I addressed in my uh evaluation for Rackham, uh, coming away with a bit of a feeling, that uh, after you had, done all this work on your, your boyhood idol and, torn away all his masks and everything that that somehow, uh you you didn't quite, have the, respect for him that you had when you started off and, I I, I didn't really have that feeling earlier on …

EXCERPT 67 [1:01:46 – 1:01:57] **Examiner EECS defense** 🗣

<u>I'm wondering how you actually get down that curve</u>, um you've uh, you stated very clearly in your thesis that, safety above all, mkay [*Candidate*: right] that you know you guarantee safety and only when you actually can't then you, sort of relax.

EXCERPT 68 [15:37 – 16:26] **Examiner Musicology defense** 🗣

the the thing that brought me up short a little bit and, I'm not trying to catch you on anything but <u>I wonder if you'd just comment on it</u> was th- th- the date of the quote was sixty-nine, which is quite a bit before, that particular concert and, <u>I just wonder the extent to which</u>, with somebody who's been so, uh, publicly available and who has made so many pronouncements some of them contradicting each other, how do you know, when, something that he says at a particular time, it can be applied to, things uh, later in his career? [*Candidate*: mhm] I uh, in this case I was looking for something, closer in proximity to the Kyoto concert, I mean seven years may not be a big deal but then I thought of it as a more global issue so <u>I wonder if you'd just talk about that</u>.

Another type of mood metaphor involving a shift from imperative to indicative can be seen in interrogative clauses. In this case, the mood element of the indicative clause is restricted in terms of the systems of person and deixis. The subject selection is *you* and the deixis is modal, particularly modulation. The fact that the indicative clause realizes a type of command can be seen in the way candidates treat them in the interaction, complying with them (or sometimes refusing to comply), for example:

EXCERPT 69 [1:15:22 – 1:16:27] **Musicology defense** 🗣

Examiner: <u>Could you talk a little bit</u> about, how this dissertation might be a spring board for, some other areas that, you're gonna pursue, either related to J- Jarrett or not possibly [*Candidate*: mhm] that um, i'm a little bit curious about what you're going to do with all this um you've got probably hours and hours of, of interviews so, [*Candidate*: mhm] in fact you, you happen to mention, n- d- I- in the passing I think once that, that you know you may do something further with Jarrett, but um, either talk about that or if there're some some windows that have been opened in this, that um you might, explore. *Candidate*: mhm... wow, that's an interesting question um, y- you know I me- I mean of- th- the first thing that comes to my mind is this may be, a little off the wall but the first thing that comes to mind is um, this has done a lot for me as a musician and and but I haven't had the time, to actually be a musician uh uh so so I'm looking forward to how this will transpire in my, practice and in my, my playing.

EXCERPT 70 [recording unavailable] **Sociology defense**

Examiner: <u>Would you like to, talk about that</u>, [*Candidate*: yeah] very, briefly?
Candidate: well, the history of, of my involvement with the topic is, is a, is a personal story, and since the, uh, since that story has undergone obviously uh, the attempt of objectification, in the process of writing, I uh, chose to, to keep this, introductory uh, summary, personal, um, in the hope that that will, get us going, uh with the questions.

In the excerpts above, the presence of the mood element expands the potential for negotiation. According to Halliday and Matthiessen (2004) these indicative variants offer a range of more delicate ways of commanding. In the case of declarative clauses, modal assessments, including modalization, may provide milder versions of a command, as in *so perhaps you might, want to make it clearer because …*, where the low modalization reinforces the sense of a mild command or suggestion. The potential offered by indicative clauses is thus opted for, making it possible to elaborate and euphemize commands. Other typical examples include (all uttered by examiners):

you may wanna use that term …	(**EECS**)
you might want to explore …	(**Musicology**)
you might want to expand that a little bit …	(**Musicology**)
you might want to elaborate on that …	(**Sociology**)
you might really make it, a more fundamental contribution by trying to …	(**EECS**)
you might also reexamine your findings …	(**Sociology**)
I wonder if you wouldn't want to locate just a little more precisely …	(**Musicology**)
I think it would be a good idea to, to, let your readers know …	(**Musicology**)
I think it would be good, uh to say something about the sources of your …	(**Musicology**)
I think it's always a good thing to include …	(**Musicology**)
I think it would be worth your while to put a a fair bit of time into this …	(**EECS**)
I think what you would want to do is you wanna study, the ways in which …	(**EECS**)

Thus, choosing the indicative mood for the realization of proposals and modalizing them seems to have the effect of amplifying the softening of commands directed to the candidates.

7.3   Final remarks

Section 7.1 has revealed a very high frequency of *I think* in the data. However it is not

possible to ascribe such high frequency solely to the strategy of participants to remain non-committal. Other factors such as the nature of the discourse, i.e. a type of discourse in which the participants are constantly trying to formulate their opinions on specific subjects, may be responsible. It is, however, necessary here to point out that Aijmer (1997), whose study is based on the London-Lund Corpus, found a much higher frequency of *I think* in her informal face-to-face conversations, viz. 0,51% (as compared with 0,36% in the corpus of dissertation defenses). I have no explanation for this difference, but it needs to be examined further, since Aijmer is led to conclude from her data that the expression is typical of informal conversation, while my own data seem to point instead to a link between high frequency and a type of discourse in which the formulation of viewpoints is central, since the corpus of defenses displays high frequencies.

On the other hand, it has been shown that relative frequency is only part of the picture and that different types of *I think* are involved. Fortunately, there is clear converge between Aijmer's results and mine about the meaning of *I think*. Aijmer distinguishes between the tentative *I think*, which expresses uncertainty, and the deliberative function, which "adds weight to the assertion or expresses reassurance" (1997, p. 22). She found that the tentative *I think* accounts for 75% of all instances in the London-Lund Corpus, while deliberative *I think* occurred in only 25% of the cases (p. 26). The criteria used by Aijmer to distinguish between the two types are prosodic and syntactic: she classifies *I think* as deliberative when it is initial in the clause and has the nuclear tone; furthermore, all examples where *I think* is followed by the conjunction *that* are also regarded as deliberative "since they carry some prominence" (p. 21). When the first criterion (syntax) is applied to my own data, it has been shown that a similar result was obtained. Thus, it seems safe to conclude that the expression is primarily used with different functions in the corpus. An analysis on the levels of syntax, interactional context and nature of the proposition has shown that in the corpus, the participants do not use

I think primarily to express uncertainty but to convey "this is my opinion". The expression therefore suggests authority rather than hesitation.

On the other hand, *I think* always, whatever the context it occurs in, expresses the *participants' personal angle*: it makes the proposition into a subjective one. From the perspective of Appraisal Theory, we could say that utterances containing *I think* have been probabilized, that is to say, they have been modalized by reference to some degree of likelihood. As already discussed, such structures render propositions dependent by associating them with the foregrounded subjectivity of the speaker. They thereby open up rhetorical space for heteroglossic alternatives (White, 2003). Thus, the use of this "probabilizing" value acts to construct utterances as being dialogic, as explicitly opening them up to possible alternatives. Such a choice of wording is, of course, strategic. For instance, it makes space for a debatable proposition by clearly characterizing it as one among a number of possible related propositions, by anticipating a dialogue with those who hold these alternative positions and hence signaling a willingness to maintain academic harmony with those positions.

In conclusion, the complex nature of the expression *I think* and the complex nature of the notion of genre preclude a simple explanation of the pragmatic function(s) of *I think*. In order to come closer to a clearer picture, not only of the function(s) of *I think* but also of other interpersonal expressions, much more research is needed on a wider range of genres, looking in greater detail at social relations between participants and their struggles for power/solidarity in the interaction. In such research, it is essential that the prosodic relations (completely overlooked here) should be considered to be equally important as the lexicogrammatical ones.

In relation to metaphors of mood, my argument has been that with these metaphors the semantic system of speech function is elaborated in delicacy, which, in turn, leads to new patterns of structural realizations and differentiations.

Halliday and Matthiessen suggest that by creating a greater semiotic distance between meaning and wording, these metaphors give more options and discretion to the addressee. I would like to suggest that the ways the examiners use these metaphors are intimately related to their assessment of the candidates work and persona in the different disciplinary contexts. While requesting particular courses of action may superficially appear to be a risky interpersonal strategy, the weight and tone of the request varies according to the different delicate types of speech functions, to the authority relations construed in the different disciplines, and to the conventions of preferred disciplinary argumentative forms. This is not to deny, of course, that individual factors such as experience, age, confidence, or professional rank may affect the choices made by particular examiners in their moment-by-moment composing. Genre and discipline are not the only factors determining how individuals see themselves, their audience, or their place in their communities because academic interactions are always individual and personal as well as institutional and cultural. However, the metaphors of mood reported in this section suggest that a heavily instantiated genre such as the doctoral defense is deeply embedded, both in epistemological and social beliefs of the participants' understanding of required institutional standards.

Section 7.2 is therefore a contribution to the literature which argues that the features of academic interactions can only be fully explained when considered as the actions of socially situated academics. In this view, the metaphors of mood employed by the examiners can be seen as contributing to the discursive construction of interpersonal relations with the candidates. Metaphors of mood are an important way that examiners accomplish to achieve a particular social purpose, respecting the field-specific standards of the disciplines and anticipating the social relations that can be appropriately appealed to.

Finally, I would like to suggest that through the use of metaphors of mood, examiners soften the requirements candidates are yet to complete, the application of certain courses of

action towards the requirements, and ways in which the candidates *may* satisfy these requirements. The use of this interpersonal strategy highlights the fact that an examiner is someone who assumes the authoritative voice of the institution, but also someone whose professional duty is to inform and not to dictate.

CHAPTER 8

Final Remarks

> There can be no semiotic act that leaves the world
> exactly as it was before. (Halliday 1994b, p. 200)

8.   Introduction

In this chapter I present the conclusions of my dissertation and attempt to make suggestions for pedagogical applications and future research. As stated in my introductory chapter, the my main objective of this dissertation was to carry out a quantitative as well as qualitative analysis of interpersonal lexicogrammatical elements in U.S dissertation defenses. The research questions that have guided me in terms of which textual and contextual features to investigate focused: a) on the probabilities attached to the system of modality as a whole; b) on the plurifunctionality of the mental process *I think*; and c) on the most common interpersonal strategy employed by committee members to ask questions and to give recommendations and/or suggestions and how such strategy might be realized lexicogrammatically. I suggested that in answering these questions the study should throw further light on the kinds of role relations which are established through talk, on the attitudes participants express to and about each other, and how they negotiate their knowledge and their academic statuses.

In Chapter 2, I discussed wide-ranging aspects of the graduate experience as a whole. In Chapter 3, I narrowed down the focus to dissertation defenses reviewing the still limited literature on the topic. In Chapter 4, I reviewed the literature on the vast semantic and pragmatic terrain covered by modality and established that the SFL framework would be employed to analyze modality in the dissertation transcripts. In Chapter 5, I discussed the

methods employed for handling the corpus. In Chapter 6, I addressed research question a) above, and in Chapter 7 I addressed the other two research questions: b) and c).

8.1   Research questions addressed

In this section, each research question set out in the introductory chapter will be addressed and answered separately. Most of the evidence provided to support the answers derives from Chapters 6 and 7.

RESEARCH QUESTION 1:

- *How can the interpersonal patterns of choice observed in the corpus of dissertation defenses be represented in terms of the grammatical system as a whole (i.e., as sub-systems of the system)? How may a paradigmatic grammar such as SFG be enhanced if probabilities are ascribed to every feature of a system or a system network? Can the incorporation of information on the actual patterns of choice realized in the corpus be a motivation for working towards the probabilistic modeling of language?*

If we accept that all language is language systematically related to its context, we may accept that a change in the context in which language is functioning will bring about language change. Since language varies according to context and the variation is taken to be systematic and predictable, *the role that a probabilistic modeling of language can play in this regard is to enable us to describe explicitly the covariation of language and context.*

In Chapter 6, I attempted to provide evidence that in order to understand some of the properties of the modal system, it was necessary to show that such system could be represented in probabilistic terms. It was shown that part of the meaning of choosing a modal feature is the probability with which that feature is chosen; thus the meaning of

'modalization' is not simply probability vs. usuality, but probability, against odds of nine to one.

In the same chapter, I anticipated the readers' objection that while it can be perfectly possible to establish frequencies of occurrence of modal features in a corpus of dissertation defenses, these cannot be interpreted as overall probabilities of the system because every text will be related to a particular register. I suggested that this would be an incorrect way of looking at probabilities and used Halliday's climate/weather metaphor (see pp. 143-144) to support the claim that by making use of larger corpora to investigate frequencies in texts we may progressively offer more accurate accounts of the system as whole.

Perhaps the major empirical finding derived from the investigation of probabilities in the modal system reported in Chapter 6 was that a participant entering such system would have 64 per cent of probability of choosing either subjective explicit modalization of probability (26%), subjective implicit modalization probability (24%), or subjective implicit modulation of obligation (14%) as entry conditions. This is significant probabilistic information which may be specifically linked to the corpus of dissertations at hand, but it may be similar to a range of other spoken genres as well.

To sum up, I now return to what was the starting point of Chapter 6. This was a brief description of a theory of language as choice, language construed as a system of possibilities. It is within such a framework that I see the quantitative study of language as motivated; the 'possible' being only the furthest scope of the 'probable'. It is my firm contention that we should take language as an inherently dynamic phenomenon, as a system which is constantly renewing itself through the interplay of the quantitative and the qualitative. And I believe that it is only through quantitative methods that language, as a dynamic open system, as a system which maintains itself through constant change, can be further studied and understood. The findings presented in Chapter 6 illustrate the role of quantitative methods in linguistics in

which types of linguistic patterning are revealed which would otherwise remain hidden. I see this in the larger context of developing probabilistic models of language, integrating language as a system of possibilities and language as a system of probabilities.

RESEARCH QUESTION 2:

- *Given the very high frequency of occurrence of the mental process* I think *many questions emerge. Does* I think *express lack of commitment to save the speaker's face, or is it a device for avoiding straightforwardness and hence a device for saving the hearer's face? Is it an expression of uncertainty and tentativeness? Can it express authority, or lack of it? Can it be used to open up dialogic space, or all of the enlisted functions depending on the situational context?*

On the basis of the findings reported in Chapter 7 the answer to the above research question appears to be that *I think* is a plurifunctional expression. The analysis was carried out using a sample of 150 randomly selected occurrences of *I think* which was scrutinized from the points of syntax, nature of the argument, and the context of situation.

From a syntactic point of view it has been shown that median and final positions are typically avoided because they tend to express tentativeness. *I think* prototypically occurs turn-initially because it signals the speaker's qualification in a position that is likely to have the greatest effect and scope over the argument that is being put forward.

In relation to the context of situation, it has been argued that the linguistic context provides evidence as to whether *I think* chiefly expresses doubt or the speaker's assertiveness in relation to an argument. These two aspects of the meaning are always present in the expression, but the context may foreground one or the other. The analysis of the corpus material revealed instances of either type, but there seems to be a preference for assertiveness. In the dissertation defenses, occasions which lead to the use of *I think* in a context of doubt

are, for instance, those in which candidates are faced with face-threatening interrogations and where they are led to accept opposing points of view. It is also worth noting that in the defenses, questions and consequently answers characteristically involve the standpoints of the participants, which means that inexorably discourse will at times center on what the participants and others believe. The incidence of *I think* is therefore partly to be explained from the purpose of a defense, which should warn us against a mechanical construal of this expression as a marker of hesitation or doubt.

In relation to the nature of the argument, it has been pointed out that there are a number of instances where the distinction between a verifiable and non-verifiable argument is not unambiguous because the argument might refer partly to a probable fact and partly to personal opinion. When *I think* precedes judgments and evaluations it may not be used to qualify the veracity of the argument. When *I think* is followed by a clause expressing a modulation the speaker expresses his/her opinion on what needs to be done, using *I think* to qualify a proposal rather than the argument.

In sum, it seems safe to conclude that the expression is primarily used with different functions in the corpus. Thus, the use of *I think* acts to construct utterances as being dialogic, as explicitly opening them up to alternative readings. As argued in Chapter 7, constructing arguments with *I think* is strategic: it creates space for a controversial argument by placing it as *one* among many possible alternative arguments; it anticipates a dialogue with those who hold these alternative positions and for this reason signals a compliance to maintain academic harmony with those positions.

RESEARCH QUESTION 3:

- *What is the most common interpersonal strategy employed by committee members to ask questions and to give recommendations and/or suggestions and how is it realized lexicogrammatically?*

As pointed out in Chapter 7, speech functions such as statements, commands and questions have both congruent and incongruent (metaphorical) realizations. In the defenses, the use of metaphorical construals is frequently employed by examiners to redress commands either as declaratives or interrogatives.

The crux of the argument that has been put forward is that the speech functional system is expanded metaphorically because it increases the meaning potential available for the participants for academic negotiation in the defenses.

It has also been suggested that examiners make use of these metaphors according to their own perception of the candidates' work and academic persona, i.e., they are rooted, both in epistemological and social beliefs of the participants' understanding of required institutional standards. Thus, the use of metaphors of mood is an important interpersonal strategy employed by examiners to mitigate the requirements imposed on candidates, be they related to reconsidering points of view or taking up particular courses of action in relation to the written work. By relying on this interpersonal strategy examiners come to the fore as authoritative voices of the institution, redressing the power differential between them and the candidates and appearing as professionals whose academic responsibility is to inform and not to dictate.

8.2   Suggestions for further research and limitations

Grounded on SFL theory, my linguistic analysis of interpersonal strategies in the corpus of dissertation defenses has primarily centered on lexicogrammar, with specific emphases on the following linguistic environments: a) the system of modality as a whole; b) projections involving the mental process *I think*; c) the examiners' use of Metaphors of Mood; and d) the probabilistic nature of the system of modality. Due to spatial constraints and to the scope of my research, I have not dealt with other areas of SFL theory which could bring forth

interesting results regarding the nature of interpersonal argumentation in a genre such as the dissertation defense:

- intonation contours could have been analyzed since the choice among the different tones carries a substantial portion of interpersonal meaning.

- the use of language for the encoding of experience, through the system of transitivity, discussing salient processes, participants and circumstances;

- the organization and structure of information, analyzing the use and functionality of thematic and rhematic structures;

Furthermore, it would have been fruitful to investigate other interpersonal devices such as attitudinal adverbs evaluative adjectives, conditional clauses, nouns, degree words, and quantifiers. In special, I believe that a study based on the taxonomy proposed by Appraisal Theory could expand qualitatively the findings reported here.

Further research contrasting interpersonal differences and similarities across disciplines and genders could significantly enrich a study like this. It could perhaps reveal if there is significant variation in terms of interpersonal strategies between the so-called hard and soft sciences and if certain interpersonal strategies are more significantly employed by males or females. Another possible research avenue that could be envisioned is a contrast between the interpersonal discourse found in U.S defenses and that of a corpus of Portuguese defenses. Would the probabilistic nature of the modal system differ significantly across the two languages? Would the interpersonal strategies found in a Portuguese corpus resemble those found in the U.S corpus of defenses? Additionally, it would be extremely profitable to contrast a range of spoken genres in relation to the probabilistic nature of their modal systems. Are the probabilistic findings reported in Chapter 6 exclusively related to the genre at hand, or would they hold for different spoken genres varying across a continuum of more/less formal?

Finally, it is important to highlight the fact that it seems virtually impossible to analyze over 13.000 clauses without coming across instances where a given lexicogrammatical item or stretch of text represents an analytical doubt. Many of these cases were discussed with colleagues and with my advisor, but as a discourse analyst I had to make my own choices for which I take full responsibility.

8.3   Pedagogical implications

Although some of the findings reported in this study may not be of direct assistance for prospective candidates, it would seem sensible to recommend the following courses of action to ensure a smoother run at "D-day":

- to encourage candidates to take part in a 'practice run' organized by the candidate's supervisor(s). This type of mock practice is advantageous because the candidates are examined on their actual dissertation with questions typically asked in the real situations. Furthermore, they provide the candidates with an experience of the likely procedures and roles to be played by the different participants. They are limited, however, in that the questions asked in the 'practice runs' may not be the same as the ones asked in the real defense, and that no-one can guarantee how the examiners or the candidates will perform on the actual day;

- to encourage candidates to attend as many defenses as possible prior to their own defense;

- to make sure beforehand that all the of the equipment (PowerPoint, overhead projector, etc) is working properly;

- to try as hard as possible not to exceed the time allotted by the chair for the presentation of the research. Rehearsing the presentation a few times with colleagues might be a good way to keep your timing controlled;

- to keep a good control of the interpersonal tone. A tone of knowledgeability and assertiveness always causes a good impression. It is important not to forget that candidates need to know how to make allowances. The candidates' ability to adjust argumentative standpoints normally strikes the confidence of committee members who might feel that their intellectual contributions are being openly acknowledged.

Thus, I would like to suggest that the key to a successful defense is probably related to the synergy of three sets of attributes which candidates must possess:

1.   *Explicit scholarship appropriate to the subject area*

- Commitment to, and a reasoned belief in, the solid doctoral foundations of the dissertation;
- An appreciation of how the dissertation displayed academic maturity and scientificism throughout its text;
- An ability to identify and exploit the synergy between chosen research paradigms and the wider context of the research.

2   *Personal resilience*

- Confidence in responding to questions that were conceptually founded, and relating answers to evidence and/or concepts in a way that engaged with the examiners;
- A willingness to reject inappropriate questions with the appropriate interpersonal tone in the knowledge that such action was 'correct in the circumstances';
- A positive contribution to moving the discussion onwards and engaging with the examiners at any level of questioning.

3   *Interpersonal awareness*

- An ability to read, and then to respond to, the social dynamics of the defense;
- A capacity to establish an academic solidarity with the examiners so that answers to questions become preludes to joint discussion of mutual interests;

- Knowing one's own strengths and being at ease in using them - socially, personally and intellectually.

Thus, it is possible to offer the proposition that: the larger the extent of synergy between explicit scholarship, personal resilience and interpersonal awareness of the candidate towards the process of the dissertation defense, the more likely it is that the dissertation will be successfully defended.

8.4   The object of evaluation: a personal view

What is actually being evaluated in a dissertation defense? Is it the written product, the candidate, or both? My view on the subject is both. Committee members and supervisors evaluate whether the candidate can hold his/her own place as a member of the academic community, whether he/she has socialized into the community, and whether he/she is capable of "walking the walk and talking the talk" (Lemke, personal communication) as a member of the community, and that is judged primarily on the basis of what the candidate has written, which directly reflects how much academic effort he/she has put into his doctoral journey.

Secondly, candidates are judged interpersonally for their types of social skills on the situation. They are judged on how they can think on their feet, that is, they are judged on their discursive skills, and whether these skills enable them to produce acceptable discourse in an academic situation. In fact, what seems to be at stake in a dissertation defense is not just whether candidates will pass or fail, but the opinion of the committee members and chairs about them, which will most likely influence: a) what they will say about the candidate to peers in the field; b) whether they will write a letter of recommendation and what they will say in it; c) if they will think about supporting the next research proposal that the candidates produce, and so on and so forth. But there seems to be a longer-term consequence for what goes on interpersonally (as well as ideationally) in a defense because candidates are becoming

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APPENDIX A

The MICASE *Browse* search engine window
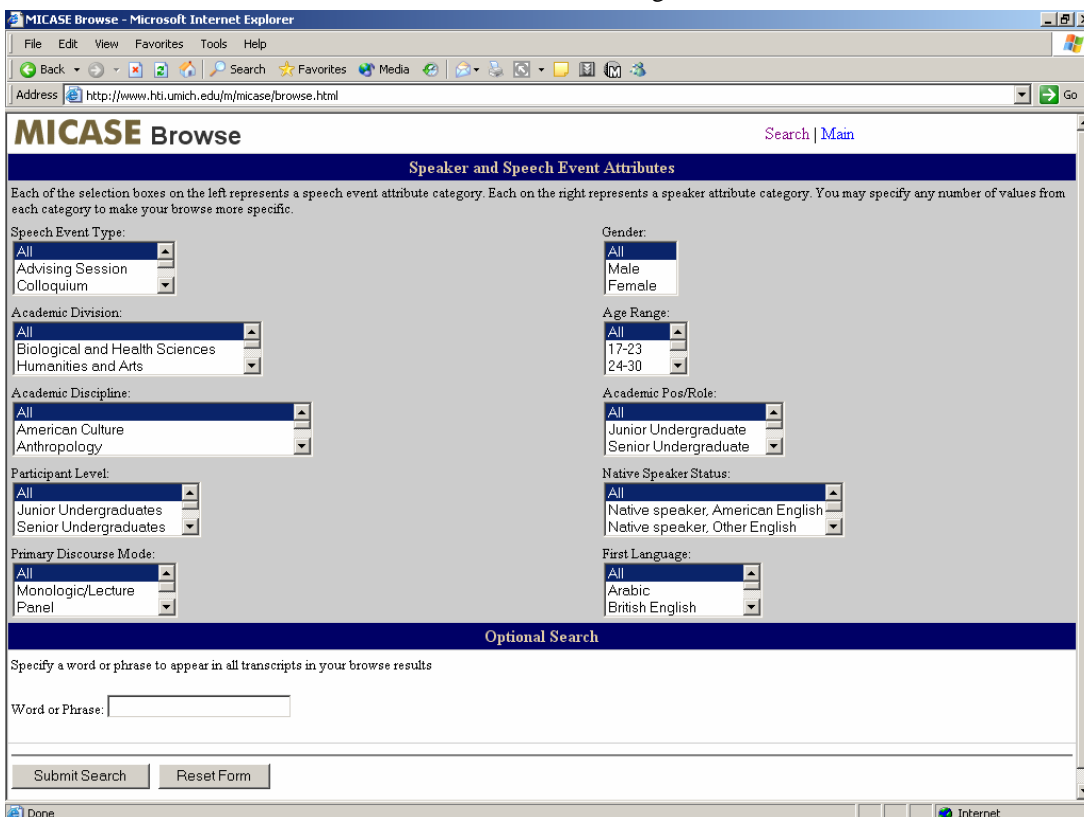
The MICASE *Concordance* search engine window
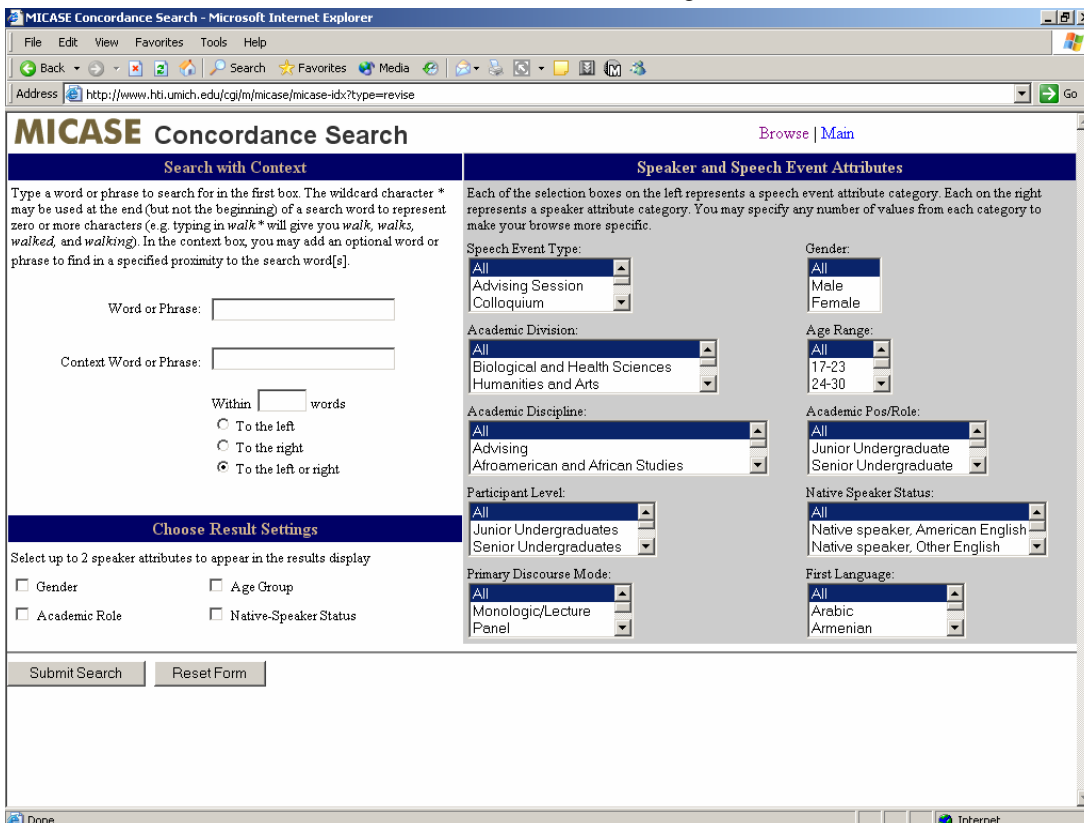
APPENDIX B – The MICASE transcription conventions

	GUIDELINE	EXAMPLES
GENERAL	Standard orthography is used for most words, even though they may not be fully pronounced, may be pronounced with a foreign accent, etc. In general, phonologically reduced forms are not represented, except as noted below.	
CAPITALIZATION	Only proper nouns (names, departments, course titles, organizations, etc.) are capitalized (in addition to acronyms; see below). Neither the beginnings of turns nor the pronoun 'i' are capitalized.	Dr Hales received his M-S and B-S degrees at Stanford in nineteen eighty-two. his PhD at Princeton in eighty-six under the Harold W Dodds Honorific Fellow-ship... oh, i i think i know what you're getting to.
FILLED PAUSES, BACKCHANNEL CUES, EXCLAMATIONS, etc.	All hesitation and filler words, backchannel cues, and transcribable exclamations are spelled out, as shown on the right.	**Hesitation/Filler Words/Backchannels**: hm, hm', huh, mm, mhm, uh, um, mkay **Yes/No Responses**: yes: mhm, mm, okey-doke, okey-dokey, uhuh, yeah, yep, yuhuh no: uh'uh, huh'uh, 'm'm, huh'uh **Exclamations/Doubt/Misc.**: ach, ah, ahah, gee, jeez, oh, ooh, oop, oops, tch, ugh, uh'oh, whoa, yay
CONTRACTIONS and LEXICALIZED REDUCED FORMS	All standard contractions of *is, am, are, had, have, would, not* are represented, including [noun + *has been/have been/is*]. Different forms of modals + have are represented Lexicalized phonological reductions are limited to those listed on the right.	i'd, i've, i'm, i'll, she's, she'll, he's, they've, etc. that'll, it'll, there're etc. coulda, could've, couldn't, couldn've, couldna, woulda, would've, wouldn't, wouldn've, wouldna, shoulda, should've, shouldn't, shouldn've, shouldna betcha, cuz, 'em (=them), gimme, gotta, hafta, kinda, lookit (as vocative only), lotsa, lotta, oughta, sorta, wanna

ACRONYMS, ABBREVIATIONS, LETTERS AS VARIABLES	Acronyms are written in all caps. Three commonly abbreviated titles are left as abbreviations, but without periods. An acronym pronounced as a word is run together as one word. [On-line version only] When an acronym is spelled out, it appears in all caps with hyphens between each letter (except PhD). [In the CD-ROM/ distributed version and the tagged version, these hyphens have been removed.] Letters used as variables in math and science are written in all caps with hyphens between modifying or adjoining elements.	Exception: PhD (no hyphens, no period) Dr, Mr, Mrs (not spelled out) NASA, TOEFL C-I-A F-B-I E-L-I L-S-and-A X-Y axis N-squared, X-to-the-N-minus-one
HYPHENS	Standard hyphenation rules apply, as in the Chicago Manual of Style, where they exist.	pre-med, pre-calc, pre-law, mid-thirties mid-nineteen-ninety-nine, pre-Christian, non-Euclidean, non-native
NUMBERS	All numbers are fully spelled out as words. Standard hyphenation rules apply, with some additional guidelines: page numbers, course numbers, and room numbers are all hyphenated.	nineteen ten nineteen twenty-nine page one-fifty-seven Poli Sci one-sixty room thirty-twelve
REPETITIONS and REPAIRS	All repetitions of a word, partial word or phrase are transcribed. Truncated or cut-off words have a hyphen at the end of the last audible sound/letter. An underscore at the end of a word indicates a false start in which a whole word is spoken but then the speaker re-starts the phrase.	it's no longer than a than a, calendar year... so, come on up, grab yourself a ins-implement of destruction. well, it will be_ it's sort of_ it's a management human-resource kind of job...
FOREIGN WORDS	Foreign words are spelled as in the original language when it uses a roman alphabet; other-wise, an approximate phonetic transliteration is used.	and see what, the Buddha, was s- was saying um, the *tatha, gata*, Sanskrit's a really interesting language...
PRONUNCIATION VARIATIONS	As mentioned above, minor pronunciation variations are not represented in the spelling, with the exception of the contractions and lexicalized forms listed in this table.	

XML TAG or SYMBOL	MEANING/DESCRIPTION	APPEARANCE IN ON-LINE TRANSCRIPTS (HTML VERSION)
SPEAKER ID		
<U WHO=S1>, <U WHO=S2>, etc.	Speaker IDs, assigned in the order they first speak.	**S1:** at the beginning of each turn or interruption/backchannel.
<U WHO=SU>, <U WHO=SU-f>, <U WHO=SU-m>	Unknown speaker, without and with gender identified	**SU: SU-f, SU-m**
<U WHO=SU-1>	Probable but not definite identity of speaker	**SU-1:**
<SS>	Two or more speakers, in unison (used mostly for laughter)	**SS:**
PAUSES		
<PAUSE DUR=:05>	Pauses of 4 seconds or longer are timed to the nearest second.	<P: 05>
[for untagged and on-line versions. Tagged version: <PAUSE DUR=":01" TYPE="CONT">]	Comma indicates a brief (1-2 second) mid-utterance pause with non-phrase-final intonation contour.	,
• [for untagged and on-line versions. Tagged version: <PAUSE DUR=":03" TYPE="FINAL">]	Period indicates a brief pause ac-companied by an utterance final (falling) intonation contour; not used in a syntactic sense to indicate complete sentences.	•
... [for untagged and on-line versions. Tagged version: <PAUSE DUR=":03">]	Ellipses indicate a pause of 2-3 seconds	...
OVERLAPS		
<OVERLAP>...</OVERLAP>	This tag encloses speech that is spoken simultaneously, either at the ends and beginnings of turns, or as interruptions or backchannel cues in the middle of one speaker's turn. All overlaps are approximate and shown to the nearest word; a word is generally not split by an overlap tag.	Text of overlapping speech is in blue.
BACKCHANNEL CUES and FAILED INTERRUPTIONS		
Embedded utterance (<U> tag within a <U> tag)	Backchannel cues from a speaker who doesn't hold the floor and un-successful attempts to take the floor are embedded within the current speaker's turn, and not shown as a separate line/paragraph.	[S3: Text of embedded speech is in orange and sur-rounded by orange square brackets.]

Embedded and overlapped utterance (<OVERLAP> tag within an embedded utterance)	Backchannel cues or unsuccessful interruptions that overlap with the main speaker's speech.	[S3: Text of embedded speech that is overlapped is in blue and surrounded by orange speaker ID and square brackets.]
LAUGHTER		
<EVENT DESC=LAUGH> or <EVENT DESC=LAUGH WHO=S2>	All laughter is marked. Speaker ID not marked if current speaker laughs.	<LAUGH>, <S8 LAUGH> <SS LAUGH>, etc.
CONTEXTUAL EVENTS		
<EVENT DESC="WRITING ON BOARD"> <EVENT DESC="APPLAUSE"> <EVENT DESC="AUDIO DISTURBANCE">, <EVENT DESC="BACKGROUND NOISE"> <EVENT DESC="SOUND EFFECT">, <EVENT DESC="GASP">	Various contextual (non-speech) events are noted, usually only when they affect comprehension of the surrounding discourse.	<WRITING ON BOARD> <APPLAUSE> <AUDIO DISTURBANCE>, <BACKGROUND NOISE> <SOUND EFFECT>, <GASP>
READING PASSAGES		
<SEG TYPE="READING">.....</SEG>	Used when part of an utterance is read verbatim.	<READING>.....</READING>
FOREIGN WORDS		
<FOREIGN>.....</FOREIGN>	Used for non-English words or phrases.	Italics e.g.: the mother says *c'est quoi*? and Annika says to *parce que* eh and then,...
PRONUNCIATION VARIATIONS		
<SEG TYPE="PRON" SUBTYPE="/seltik/">Celtic</SEG>	Used when an unexpected pronunciation is used that would affect comprehension of the surrounding discourse. Dialect or other phonological variations are generally not represented.	Pronunciation guide follows the word e.g.: ...they asked the librarian for pictures of old Celtic <PRON: /seltik/> uniforms the basketball team, and it turns out that the project was he was supposed to find Celtic <PRON: /keltik/> costumes.
<SIC>...</SIC>	Used when a speaker makes a mis-take without self-correcting, and the error might otherwise appear to be a transcribing error.	*(sic)* follows the word. e.g.: despite the fact that that was the era of Women's Lib-eration like i say on the cover of Newsweek, and Gloria Steinman *(sic)* and uh Betty Friedan...

APPENDIX C

Overview of the project submitted to the University of Michigan's Institutional Review Board of Behavioral Sciences to obtain consent to collect data

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Project Abstract:
The project entails continued data collection and linguistic analysis of existing data for the Michigan Corpus of Academic Spoken English (MICASE), a publicly available web-based collection of approximately 200 hours of recordings and accompanying transcripts of naturally occurring speech collected at the University of Michigan.

In addition to the ongoing linguistic analysis of the existing data, we will undertake the collection of approximately 40-50 hours of additional speech recordings in classes and office hour meetings involving graduate student instructors (GSIs), as well as dissertation defenses. The goals of the project are to study the speech patterns of graduate students in their roles as teachers and as scholars.

In classroom situations, we plan to investigate issues relating to speaking styles, broadly conceived, and question asking and answering patterns, including the pedagogical effectiveness of different types of questions, issues relating to politeness strategies, and differences between questions asked in different types of classes (e.g., lectures versus discussions). Furthermore, we plan to compare speech patterns of graduate students in classroom teaching situations with those used in one-on-one or small group meetings during office hours.

We will be comparing speech patterns of native and non-native speakers, and the graduate student speakers with professors (using existing MICASE data). The discourse of dissertation defenses is of interest for this project in that it represents a situation where graduate students are nearly elevated to the level of colleagues, while at the same time being challenged and obligated to defend their own research.

Research Design:
The current phase of this project is designed to study the language of graduate students in their dual roles as novice instructors and as emerging scholars. To that end, we intend to collect approximately 40 hours of recordings from classroom and office-hour instructional situations in two to four different departments, and approximately 10 - 15 hours of recordings of dissertation defenses.

For the first part of the project -- the study of instructional speech -- potential participants will be recruited from the selected departments, at least one of which will be from the humanities/social sciences, and at least one from the hard sciences. Once they agree to be recorded, we will record and observe one or more classes and office hour sessions from each graduate student instructor. We plan to conduct these recordings during the fall 2003 and winter 2004 terms. One member of the research project team will attend each of the classroom recording sessions, in order to observe the interaction more closely and take notes; in the case of office hour sessions, the recording equipment will be set up and no observers will be present during the recording. An equal number of native and non-native speakers will be recruited from each department, and an attempt will be made to ensure a gender balance among the primary participants.

Each recording will be transcribed according to conventions established during phase I of the MICASE project. The transcripts -- and sound recordings, for those who consent --

will then become part of the web-searchable MICASE archive.

The primary goals of the part of the study on instructional speech are to investigate speaking styles in instructional situations, including patterns of question asking and answering in both lecture and discussion classes (by both instructors and students), and the relationship of questioning strategies to fostering effective classroom discussions. Other features of interest include issues relating to politeness strategies and conventions, and differences between the language patterns used in class versus in office hour meetings outside of class. Finally, we plan to compare the language used by graduate student instructors in the 'hard' sciences versus those in the 'soft' sciences and humanities, and also to compare non-native speaker and native speaker graduate students, as well as graduate students and professors (using existing MICASE data).

The analysis of the transcripts will be ongoing indefinitely, since this data will also be combined with the existing MICASE transcripts, and the main purpose of such a corpus is to provide a publicly accessible digital resource for the ongoing study of naturally occurring spoken language.

The second part of the project will seek to record between 5-10 dissertation defenses during September and October 2003. (A project researcher will attend the dissertations, audiotape them and take personal notes). All of the recorded defenses will be subsequently transcribed in the same way as the classroom data, and will be added to the MICASE archive. This part of the study deals, in broad terms, with how knowledge is negotiated and exchanged among the participants of this specific speech event through interpersonal choices of vocabulary. Examples of the types of linguistic features that will be analyzed include how criticism is voiced, how recommendations and suggestions are given and how these are accepted and/or rejected by the candidates. Furthermore, the study will attempt to investigate whether it is just the dissertation that is being examined, or whether it is the candidate who is being assessed personally as someone who merits a doctorate or can be consider as an ambassador of the awarding institution. Within two weeks following the defense candidates and examiners who are willing will be asked to reflect on their experience of the defense; these interviews or written responses will be used to supplement the transcriptions and audio recordings.

Total confidentiality will be granted to the participants, both in relation to the recordings and transcriptions as well as regards the interviews.

Both of these sets of data -- the recordings of dissertation defenses and those from GSIs in instructional settings -will be used to analyze various features of the language patterns of graduate students, in an attempt to better understand the development of an academic speaking and teaching style, and how speech styles of graduate students change when they are talking to students versus talking to their professors.

Significance & Benefits of Research:
The two main goals of this project relate to the teaching of English as a Second Language for students at the university level, and also to the training of graduate students in their roles as teachers. Thus the project has both linguistic and pedagogical aims.

We are rapidly moving into an era where English is becoming the lingua franca of scholarly oral communications. We are in an era of increasing international movement as exchanges and links of various kinds proliferate, with increasing interest in scholars around the world from many disciplines in obtaining a qualification or degree from an American institution. The MICASE project is a valuable resource to many students, teachers, and researchers around the world who are eager to study linguistic features of

American academic speech. The present project will significantly enhance the MICASE database, by adding data primarily from graduate students, who are currently only minimally represented in the corpus.

Non-native speaking students and teachers of ESL can benefit from the results of this research, as we will analyze specific linguistic features of classroom language, and make specific recommendations for applying the findings to ESL curricula and teaching materials. In addition, the analysis of both the instructional data and the dissertation data will be significant not only to non-native speaking students of academic English, but also, since on part of the analysis will deal specifically with effective instructional strategies, this research will also benefit native speaker graduate students or novice professors who are preparing to teach, or seeking to improve their communication skills in the classroom.

As for the study of the dissertation defense specifically, this project represents groundbreaking research into a vital speech event of U.S. research institutions. Whereas considerable attention has been paid to the characteristics and structures of written dissertations defenses, research into the actual characteristics of the oral defense is limited to a few studies. Thus, a primary aim of this study is to extend the small body of research on dissertation defenses, so that we can begin to understand better what goes on in this important rite of passage, where Ph.D. candidates emerge part of an academic elite. Secondly, it is hoped that by providing an overall picture of the discourse of dissertation defenses, and how linguistic strategies are used to achieve specific rhetorical effects, we can shed further light on how this specific genre is shaped and, possibly, offer prospective candidates important information about some of the typical strategies for a successful oral defense, as well as a grasp on some of the criteria frequently adopted by examiners to assess the dissertation, such as, how deeply the dissertation goes into the issues and whether the candidate has faced up to everything involved; how candidates have dealt with contradictions in the evidence; how they have sorted out, if not resolved, the problems; and the candidates' conceptual understanding, critical ability and explicit and well organized argumentation.

Risk to Subjects:
Please include description of physical risks, psychological risks, social/reputational risks, and other privacy risks. (Use as much space as necessary):→ **[instructions given in the form we had to fill]**

Minimal risks relating to privacy are associated with the proposed project. Participants may feel inhibited about speaking up in classes or office hour appointments because they are being recorded. They may be inclined to monitor or edit their language usage or the things they would like to say in ways they normally would not. However, we will only be recording a few sessions with each instructor during an entire semester; therefore the potential for this to have a serious impact on their classroom interaction is minimal. Furthermore, all participants will be recorded only with their explicit consent and prior knowledge, and they will have the opportunity to reconsider the use of their speech after the recording has been obtained, if they feel uncomfortable about it for any reason.

Additional risks have to do with anonymity. Although the data will eventually be publicly accessible to linguists and other interested researchers, care will be taken -- i.e. last names and other identifying information are changed -to insure that participants' identities remain anonymous, as has been done in the earlier stages of the MICASE project.

APPENDIX D

Email sent to prospective subjects for data collection

Become a part of linguistic history!

Would you be willing to have your
public dissertation defense recorded?

The Michigan corpus of Academic English (MICASE), an English Language Institute project, is soliciting Ph.D. candidates and their respective examining boards who will allow us to record their dissertation defenses. There is no time commitment on your part, we will not interfere with the ceremony in any way, and we guarantee total confidentiality for those who agree to participate.

The MICASE project is the first of its kind in North America, and serves as a publicly available resource of authentic speech data for English as a Second language teachers, researchers, students and testers. At present, the database contains speech events as varied as lectures, seminars, advising sessions, colloquiums, office hours, student study groups, etc, and many people have already begun to use the transcripts that are available on our website – **www.lsa.umich.edu/eli/micase/micase.htm.**

At the present time, we would like to add to the existing holdings several additional samples of dissertation defenses in all academic divisions.

If you would consider participating in this groundbreaking project, please send a message letting us know your academic division and the date of your defense. Join many of your esteemed colleagues whose recordings are already part of the corpus.

For more information feel free to email the project director or me. Thank you for your attention.

Leonardo Recski (**lrecski@umich.edu**)   Rita Simpson (**ritacsim@umich.edu**)
Project Fellow Researcher   Project Director
MICASE   **MICASE**
English Language Institute   English Language Institute

Appendix E – Dissertation Defense Transcripts

The Sociology Defense (recorded at University of Indiana in 1975 – courtesy of Prof. Allan Grimshaw – no audio file available)

A = Adam (Chair and Advisor)
L = Lee (candidate)
S = Shern (Committee Member)
P = Pat (Committee Member)
J = James (Committee Member)

```
0001  A: . . . got to be here and what she's doing and what she's done and
0002     then sort of in order we'd ask you as our outside reader if you'd got
0003     some questions you'd like to ask her and then the two of you and then
0004     I'll ask something if you've left anything over for me out of that 800
0005     pages there's a limited number of questions ((J: laughs)) and of
0006     course anybody can can break in for clarification at any time so why
0007     don't you tell us what you've been doing and how you got here and
0008     [and what you've done
0009  L: [after I f-finished high school I went to a college which was
0010     called Christian College at that time it's now called Columbia College
0011     it was a girls school in Columbia Missouri which was renowned for its
0012     academic excellence and as I was finishing there I applied to UCLA to
0013     get into a uhm undergraduate law school program in which you did not
0014     get a baccalaureate degree and you moved into law school and was
0015     turned down because I was a woman so I went to Miami University for a
0016  S: specifically uh that overtly [you are a woman therefore you]
0017  L:                              [yes uh huh ] yuh this was in '48 and
0018     the influx from the war was over ((S: um hum)) and af- at Miami I
0019     majored in political science and biological sciences and the latter
0020     half of my senior year I was informed that I would have to go to work
0021     come fall and one semester I qualified to teach high school by Ohio
```

0022   standards and ended up teaching uh generalized science and history and
0023   a world government and er world history and government in Cincinnati

0024   and then I went back to graduate school at the Regional State
0025   University and I went into counseling and guidance because it was the
0026   only academic area that would permit me to get into a university
0027   environment and operate professionally at that time with a master's
0028   degree then I came to MWSU and was on the dean of student staff at that
0029   time the women's halls were separated from the men's halls and I was
0030   involved in programming and counseling and advising in the women's halls
0031 S: are you the one who uh in-invented the open door and one-foot-on-
0032   the-floor format?
0033   [((general laughter))]
0034 L: [could have been] uh and at that time they had hired in five new
0035   staff members all of whom were young and there was promotional
0036   opportunities for only one they selected the one who was to be
0037   promoted and I went on to another university into an advanced
0038   administrative position in student activities ultimately got moved
0039   into budgetary responsibilities within the university and came to the
0040   conclusion that I had done all I wanted to do in that line of work and
0041   because universities were opening up and women could get in to
0042   doctoral work that I would simply return and I chose a entirely new
0043   field which was sociology [I
0044 A: [you mean it was a new field then Lee
0045   [or ((laughs))
0046 L: [for me my first course in sociology ((P: laughs)) was your class
0047   ((S: let me tell you a little history)) in social organization ah
0048   haven't you heard the story about my problem in Melby's course? I was
0049   told to do some reading for on Weber and I went to the library ((S:
0050   and looked up)) and a week later I went to see Melby and I said I have
0051   looked under v-e v-a ((laughter)) how do you spell it ((P: yuh)) but
0052   uh I had tried to get into graduate school when I finished my master's
0053   at the Regional State University I needed financial assistance and was
0054   denied it again because I was a woman and received a good half-hours
0055   lecture on how I should get married and have children and forget about
0056   all this intellectual nonsense well these experiences began to develop
0057   in me some kind of interest in uh women's reaction because I obviously
0058   had been consistently conforming in my reaction trying to find what
0059   avenues I could do some functioning in but not challenging the
0060   restrictions I had been running into and my experience at MWSU in the
0061   doctoral program was extremely satisfying intellectually because I was
0062   permitted to study and deal with kn- uh levels of knowledge that my
0063   previous experiences hadn't permitted and then within the department I
0064   ran into discrimination in terms of applying for a teaching
0065   assistantship and I was told by the chairman at that time that I could
0066   not teach because I couldn- women could not control the behavior of

0067   freshmen well subsequently [the intrusion]
0068 S: [what year was [this?]

0069 P: [((laughs))
0070 S: whoa whoa whoa uh uh uh what year uh uh?
0071 L: that was in nineteen sixty ((pause)) eight
0072 S: that locates it pretty specifically doesn't it
0073 L: yuh ((general laughter, P: yes)) and then another faculty member
0074   Zeb Williams then took me on as a graduate assistant in research and
0075   through my performance there and a change of administrative structure
0076   within the department I got into the teaching associate position and
0077   the combination then became a very very satisfying uh procedure
0078   through but it was my own history of experience that probably directed
0079   my interest to radicalism and uh one of the first questions I asked
0080   was you know are women really in fact any different than men in the
0081   kinds of social phenomena which lead to radicalism and is the apparent
0082   uh is it that women in fact run into obstacles more frequently when
0083   they try to get into advanced education or into professions rather
0084   than women becoming radical for a different reason and I combined
0085   those two in my dissertation I was asking can the same theoretical
0086   formulation be used to explain radicalism across different groups and
0087   why is it women become radical ((pause)) now again pulling from my own
0088   experience uh my presumption that I could go to graduate school in
0089   other words I did not see I did not identify sex as a limiting factor
0090   this was in fifty-four uh made me wonder to what extent did the kind
0091   of socialization experience that women get ((S: mmm)) have to do with
0092   their definition of the situation that if you're interested and you're
0093   able and you're capable certain avenues obviously should be opened to
0094   you ((S: mmm)) and putting all those things together came up with my
0095   research problem I since leaving MWSU I have been on the faculty in
0096   the department of anthropology and sociology at ASU where I've been
0097   teaching undergraduate courses in the area of adolescence and theory
0098   and methods primarily
0099 A: so Lee what di- what did you briefly what did you find out
0100 L: in the disser[tation?
0101 A: [yuh why don't you tell us a little bit about what you
0102   did in the dissertation and
0103 L: in terms of the uh uh test of the three theories that I chose to
0104   use I found that the uh system constraint variables systems constraint
0105   variables and the variables from values theory each explain about the
0106   same amount of variance a moderate amount of variance in radical
0107   attitude and radical behavior and I found that relative deprivation
0108   theory which was formulated by Gurr and and it's a unique formulation
0109   built on frustration-aggression motivation uh in no way was supported
0110   by the data then in looking at the background factors I found that two
0111   aspects of family experience in conjunction with the uh perception of

0112   women as a minority group and the perception that the social structure
0113   systematically discriminates against women uh this is the use of the

0114   father as a negative role model
0115 S: Adam we have the uh
0116 L: and it is the uh the measured variable was whether the respondent
0117   did or did not seek advice from the parents in problem solving and it
0118   was the not seeking of advice and a very personal variable then added
0119   to those four is the thing that changed their religious preference
0120   from their childhood religion and those five acting together account
0121   for I believe roughly forty-two per cent of the variance of radical
0122   attitude then radical attitude in conjunction with a value orientation
0123   which is called self-expression it-it measures a valuing of expressing
0124   oneself those two in conjunction are the best predictors of radical behavior
0125   ((pause))
0126 P: when I went through it Lee I had a number of questions uhm and let
0127   me just deal with some of the the questions that have to do with your
0128   methodology to begin with and then come to some of the more general
0129   ones uhm in concern my concern with the the method I noted two things
0130   one is that you don't really explain how you chose your interviewers
0131   that you used you don't say anything about their personal characteristics
0132   I don't know for example if any of those interviewers were black you
0133   do indicate that you tried to assign them to people on the basis of
0134   demographic variables without going into much more detail than that
0135 L: uh the in choosing the interviewers I was initially limited to
0136   availability from among those who were available I tried to select a
0137   represented representation of age range and I tried to select people
0138   who in my interviewing of them I simply made the decision that they
0139   seemed to be capable of handling the one time only kind of interaction
0140   uh I chose a graduate student who was in sociology uh and I chose a woman
0141   who was a graduate student in radio and television but had a minor in
0142   sociology and there were two seniors one was a major in political science
0143   and one was a major in English and there was a junior whose major was
0144   in uh health education and physical education and the other one was
0145   a graduate student too but not degree graduate student who completed
0146   the undergraduate work taking some graduate courses really sort of
0147   [in between kind of thing I believe the major was history
0148 P: [special degree student (probably) mm hm anybody black?
0149 L: pardon?
0150 P: was any of your interviewers black?
0151 L: no none of the interviewers were black
0152 P: okay
0153 L: I had made an effort to get a black interviewer she was a student I
0154   had had who was a senior and working in the upward bound program and
0155   th- th- the willingness to participate was there but the time conflict
0156   became impossible

0157 A: do you think that had any impact on the kinds of results you got
0158 L: well I can only be partially objective on that I did most of the

0159   black the interviewing of the black students uh I have had
0160   considerable experience and training and interviewing I think I was
0161   able to diminish some of the effect of being a white person but I'm
0162   not sure that I totally eliminated it on the basis of the ease of
0163   communication in the interview in all but one instance I would say
0164   race was not having an afa- an effect
0165 P: uhm hum
0166 L: but uh it could have been
0167 A: you had one interview where [she quit in the middle right?
0168 L: [I had one interview where there was
0169   extreme anger at not at me but the anger was at raising questions
0170   about women's equality when black men are still discriminated against
0171 P: mm hm
0172 A: um hum and did she terminated the interview did she [did she finish?
0173 L: [No
0174 L: she refused to answer the set of questions on systems constraint
0175   but she completed the interview
0176 P: mh
0177 A: did you know before you got when you drew your sample now did you
0178   have any knowledge before you actually contacted anybody what their
0179   race was ((L: no no)) whether they
0180 A: so you don't do you you don't have any way of knowing do you then
0181   whether there was say disproportionate refusals which may be partly in
0182   the back of your mind ((to P))
0183 P: that's right uh huh
0184 L: well I drew the sample and then I contacted each uh respondent
0185   soliciting their participation in the contact I became aware of the
0186   fact that they were or were not black
0187 S: you contacted them personally?
0188 L: yes
0189 S: I see
0190 L: uh and u-uh I had we had absolutely no refusals from blacks ((P: mm
0191   hm)) at all all the refusals were white
0192 J: what was the percentage of ((P: I see L: pardon?)) refusals?
0193 J: what was the percentage of refusals from the whites?
0194 L: it varied by class the overall uhm acc- acceptance rate for the
0195   study I think was about ninety-four percent
0196 S: mm hm
0197 P: yuh, it was
0198 L: uh the master's group was the group that had the lowest they
0199   dropped below ninety about eighty-eight
0200 S: yuh ((pause))
0201 P: it was a very high acceptance rate willingness to go along the

0202   problem is that the N for the black candidates was so small ((L: yes))
0203   N it thirty-two see and you must have contacted what thirty-three

0204   maybe [(because) you
0205 L: [I think the N was thirty-two but there were only thirty-two
0206   blacks drawn in the sample
0207 P: okay
0208 L: we- we'd have one hundred per cent of the black respondent participating
0209 P: so you did go ahead and use a portion of that one interview though
0210   even though the person didn't answer the questions on systems
0211   [constraint
0212 L: [yes the interview was completed with just the one set of questions
0213   the forced choice set and she just had a very very strong reaction to
0214   it ((P: uh hum)) but not to me ((P: uh hum)) and I simply waited for
0215   her to calm down and then I went on with the interview and she went
0216   ahead [(uninterpretable)
0217 A: [was she an undergraduate woman or a graduate woman?
0218 L: she was a graduating senior she you know she was finishing at the
0219   end of summer and was graduating at the end of summer I take that back
0220   one of the blacks that was drawn in the sample I just remembered this
0221   was not interviewed but it was not a refusal she was the one who had
0222   been picked up in the library by the security officers
0223 S: [oh, yuh]
0224 P: [oh yes yes ((chuckle))]
0225 L: and then she disappeared and I had tried she had been working over
0226   at the ombudsman's office and I tried his ac- through him to get
0227   access and her counselor in the hall now she was never contacted but
0228   she w- had been drawn and was not interviewed
0229 P: uh hum okay another concern that I had uh Lee was that your use of
0230   Duncan and Sheff'e test following uh significant analysis of variance
0231   to test the the individual comparisons because basically those tests
0232   do not have the power say that the Tukey has and I wondered why you
0233   used the the less conservative test instead of tests rather than the
0234   Tukey see you- you've made so many comparisons around here that you
0235   run a very high risk of getting some significant results when in fact
0236   it's just it's just chance operating ((pause)) and ((pause))
0237 L: I-I y'know I can't do anything more than say that I used the Sheff'e
0238   and the Duncan both because one is considered more conservative and
0239   the other is considered more liberal uhm I felt that that was
0240   primarily a preliminary analysis to find out if class age or race was
0241   having a confounding effect uh and I used those as some control on the
0242   very thing you mentioned and ((P: mm hm)) that is I could get a
0243   significance because of the number of variables and I felt that the
0244   range test would give me some indication of a chance factor resulting
0245   coming forth and uh y'know to the extent that it gave me controls it
0246   restricted some of the 'er limited some of the problems you-you're

0247   raising [though obviously it's there

0248 P: [yuh the Duncan doesn't have much power ((L: what))

0249   basically Duncan doesn't have much power ((pause)) the the Sheff'e test

0250   is considerably better but the Tukey of course is like is like the

0251   extreme Sheff'e ((pause))

0252 S: uh do you uh uh ever considered a set of findings that you would

0253   have deemed significant by virtue of one test uh compared against the

0254   set of findings you would have deemed significant by the other and ask

0255   would you have come to different conclusions uh with respect for

0256   example to uh y'know the notion that uh the uh the uh relative

0257   deprivation theory contributes least if anything to the explanation of

0258   the phenomenon you might engage in that exercise

0259   [as a as a protection against the problem]

0260 L: [yuh on that particular uhm yuh in that] particular series I don't

0261   believe the range test differed I'd have to check it ((S: yuh)) but it

0262   my- my- my sense was that the range test varied on the the variation

0263   between their the two range tests occurred primarily on the value

0264   variables and not on the uh either the constraint variables or on the

0265   relative deprivation variables

0266 S: you might you might also examine your findings to see whether the uh the

0267   set of significant findings and the set therefore of the nonsignificant

0268   findings are patterned uh that is th- tend to fall within some

0269   particular domain of variables for example if they're unpatterned it

0270   suggests that what you're getting is random results y'know uh and and

0271   selecting building a case on more or less random results if it they-

0272   if they're discernible pattern that's much more unlikely so you might

0273   think of your results in those terms again as a check against the

0274   [((pause)) potential capitalization on randomness on random positive

0275 L: [one thing which I did which I did not yuh one thing which I did

0276   which I did not include in the uh body of the dissertation was that

0277   when I examined the relationship of family factors to the values uh

0278   then I took those findings and I took the analysis of variance of

0279   racial difference I couldn't do this with class and age ((S: cough))

0280   and I analyzed whether there were racial differences in these

0281   background factors which were associated with the values ((P: mm hm))

0282   an' I I f- I did cite some of the racial differences in a ((P: yes))

0283   footnote in chapter seven but some of the background factors which

0284   were associated for example with a political interest were

0285   differentially distributed between blacks and whites and blacks and

0286   whites differed on the interest in ((S: hm)) that particular value

0287 P: mm hm I was particularly concerned Lee with the th- possible

0288   implications of this for your acceptance of a difference ah- for the

0289   the value orientation theory because you ran a number of tests there

0290   large numbers of which were nonsignificant and yet you went ahead and

0291   accepted it as having contributed a reasonable amount to the to the

0292   prediction of-of both radical attitudes and radical behavior and I was
0293   a little a little disturbed in reading that because ((L: well I)) I

0294   thought maybe you well you did something like twenty-five F-tests uh
0295   which are presented in a series of tables four of those F-tests were
0296   significant now of course there were a lot of correlational analyses
0297   too and- and the same general pattern showed out that you did lots of
0298   correlations most of which were nonsignificant but some were
0299   significant and yet of course you you go ahead and reject the null
0300   hypothesis in connection with the the value orientation theory
0301   ((approximately 5 second pause))
0302 L: I- ((P: it's)) I-I really am- am confused are you saying that
0303   analysis of variance of the value orientation to be dependent
0304   variables of radicalism?
0305 P: no I don't think so I don't think those I think the correlations
0306   were with the the radical attitudes and radical behavior right?
0307 L: yes
0308 P: ooph I've got to find the paper with my notes I did notes on this
0309 A: so it wouldn't uh you really ought to have an index
0310 S: yuh
0311 P: yuh ((through laughter))
0312 A: different ((P: right)) colors for different
0313 S: yuh [you
0314 P: [well basically it it gets down to uh the same problem I think
0315   that Dr. Sherzer has raised and that's that you really need to have a
0316   a very consistent pattern when you claim significant results
0317 L: well i- the uh analysis of variance tests were in examination of
0318   the possible effects of class age and race the uh rejection of the
0319   null hypothesis was on the basis of the regression analysis
0320 P: mm hm
0321 S: would the- the- the
0322 P: but many of the correlations [feeding into that were not significant
0323 S: [but the inferential
0324 L: pardon?
0325 P: many of the correlations feeding into that were not significant to
0326   what you what you cite here
0327 S: the the inferential problem Lee I- I'm not sure uh being communicated
0328   i- uh y'know you run a hundred tests using the point oh five level as
0329   the level of rejection a- and uh uh by chance you're gonna pick up
0330   five significant findings in a hundred tests uh given that that there
0331   are no significant findings and what uh uh Pat is- is asserting is
0332   you- you've run a large number of comparisons twenty five in this case
0333   you get four significant findings uh there is some reasonable chance
0334   that those four are simply y'know the tail of the chance distribution
0335   that the- the- that they represent findings that could have emerged
0336   by chance uh but appear as significance by virtue of y'know the

0337   distributional quality of uh of uh of significant tests and- and- that-
0338   that's the question that's the issue that's being raised

0339 L: well uhm I- I don't understand how the analysis of variance tests
0340   on class age and race ties into the regression analysis of the
0341   formulations of the theory
0342 P: because it it contributes to your assessment of the support or the
0343   non support that you [find for particular theory yuh]
0344 L: [I see because in other words because I
0345   rejected] class as being the explanatory variable or ((P: right right
0346   yuh)) race as being the explanatory variable well then are you not
0347   arguing that because I got four out of twenty-five rather than
0348   rejecting those four I should have accepted them
0349 P: I think you did accept them
0350 L: pardon?
0351 P: you did accept some of them because you you went on to
0352 A: well no what I understand the argument to be Lee is something like
0353   this that they're they're s- saying as you well understand that if you
0354   run enough tests some of them are going to show up ((L: yuh)) to be
0355   significant anyhow and that given that you ran twenty-five tests and
0356   only a modest proportion of them came out as significant that there's
0357   some risk that that could have happened by chance and that to then move
0358   to the next step of the analysis assuming that they were significant
0359   introduced certain risks that you may have been interpreting
0360   them as significant when as a matter of fact they might have occurred
0361   by chance and that so you were moving on into the next step of the
0362   analysis with a finding which was itself suspect is that is that uh
0363 P: which may ((A: yuh)) which may have ((S: yuh)) been suspect it-
0364   it's it's a risk that I think should be discussed and addressed in
0365   some way in- in your dissertation and certainly if you write this up
0366   you'll want to do that now if you can point to a pattern if you can
0367   point to some reasons for believing that these differences are indeed
0368   real that you're not just picking up chance factors then I think that
0369   will strengthen the conclusions [(that you want to bring out)
0370 A: [yuh particularly for example if
0371   they were in that set of twenty-five they're clustered somehow ((P: um
0372   hum)) and three out of four of them were in one of these clusters
0373 P: well well they're pretty [different]
0374 A: [or or whatever] yuh I- ((L: well it)) I
0375   don't recall every table in there ((general laughter))
0376 L: well you know just as a matter of explanation
0377 P: yuh ((pause))
0378 L: the analysis of the three possible categorical variables class age
0379   and race I don't see has any relationship to the theoretical
0380   formulation that people who have these values will be radical now if
0381   those values were differentially distributed among age class and race

0382   say every twenty-five of those things came out significant it still
0383   would have no effect on whether these values produce radicalism what

0384   it would have an effect on is raising the question of why is it that
0385   women who are of x-age or x-class or x-race are the ones that have
0386   these values? but it would have no effect on an assessment of whether
0387   individuals with these these values have these radical attitudes ((S:
0388   hm)) and that I- that's why I didn't go ahead and do what you are
0389   suggesting because I don't think it is directly related to the test of
0390   the hypothesis it was an attempt to explore the possibility that and
0391   in part in preparation for the latter part of the dissertation that
0392   there may be some time factor or age factor or race factor in
0393   socialization and family factors which are producing these variables
0394   among these people
0395 P: hm well I don't pretend to to know a lot about these theories that
0396   you enlist and three theories that you decided that you were going to
0397   test and obviously you sampled those from a group of theories in fact
0398   they were representative of those but from your presentation of them I
0399   got the impression that the value constraint theory um says in effect
0400   that people who have certain characteristics are going to be radical
0401   and it doesn't say anything about whether or not they are of a
0402   particular sex or particular race so that if you find that- that
0403   variables such as race and sex do play a role do have an influence on
0404   the values people hold then this means the theory has to be revised
0405   that [the theory isn't adequate]
0406 L: [not really] because if- if the theory is saying people with
0407   these values have these attitudes then it doesn't make any difference
0408   in terms of the testing of the hypotheses why certain groups of people
0409   have those values the only thing that matters is the relationship
0410   between the- the presence of these values as characteristics of the
0411   individuals and the presence of these attitudes now I think in terms
0412   of the benefit of of expanding our knowledge and increase- increasing
0413   our precision of explanation I should be concerned with the question
0414   of do certain groups of people have these particular values ((S: hmm))
0415   ((P: mm hm)) but I don't see it having any confounding effect on the
0416   testing of the hypotheses
0417 P: hmm it's not a confounding effect it's a- an effect which would
0418   indicate that the theory as it stands either is or is not adequate
0419 L: not really because it would indicate that the theory as it stands
0420   which is simply these values are related to these attitudes if it is
0421   to have a uh complete logical deduction with explanation needs to
0422   explore where these values come from so that these particular groups
0423   of people have them but in but I I can't see any relationship between
0424   the power of of the theory to explain ((S: Lee what if)) and the
0425   question of of the distribution of of these [independent variables
0426 S: [what if what if the uh

0427   a particular uh set of values or particular uh uh standing on a a s- a
0428   set of value dimensions overlap completely with a particular racial

0429   category or a particular uh class category or what not now now
0430   admittedly that's an unlikely possibility ((L: mm hm)) but there is a-
0431   an an attitude to- to- to to declare their complete independence so to
0432   speak I suspect overstates the case ((L: well)) because at least in
0433   the extreme if for example uh uh uh high standing on uh value of
0434   independence uh those people who val- who were important vis-a-vis
0435   radicalism again I- I- I'm not that doesn't pretend to restate a
0436   finding it- it's it's uh selecting an illustration but if it were the
0437   case that high standing uh uh were related to radicalism and all uh
0438   all high standing on that value were white rather than black then it-
0439   then it's quite clear that uh you would have to have some uh means of
0440   separating the racial variable and the value variable before you could
0441   test the quote value theory and so it's not irrelevant it seems to me
0442 L: well do that with class and then I'll answer your question on race
0443 S: be my guest ((laughter))
0444 L: okay uhm ((pause))
0445 S: it's a logical point that's at [issue here]
0446 L: [no I'm trying] no I'm trying to
0447   think of the man's name he writes -- Blalock ((S: uh)) okay in
0448   Blalock's book on
0449 A: I'm glad you have a hard time thinking of his name ((laughter))
0450 L: I think ((A: (uninterpretable))) it it's his "causal" book but I
0451   wouldn't attest to it at the back of that book he coming at
0452   methodological thing but he particularly addresses himself to the
0453   question of treating race as a nominal variable ((S: should be))
0454   because race in essence he says stands for possible differential
0455   socialization experiences ((S: mm hm)) and that we cover the uh we
0456   block ourselves from further explanation of what kinds of experiences
0457   lead to what kinds of uh results when we use things like sex and race
0458   as our uh [controlling variables (   ) yuh now
0459 S: [or class for that matter an- any categorical variable I
0460   quite agree [as a social psychologist I have to]
0461 L: [if you know if it overlapped] ((S,J: laugh)) you know
0462   if it overlapped particularly with the racial group then what I think
0463   you would have is this category of people these things are related
0464   ((S: mm hm)) now taking Blalock's uh reasoning then I think what you
0465   have to ask what yourself is what kinds of socialization experiences
0466   among these kinds of people lead to this characteristic and then you
0467   would have to ask yourself are these socialization experiences
0468   uniquely found among the whites as opposed to among the blacks and I-
0469   see I'm not in any way saying that your questions aren't extremely
0470   relevant to the to a research program of trying to get at a greater
0471   explanation of the whole process but I can't see where it would be

0472   involved in the explicit testing of the hypothesis
0473 S: hm ((pause))

0474 P: okay let's move on because I've been concerned about the
0475   contribution of this to some of the conclusions that you draw in your
0476   last chapter and you mention ah there that you think that the value
0477   theory can be included in the cognitive perspective in- in a systems
0478   constraint theory uh but the reverse is not the case and that you you
0479   think this may be a pre-condition I wondered what your reaction would
0480   be to bringing them together in the following framework in which you
0481   would view values if indeed you found significant support for the- the
0482   value theory uh as pertaining or contributing in some fairly direct
0483   way to the establishment of radical attitudes but that it takes some
0484   kind of triggering mechanism to bring forth radical behavior ((L: uh))
0485   which may indeed be the encountering of of ((L: yes)) some kind of
0486   blockage or ((L: I think that tha)) recognition of of uh
0487 L: with the exception of the one value and that is self expression I
0488   you know I think that logically that could be a very very fruitful way
0489   of trying to organize it I know that part of my problem in trying to
0490   organize it...
0491 P: ...theory as you had defined it in terms of the variables
0492   you [had used]
0493 L: [that's right] I was trying to say that rather than in
0494   conceiving of a value as an internalized integral part of of the
0495   personality which takes on motivating power and that the individual
0496   person is not an actor relative to that value at all that to move it
0497   over into cognitive kind of framework where you have the individual
0498   perceiving and defining the situation that values within that context
0499   ((P: mm hm)) would play a different role but would still be very much
0500   a part of the process of developing radicalism I think your suggestion
0501   that that the role of values vis-a-vis radical attitudes and then a
0502   triggering mechanism which produces the behavior ah could be a very
0503   viable way ah I- I- I obviously did not develop it I ((P: mm hm))
0504   simply was suggesting that this ((P: yes okay)) is the direction of
0505   thinking that we should be moving
0506 P: mm, hm
0507 A: how would you ever find th- a triggering mechanism I mean that's an
0508   interesting notion and you know when I did that stuff on violence I was
0509   looking for what I called them precipitating incidents and fortunately
0510   there they were fairly easy to identify cause those were big events but
0511   wh- wh- what if you were to say that's like somebo- what you're saying
0512   is like there are people who are ready to become radicals
0513 S: from the first time they're told that they can't teach a class
0514   because they're [a woman? it uh
0515 P: [it's that may exactly ((A: okay)) that's a very good
0516   [example

0517 A: [but uh but how would you identify that I mean particularly ((P:
0518   ask a woman (laugh))) if you're into survey research ask a woman

0519 P: ask the person yuh well if you find behavior ((A: would people
0520   really know?)) that is identified
0521 S: oh sure I- I suspect they would well at at least the class of
0522   people who were sufficiently self conscious and analytic about
0523   themselves to engage in any aspect of this process would know yes
0524   [I-I
0525 A: [well yuh but but as just one of the things Lee doesn't have you
0526   know this is a primarily a in quotes middle-class group at least they
0527   got to College ((L: yuh)) but there- there must there be women out
0528   there as Jay Demerath calls it who've also had experiences and were in
0529   some way ready and became radical but I wonder if they'd be able to
0530   identify I mean isn't isn't there also the kind of thing like it's
0531   like grains of sand wearing away you know it would be very hard to say
0532   just which was the thing that really precipitated it you know that ya
0533   get crapped on for a long time and finally say no more ((P: mm hm))
0534   and that's that's ya know ya call that a triggering mechanism well
0535   that's a trigger that might last for fifteen years th- I mean I've
0536   known ((P: that's right)) you know Ph.D.'s who were lecturers for a
0537   long period of time and finally said no more
0538 L: yuh ((general laughter))
0539 A: well
0540 P: in terms of the background variables Lee would do you think it would be
0541   reasonable to uh consider them as contributing to the independence
0542   of the individual? you certainly look at lots of them and uh
0543 L: I uh I think the main thing that came out of the analys- the two
0544   main things that came out of the analysis of background variables and
0545   one I think I stated very explicitly in the dissertation and that is
0546   that uh- when in research people go in and take two or three family
0547   variables ah and find relationships and then attribute causation or
0548   im- imply causation coming from these particular practices without
0549   putting everything into a multivariate analysis in which you are
0550   controlling the interaction and the interplay of these variables uhm
0551   this is simply going to produce a proliferation of family factors that
0552   are producing end products ((P: mm hm)) and that we need to s- s- now
0553   I didn't put this in the dissertation I think we need to start
0554   thinking about categories of- of outcomes autonomy and independence
0555   dependence and possibly looking at the kinds of family socialization
0556   practices which move towards one or the other of these several
0557   categories and then the relationship of these categories now again I
0558   didn't think I could go into it in the dissertation but it seems to me
0559   that obviously the next line of research has got to be in terms of
0560   self concept and role identity ((S: bravo)) I- di- I think that's in
0561   there ((S: laughs, J: (uninterpretable))) and I think it's I didn't

0562   want to go the step of inferring it because I hadn't incorporated it
0563   in the design but to me there's a gaping hole there and that's the

0564   thing ((P: mm hm)) that we're going to have to get at and then ask
0565   what kinds of experiences ((P: (uninterpretable))) lead to what kinds
0566   of self definitions and what kinds of organization of self and how and
0567   then do these become the predictors of
0568 P: [mm hm
0569 S: [you might you might get your new vice president for development in
0570   graduate studies [to work with you
0571 L: [yuh you see that to me ((P: laughs)) was the ((S:
0572   Mel Seiler)) was the real hole ((P: oh)) that became ((J: is he moving
0573   up there now?)) visible in this thing and you see because I had
0574   designed ((S: I talked to him last week)) it with on the basis of
0575   studies that had been done and findings that had been done and I was I
0576   was directed by my interest in saying okay everyone's claiming all
0577   these things or doing these things now which of them seem to be the
0578   more critical variables ((P: mm hm)) and I had not thought of
0579   introducing self concept at that point in time
0580 P: well there's been some very interesting work ((L: yuh)) yours
0581   included of course and looking at family interactions and their
0582   contribution to radical attitudes radical behavior
0583 L: and if you'll notice I did slip away from the variables a little
0584   bit in chapter six and chapter seven in which I started talking about
0585   a sense of autonomy ((P: mm hm)) and a sense of independence from them
0586 S: thank god you didn't think about it Lee we'd have four hundred more
0587   pages ((general laughter))
0588 P: that's right ((through laughter)) ((pause)) a few other little
0589   things we can talk about sometime ((laugh))
0590 A: well ((P: yuh)) we can come back to em Sherm do you wanna
0591 S: yuh uh yeah let me pick up uh briefly uh on a sort of a- a- a prior
0592   question to the one uh Pat was raising I- the in the preface er the
0593   prefacing uh set of assertions in the- in the concluding chapter
0594   chapter seven the uh uh your language is- is something that says
0595   cognitive theories and value theories are competing theories of
0596   motivation or you call them competing uh uh competing in what sense do
0597   you see them as logically competing with one another? do you see them
0598   simply as having buil- be- been built in uh to differing explanations
0599   uh and so are available and people so to speak take their choice
0600   [uh
0601 L: [I see them as competing in the sense of a basic issue in role
0602   theory uh whether the Lin- Linton-Parsons concept of role the passive
0603   reactor to expectations uh the roles are abstracted from individuals
0604   but in essence the individuals are left out of that ((S: mm hm))
0605   theory which is it ((S: and and that would)) fits in to Parson's
0606   larger framework of the integration of society through the

0607   internalization of values ((S: okay)) an- and the cognitive or the
0608   Gurin theory really is coming out of the symbolic interaction general

0609   framework or the ((S: mm hm)) conflict theory kind of general
0610   framework in which the individual's a participant uh not ((S:
0611   (uninterpretable))) totally free but a participant in and reacting to
0612   in defining situations and it's it's that uh separation that I feel
0613   makes them competing
0614 S: I see but but that also suggests the possibility of an integration
0615   [(uninterpretable)
0616 L: [if values are not conceived of as internalized parts of a
0617   personality system but are dealt with as a variable within human uh
0618   behavior in which the individual is using these values in some manner
0619   ((S: mm hm)) either as a standard or as a part of a self concept I
0620   mean I'm not suggesting the manner in which they are using them but I
0621   felt that values had to be put into the concept of the individual as
0622   an acting in actor rather than within the concept of the integrated
0623   internalized passive reactor ((S: uhm)) formulation now once you move
0624   them they are no longer competing
0625 S: okay okay
0626 A: Well Sh- Sherm ((S: mm)) just out of curiousity th- que- one of the
0627   questions I've got on the back of my mind is that thing that disturbs
0628   you so much social psychology versus social organization ((P and S:
0629   (subdued laughter))) is that do you have that partly in mind when you
0630   asked ((S: no)) in what sense competing
0631 S: uh no I- I- uh not really although given uh uh Lee's response ((A
0632   and P: (subdued laughter))) it gets built back into uh uh the question
0633   I was asking no I simply struck by the the- uh notion of a set of
0634   theories uh uh the possibility that what was intended uh in that
0635   assertion is that uh these theories are in essence contradictions to
0636   one another that uh that uh if one is true the other must necessarily
0637   not be true [uh
0638 L: [I think as the theories are formulated in terms of their
0639   basic assumptions ((S: mm hm)) this is there but this does not mean that
0640   values ((S: okay)) conceptualized in a different manner can't very much
0641   be a part of ((S: mm hm)) yuh and so I I really was not addresssing
0642   myself to the role of values ((S: yuh)) as much as I was addressing
0643   myself to the competition between the original assumptions
0644 S: the underlying the [underlying structures within which these these
0645 L: [underlying assumptions
0646 S: concepts ((L: that's right)) play their ((L: yuh)) part okay mm no but
0647 P: it would indeed seem strange if any kind of cognitive theory
0648   wouldn't encompass value in at least ((S: yes yuh)) the broader sense
0649 L: yuh I had hoped to make that clear with my uh a- approaching the
0650   selection of the theories through an analysis of motivation theory
0651   because I think it's in their motivational assumptions that the basic

0652   uh com- competing ((S: mm)) position is to be found ((pause))
0653 S: I've got a couple of uh particulars uh you go you read this and

0654   I've read it all at one point or another ((general laughter))
0655 J: awake or asleep?
0656 S: uh no no awake sometimes it's hard to uh see uh the forest for the
0657   trees and it turns out there are a couple of trees that are
0658   particularly interesting for one reason or another to me uh one is the
0659   uh the anomaly in your finding on differential radicalness by uh
0660   levels of education it's strange that uh juniors uh be uh
0661   comparatively radical it's strange in a sense or at least it seems to
0662   me to call for some uh thinking attempted explanation that Ph.D.
0663   students be unradical uh the the uh set of anomalies a lack of any uh
0664   uh continuous process through the age dimension uh I find interesting
0665   uh tell me about it
0666 L: I- I can address myself to the Ph.D. student I think somewhat
0667   cogently I- anything on the junior would just have to be a shot in the
0668   dark ((S: mm hm)) but I think with a Ph.D. women
0669 S: wi- le- let me get do you think it might well be a random perturbation?
0670 L: no I think there's probably a systematic ah phenomena with the
0671   Ph.D. women the junior women may well be random I'm not sure but with
0672   the Ph.D. women uh they are basically have been accepted into and were
0673   performing very successfully and given all of the restrictions women
0674   experience they basically knew they were having it made I mean they
0675   were going to be able to get into college teaching or which were most
0676   of them wanted to go they had been accepted into graduate school they
0677   had overcome the hurdles ((S: okay)) and uh were not concerned about
0678   changing the structure or altering uhm role definitions because they
0679   had in essence defined for themselves whether they were or not going
0680   to get married every Ph.D. woman that was mar- I had them married and
0681   not married the unmarried Ph.D. women weren't planning to marry the
0682   married women presumably have worked out whatever role uh conflict
0683   they might have had with their husbands and family and were in school
0684   now I just really think that they were not subject to in their own
0685   lives the experiences that might quote trigger ((truncated laugh)) now
0686   [I can address one
0687 P: [been interesting if you'd a gone on
0688 L: what?
0689 P: I said it'd be been interesting if you'd gone on if you had ((S:
0690   with uh)) included ((L: yuh)) in your sample some of the first second
0691   year faculty women I suspect they've had triggering mechanisms
0692   ((laughter))
0693 A: not here [not here ((through laughter))
0694 L: [if you'll notice th- that the one condition under which I
0695   found uh the young Ph.D. there was one woman who was twenty-two was a
0696   Ph.D. student and she she came out being terribly radical uh within

0697   the Ph.D. group but now I can't address myself to the question of their
0698   background except that most of your older women were at the Ph.D. level

0699   and if mother's occupational mobility is contributing anything to this
0700   the one's that are over thirty by and large their mothers had a
0701   different experience in that they started doing things before World War
0702   II whereas the younger women's mothers started doing things after World
0703   War II and I'm just speculating here ((S: hm)) that some of the mother's
0704   experiences might have been different as to the junior women
0705 S: well what about something
0706 A: Sherm ((S: uh yuh)) about the junior women do you remember Jim
0707   Monroe did you ever look at his dissertation?
0708 S: Monroe?
0709 A: Monroe in social science
0710 S: no no
0711 A: he did a study of uh West Point and what he found was a uh uh very
0712   interesting distribution of certain kinds of attitudes and that was
0713   that the freshmen were gung-ho and became more cynical in the middle
0714   years and then the seniors were gung-ho and his interpretation and
0715   that's of course all it could be was that they came in pre- socialized
0716   or they wouldn't have gone there in the first place then they found
0717   out it wasn't what they expected and then they found out well I'm
0718   going to go in the army and I'- you know it was kind of dissonance
0719   ((S: mm hm mm hm)) reduction might be involved in it and I- I don't
0720   find this a- a- an absolutely implausible interpretation for some of
0721   the kinds of variations you've got over the undergraduate years
0722 L: this is true particularly for women in a time when there is some
0723   public definition of women's roles being different having to make
0724   decisions about after the senior year having to make decisions about
0725   marriage I'm sure that junior women are similar to the men who are
0726   saying well I'm going to be going into the army a year from now I'm
0727   going to be facing something they they could be [but
0728 S: [mm but then why
0729   why the recovery by seniors from that ((L: I have no idea)) point of
0730   view uh one might add to that general line of explanation uh yuh
0731   freshmen stu- fre- freshmen freshwomen ((laughs))
0732   [come in first year-
0733 P: [first year students
0734 S: hm?
0735 A: first year students ((laughing))
0736 S: fresh- persons first year students ((through laughter)) well I I
0737   don't know whether it's true for males or not we're we're dealing with
0738   ((P: yuh)) an all female uh uh population ((P: right)) here
0739 P: female first-year students ((through laughter))
0740 S: come in relatively naive vis-a-vis these things uh the first couple
0741   of years first year uh first two years may be a process of gradually

0742   uh learning about the uh the uh the restrictions uh being told they
0743   exist being told the the nature of the barriers becoming aware uh we-

0744   well I'm not with the seniors at a- a a is it possible that the
0745   seniors learn that that uh changes are being made in the world or that
0746   that there is possibilities of recovering uh recouping I ((J: or
0747   maybe)) there must be some kind of anticipatory entry into the world
0748   at large phenomenon uh
0749 L: for the seniors
0750 S: for the seniors [yuh
0751 J: [but that's it they have they have to scale down
0752   their radicalism if they're going to make it out there
0753 S: uh well the al- the alternative is to say I'm going out there and
0754   by god I'm going to beat it down uh
0755 J: that's not realistic though they're more likely to think I've got
0756   to come in terms with it's just like in the Rossi study when these
0757   women were in college they were very radical when they got out ten
0758   fifteen years years later they were indistinguishable from women who
0759   were very traditional in college i- it was it was the realities of the
0760   marketplace quote unquote that made them
0761 S: mm
0762 L: the response to the reality [of the situation
0763 J: [response to the realities right of the
0764   pressures
0765 L: cert- one of the things that the seniors were interviewed in from
0766   the end of July until about the first middle of October so I was not
0767   getting a spring I- uh I me- I mean then my question comes would you
0768   find more of a difference among seniors if you did it when they were
0769   getting closer to graduation?
0770 S: yuh
0771 P: mm hm
0772 L: uh see I literally got them when they had only been seniors for a
0773   very short ((S: yuh)) period of time
0774 A: but y- you know Sherm there's one thing there is th- I don't think
0775   you can assume as a matter of fact about the cohort that Lee looked at
0776   that all those first-year women were all that naive because some of
0777   these kinds of concerns weren't they in the high schools
0778 L: oh yes
0779 A: in the late 60's an-
0780 S: in the late 60's? uh
0781 A: and even in the 70's I mean I think th- as a matter of fact there
0782   was a period maybe some kind of a lag when after things had simmered
0783   down somewhat on college campuses where there was still a great deal
0784   of concern about some of these things in in in high ((S: yuh)) school
0785 P: uh there's been a lot in the press ((A: yuh)) since about seventy
0786   particularly since seventy-two

0787 L: ya know this phenomena of the doctoral woman is in part if you'll
0788   talk to people who are in in now or working in the woman's movements

0789   is at least I have heard that they bemoan the fact that the
0790   established professional woman in many instances will not be active
0791   will not uh take risky behavior in trying to do anything what they are
0792   willing to do is in their classes huh to present to the students
0793   information about the issues and ah to one extent it comes from an
0794   unwillingness to rock the boat because I personally have the security
0795   of having made it I don't know ((pause))
0796 A: well there's some women who never didn't know they had a problem like
0797   Clara ((S: yuh)) Lakin who you know who didn't discover until she was
0798   seventy years old that she ((laughter)) was you know reamed over all
0799   [that time
0800 P: [and then she discovered it with a vengeance ((through laughter))
0801 J: ((laughter)) made up for it since
0802 A: yuh yuh
0803 S: no Clara's uh judging from Clara's personal experience uh was not
0804   that she was done in but 'n' that her later work is really a a
0805   function of her empathy with others who [had problems
0806 A: [yuh but] now she you know
0807   I read something that that she had done not terribly long ago a letter
0808   to the editor or something somewhere in which she said y'know I'm
0809   beginning to be persuaded by this and maybe there were things I didn't
0810   recognize ((S: yuh)) you know that a-
0811 S: and there might be some reconstruction of history in the process too
0812 A: yuh [I'm sure]
0813 S: [there's] another finding that I uh that a- that's well it's uh
0814   it's anomalous and then you point out as such that's the the finding
0815   in the in- in in dealing with the instrument uh uh activities uh uh
0816   ranked uh in terms of the amount of risk involved that a that a th-
0817   business of marching in strikes and so on are are are out of line for
0818   these women they- if if you order these activities on risk there's not
0819   a neat progression and my question is simply if you have any idea of
0820   what might account for that finding assuming it's not a random
0821 L: that they're out of line for the different?
0822 S: yuh [yuh]
0823 L: [uh] the only explanation I could offer is that there might be
0824   a correlation between the legitimation of the issue vis-a-vis the
0825   broader society's response to it and the kinds of activities they're
0826   willing to engage in the more legitimate the issue appears to be
0827   although it may not be a- a majority legitimation ((S: mm)) but a
0828   large minority is legitimating it the more risky or the more uh
0829   visible the more lawbreaking activity because we found that on the
0830   Viet Nam and the race issue which I think the society basically has
0831   legitimated more than the women's issue ((S: mm)) ah they're just more

0832 willing to participate that's the only approach that I could think of
0833 that might offer some kind of logical explanation for it

0834 S: [hm uh I I- think the partic- mm]
0835 P: [it'd be interesting to know] wh- what triggered the violent
0836 behavior on the part of English women the Suffragettes in England who
0837 were very violent in contrast of course to American
0838 [women who you've been listening to]
0839 L: [I had not a great many] but I had some women that in anticipated
0840 behavior measure indicated they would participate in violence over the
0841 women's issue
0842 A: was it clear what was meant by violence I mean it's one thing ((P;
0843 mm hm)) somebody would ((L: I said it would)) say you'd chain yourself
0844 to the- the [House of Commons they would] call that violence
0845   P: [the fence post yes (laughs)]
0846 but there's another thing to go out an- y'know pick up a- a lathi ((S:
0847 mm)) and- and smash somebody over the head
0848 P: [they did that too ((laugh, A joins in laughter))
0849 S: [my notes uh my notes] are sketchy here but I- I- I think the point
0850 that I was originally interested in uh at any rate is slightly
0851 different my notes read and I quote as follows maybe you can
0852 reconstruct the context out of which this note is written ((P, A:
0853 laugh)) because at the moment I can't finding on lower r's for joining
0854 organizations in marching strikes etcetera i.e., out of place in term
0855 of presumption of amount of risk involved any guess as to why I don't
0856 remember at the moment precisely uh what the [the- the
0857 L: [wha- what it may be
0858 is that in Guttman scaling of behaviors they actually have behaved in
0859 on the Guttman scaling of ((S: yuh)) behaviors that they anticipate
0860 S: there is a lower ranking
0861 L: they got they got the order on the have ((S: yuh)) is quite
0862 different than the order on the anticipate logically the order on the
0863 anticipate represents increasing risk ((S: mm hm)) and I would presume
0864 that availability of opportunity and the form of uh confrontation that
0865 the particular issues have used has something to do with the the rank
0866 ordering on the uh
0867 S: on the
0868 L: yuh
0869 S: have engaged [in]
0870 L: [that] they have participated in uh an- i- it- it uh
0871 comes down to ease it's much easier ((laugh)) to be in a in a rally in
0872 the meadow about the Viet Nam War than going over and joining an
0873 organization an- uh
0874 S: mm
0875 P: going out and participating actively
0876 L: I think it's a pretty mundane type of explanation but I'm sure it

0877   has something to do with it
0878 A: yuh as Pat says there there are hundreds of members of the AAUP but

0879   uh only fifteen know me ((spoken through laughter))
0880 P: right ((laughs))
0881 S: ther- there's uh to shift gears a little bit uh your earlier
0882   comment drawn from uh Blalock on the uh potential depth to a uh
0883   structural concept like race uh the argument that it should be
0884   interpreted as a socialization variable uh race is a-a a question uh
0885   uh that I think can be raised on a large number of points in your in
0886   your dissertation and the discussion the particular form that I've
0887   raised my que- raise the question out of my reading has to do with uh
0888   uh a variable like upper-middle class family that you draw uh draw on
0889   in chapter three you you take uh Flack's work a- an- from Flack's work
0890   you see it as a socialization into values variable that's the way
0891   that's the interpretation you give it uh it's also however it seems to
0892   me an opportunity variable upper middle-class family represents a an
0893   amount of resources available to engage in given a- activities and in
0894   that sense it's an opportunity variable and at that point I- the
0895   obvious question becomes uh y'know what justifies the interpretation
0896   of it as a socialization variable as opposed to an oppor- opportunity
0897   variable uh is it one is it the other is it both is it something else
0898   uh the y'know there's no- there's no inherent connection between in
0899   your earlier- earlier instance race and socialization uh or in this
0900   case a class position and socialization uh no necessary reason for
0901   interpreting it as socialization as opposed to opportunity or as
0902   opposed to ((L: uh)) something else
0903 L: uh I understand the question ((S: mm hm)) I- I'm somewhat confused
0904   on the finding because uh occupation education income
0905 S: I- I don't think I'm really raising a question about the finding
0906   ((L: oh oh okay)) I'm simply raising the question about the the
0907   process by which one gives meaning to a categorical var- variable ((L:
0908   well)) in this case again the assignment of a socialization meaning to
0909   a class [variable
0910 L: [I- I- I was I think I was directed permitted myself to be
0911   directed by Flack's interpretation ((S: mm hm)) of it ((S: mm hm)) and
0912   uh in essence what he was doing is uh because he had taken the
0913   Linton-Parsons modeled role he was restricted to identifying a
0914   subculture which uniquely produced these values configure- this value
0915   configuration and I I was attempting to address the question of is it
0916   unique to a a particular group the upper class in this instance uh-
0917   now I didn't introduce opportunity primarily because I was being
0918   directed in my focus by Flack's assumption
0919 S: yuh but now [if if we go beyond that point]
0920 L: [but I y'know I think your] question was not answered
0921   by my work ((pause))

0922 S: I think uh I-I suppose my more general point is uh that uh uh given
0923   this set of indicators and given the set of findings uh uh one has to

0924   guard against the possibility of the interpretation of the findings
0925   based on these indicators uh an interpretation of the findings that's
0926   premised on only one of a possible large set of meanings attachable to
0927   the indicators so in effect what you ought to do at some point is to
0928   raise the question what alternative interpretation could be given to
0929   the in- indicators and therefore what alternative uh uh theoretical
0930   conclusions might I uh might uh might be might be reached uh you run
0931   into these problems all the time when we use uh when we use uh
0932   surrogate variables of one sort or another in in class as- as- as a
0933   surrogate for uh for socialization as in the uh the occupational
0934   studies the Duncan stuff SES that stands for background variables and
0935   that's socialization now that's one way of interpreting it uh but
0936   there are certainly other ways systems constraint variables ((spoken
0937   through laughter, P joins in laughter)) [to make a point
0938 A: [uh uh I was thinking of
0939   like why people who say take reports of behavior as behavior
0940 S: that's right [((laughs))
0941 P: [((laughs))
0942 L: I- I didn't pursue that line since those particular variables were
0943   not found to be ((S: no no no no)) important but I understand what
0944   you're saying an- an- I think it uh i- i- i- inherent in my occasional
0945   argument that we need to be concerned with in-class differences and
0946   between class similarities ((S: mm hm)) uh is that very thing although
0947   I didn't elaborate on it uhm ((pause))
0948 S: then is it the uh I have a question and again it's abstracted from
0949   reading something and maybe and I'm not I'm not sure it makes sense
0950   without you supplying the context for it but uh again my notes read uh
0951   what's the relationship between system blame variables and ver- value
0952   variables do they overlap substantially? rather are the proportions of
0953   variance these explain uh independent proportions of the variance and
0954   obviously i- it must have seemed to me that the that the uh that what
0955   you were calling system blame variables had a fair amount in common
0956   with [(uninterpretable)
0957 L: [I didn't directly uh I think maybe there's one sentence in
0958   there ((S: mm hm)) which says something on that I did put the uh in
0959   the appendix the inter-correlations
0960 S: how high were they do you remember?
0961 J: ...two uh general kinds of things um one goes back to something
0962   that Pat was talking about before uhm and that is when you talked
0963   about these uh values theories what you call value theory and systems
0964   constraint and relative deprivation and apparently you were trying to
0965   escape from uhm y'know the traditional functionalist mode of getting
0966   at these things uhm why it is you never uh chose some contemporary

0967   notions such as social exchange or or power or y'know the use of
0968   resources y'know the the mechanisms you were talking about before the

0969   triggering mechanism for example may be you know uh ah a variable such
0970   as y'know being cut off from rewards which in your case it was y'know
0971   why you didn't intr- introduce those notions because presumably you
0972   know in- in in Homans especially but also in Blau there is the very
0973   point you were making namely functionalism and Gouldner functionalism
0974   has y'know no- not taken us not far enough exchange can take us further
0975   resource theory uh was there any particular reason y'know you didn't
0976   bring that into your either your conceptualization or your analysis?
0977 L: I- it wasn't brought into the initial framing of the uh research
0978   problem because I was trying to restrict myself to existing specific
0979   formulations and I that had been empirically tested on some population
0980   because I was interested in comparing results on different populations
0981   and I frankly know of no uh middle range or minor range theory of
0982   radicalism which has been explicitly formulated out of exchange theory
0983   uh now I then did not incorporate in an interpretation when I went
0984   beyond the testing of the theories into the socialization ((cough))
0985   because I I was dealing with primarily a population ((clears throat))
0986   in which the exchange would had to have occurred between the
0987   individual and the members of the family or the individual and the
0988   school I mean this had be- this was the common uh previous experience
0989   that everyone although I had numbers that had additional kinds of
0990   experiences and I wasn't rejecting the exchange theory interpretation
0991   in- in any way and I think one could come in and utilize it but I was
0992   trying to restrict myself to the demands of regression analysis in
0993   that I stayed with the particular variables which were measured which
0994   are were basically set up as conceptually distinct and not moving too
0995   far away from the variables now the particular variables measured were
0996   not measuring relationships between the individual and other people
0997   with the exception of the characteristic of a relationship in-in terms
0998   of conflict and since I was not measuring actual interaction between
0999   the respondent and some designated other I didn't think that exchange
1000   theory could be brought in at that point for an interpretation ((J:
1001   although uh)) I was getting recall data really of end-states which is
1002   an undesirable way of of measuring consequences of interaction but I
1003   was restricted to that kind of data
1004 J: but in your interpretation though you talk about the uh part- the
1005   children participa- when they were kids when they were youngsters they
1006   participated in processes of decision making and so on to make them
1007   more or less autonomous you know the act of going to your parent and
1008   asking for advice or not is essentially tapping their resources so in
1009   effect you were bordering y'know you did draw on some of the notions
1010   that tho- that that kind of a theory
1011 L: uh d- certainly I- I was influenced by that kind of a theory but I-

1012   I didn't feel that the uh what I refer to as a static in other words a
1013   description of yes I did or no I didn't ((laugh)) go for advice or yes

1014   I did or no I didn't participate in family decisions provided me with
1015   enough information to make any inferences about the characteristic of
1016   the relationship in the decision-making process or in the advice-seeking
1017   process I mean I felt that I was using questionable data using recall
1018   data anyway and I had to stay as close as possible to the description
1019   of the behavior as opposed to the characteristics of the relationship
1020 J: well if you were going to do it again y'know I said you indicated
1021   before you were going to introduce certain notions of self concept and
1022   so on would you try to get at some of these processes?
1023 L: what I think I would prefer to do is take bits and pieces of this
1024   thing and break it down into separate research ((J: mm hm)) projects
1025   for example one area that I'm very interested in researching is this
1026   whole notion of role taking which I was inferring from uh a described
1027   behavior and I would see this as requiring a population of younger
1028   people in where I would get data from the parents and about the family
1029   as as the thing is happening and I think examining the interchange or
1030   the exchange within the relationship would be a critical dimension of
1031   the data very much so
1032 A: now I'm just sitting here wondering James how would you uh I mean I
1033   could see where power as a as a variable could be important in this
1034   kind of thing but how somebody might articulate the notion the notions
1035   of exchange theory into testable hypotheses about how people come to
1036   be radicalized now it could be done ((clears throat)) but there's
1037   certainly nothing in any of the literature that I've looked at in
1038   exchange theory I mean it's just like saying well probably attribution
1039   theory or any one of a variety of things y'know since they purport to
1040   explain social behavior could in some way be bent but did you have
1041   something specific in mind for example about how exchange theory about
1042   how you might ask a question about that? ((J: well)) and becoming
1043   becoming militant
1044 J: uh yuh to some extent as I as I read read the ah especially the
1045   last part where y'know you did talk about the child growing up in in
1046   the home uhm implicit in that discussion y'know reading between the
1047   lines so to speak th- y'know one could one could ah pick out uh
1048   certain things that were going on between parents and children like
1049   the great stress that Lee places on uhm the as I said before the
1050   development of autonomy and the literature she cites where where that
1051   is y'know been described to some extent so it seems to me that what's
1052   happening is that children are providing resources not just economic
1053   of the kind Sherm indicated before but also other kinds of resources
1054   and ah somehow as a process there of children picking and choosing and
1055   negotiating or refusing to negotiate uh defining significant others
1056   with whom they develop exchanges and ah it seems to me that might be a

1057   fruitful way to ah to get at this triggering mechanism you were
1058   talking about before because a network of of exchanges is built up

1059   over time which uh leaves 'em to decide y'know what in other words
1060   rather than the concept of values I guess is really how we got on this
1061   to say that there are certain resources or interests which these
1062   people want and prefer and it's really that that they're moving toward
1063   y'know wha- so so what led them uhm to decide those were the interests
1064   that they wanted why couldn't they get them in traditional kinds of
1065   exchanges and why did they think they can get them in other situation
1066   and then if the exchange if if in a nonviolent exchange or an ordinary
1067   kind of exchange they can obtain that then that might lead them to uh
1068   y'know to define new rules of exchange to assert power to try and get
1069   them through non-legitimate quote nonlegitimate means
1070 L: yuh I just felt that it required a different research setting than
1071   my particular population provided ((J: mm hm)) uh to get at these
1072   kinds of things in terms of things that they were experiencing for
1073   some of them twenty years before and for ((J: yuh)) others one year
1074   before ((J: yuh)) but I just y'know it it y-you I thought you're
1075   treading on treacherous ground when you use recall data back to high
1076   school uh of factual kinds [of descriptive information and
1077 J: [sure I agree I agree that's] why I
1078   asked you if you were doing it again 'n' it would have been
1079 L: I ((J: yuh)) wouldn't I think I- as I said I would prefer to break
1080   it down into some smaller kinds of more focused research in which
1081   pieces of this process which I was guessing at to some extent or
1082   inferring from data were analyzed in the proper research setting
1083   ((pause))
1084 J: well that leads me onto my second kind of question if I may uhm
1085   y'know the N here is very very small and Pat has suggested some of the
1086   statistical problems which we don't need to repeat but it
1087 A: you don't mean the N of tables?
1088 J: no no ((laughs, joined briefly by S))
1089 P: you- you mean the- the N of black respondents?
1090 J: no no the- the
1091 S: the overall N
1092 P: the overall N? it's it's [not so small ((laughs))] come on
1093   ((laughs))
1094 A: [it depends on your field he deals with
1095 S: [small by ((pause)) large by psychologists
1096   st- standards of research in psychology
1097 P: three [hundred that's a very uh ((laugh)) sizable N ((laughs))
1098 J: [well to the level of generalization though that] she see
1099   y'know implies that y'know this we're you know we're talking about
1100   college student and to generalize from that y'know it s-seemed to me
1101   rather uh rath- dif- ra- tentative and I just wonder uh y'know if if

1102   uh if I were going to in terms of of both theory and policy if I were
1103   going to uh develop a theory of the development of pol- political

1104   radicalism among uh adolescents or young women or if I were going to
1105   be a policy maker and organize curriculum to develop y'know radicalism
1106   could you really convince [me ((pause)) ((laughs))
1107 S: [to develop or inhibit radicalism
1108   [which is it? ((laughs))]
1109 J: [well creativity ((laughs))] uh could you really convince me uh how-
1110   how would you go about convincing me that you really had got stuff
1111   that would really ah y'know make me act on the basis of your findings?
1112 L: first I'd try to ascertain what kind of criteria you use for
1113   convincing ((S and A: laugh))
1114 J: I- I mean if I spend uh a hundred thousand dollars to revise the
1115   curriculum in my in my uh high school or my y'know community school
1116   corporation
1117 S: I don't think that's Lee's ((J: laughs)) question James
1118   [Lee's question is what] ((spoken through laughter))
1119 A: [she wants to know] what do you need to have in order to have it
1120   demonstrated to you what is your criteria [for proof or conviction]
1121 J: [okay well I mean] what
1122   are the scientific criteria that uh really lead you to to argue for
1123   the validity of what you're saying cause y- you do wax rather eloquently
1124   in that last chapter about children growing up in these kinds of homes
1125   will do this be that and be the other way and it's there where you
1126   bring y'know the forest into view but then one goes back an- goes
1127   back and looks looks at the trees one isn't sure that you can be quite
1128   so y'know general and and all encompassing in your conclusions
1129 L: uh the scientific criteria would almost have to restrict you either
1130   to the sample or to the immediate population from which it was drawn I
1131   did not attempt to present or even do the statistical analysis of the
1132   ah inference to the population I don't think you can go beyond the
1133   population I- I would think that the the framework in which some
1134   convincing might take place would be the consistency of findings
1135   across a number of different studies using a number of different
1136   groups I don't think it's to be found in this study alone by itself
1137   but y'know if- if you look at some of the stuff by Haan, Block and
1138   Smith on cognitive development and some of the work by Kohlberg on
1139   cognitive development some of the descriptions of the studies
1140   descriptive studies of the students at Berkeley and some of the work
1141   on the blacks in Watts Detroit Newark by Kaplan and Paige and then add
1142   this study to it you find a consistency all the way through here in
1143   terms of the description of a sense of autonomy uh sense of
1144   independence uh self expression uh intellectualism as a value as
1145   opposed to uh pursuing grades in order to make it in the occupational
1146   I think that's the only basis on which a practitioner can gain any

1147   confidence in the probability that these variables are related to
1148   these kinds of behavior this simply is saying it holds for women too

1149   but that's all it's saying
1150 A: well- no I think there's an implicit claim beyond that Lee I think
1151   that like Lee is saying in some sense that if you're not convinced by
1152   this with a sample of three hundred how is it that people who were
1153   convinced earlier by studies by Flacks and similar people with samples
1154   that weren't even probability samples and were purposive samples and
1155   where y'know quite sweeping generalizations were being made so I- I
1156   don't think
1157 S: I like ((A: yuh)) Lee's defense better Adam ((J,P,S: laughter))
1158 A: well I- I- I think in terms of some of the kinds of criteria that
1159   y- you- that you have in mind that Lee's is more persuasive to me
1160   although I don't necessarily agree with all of the conclusions than
1161   some of those impressionistic kinds of things an' an- and some of the
1162   things on which the theories that she's pro- purporting the test were
1163   were originally based I guess that's all I have to say but I hell I
1164   don't know James if I tried to persuade you to y'know accept me I use
1165   a sample of one sitting up there in my office ((laughs, joined by P
1166   and J)) just me and my crystal ball, you know ((pause))
1167 J: I want also ask Lee how how she uh moved so far in working for Zeb
1168   Williams and being that kind of social organizationist to the kind of
1169   social psychologist you are today
1170 S: seen the truth ((laughs, joined by J))
1171 L: I took a seminar ((J: from Sherzer?)) in symbolic interaction
1172 J: I see ((through laughter))
1173 S: that was a good class that time a lot of good people in that class
1174 L: which really intrigued me
1175 J: uh huh
1176 S: I'd [the uh
1177 P: [see it was a critical incident ((general laughter))
1178 J: it was a critical incident ((pause))
1179 S: someday we'll get over the notion that these are opposing views
1180   [and that they're
1181 L: [I see don't see them as ((J: yuh I'm being (uninterpretable)))
1182   opposing and that's why I took my speciality in stratification
1183   (uninterpretable)
1184 S: mm
1185 J: I don't see what the (uninterpretable)
1186 L: I think they're intimately related and interact and effect each
1187   other which doesn't mean they can't be uh studied in s- isolation but
1188   uh- I obviously am more interested in the connecting links huh- than I
1189   am in studying them in isolation
1190 J: mm
1191 A: no I think that it's quite clear that social psychological

1192   variables will probably explain that remaining ten or twelve percent
1193   of the variance left ((J: laughs)) after the structural variables well

1194   James do you have other questions?
1195 J: no that's it
1196 A: Sherm?
1197 S: no no (uninterpretable)
1198 A: Pat? ((pause))
1199 P: well yuh I was little bothered by a statement you make in Chapter
1200   Six I copied only part of it here and let me see if I can find the
1201   rest because I think it really runs down all of the mother's instinct
1202   of the women you've contacted you say
1203 A: [((laughs))
1204 L: [((laughs))
1205 S: I'm curious go ahead ((laugh))
1206 L: what [page are we on?
1207 J: [what page is that?
1208 P: I'm on page ((S: four thirty)) four thirty middle of the page
1209   middle of the uh well ah middle of the first full paragraph
1210 L: four thirty
1211 A: four thirty
1212 P: uh huh
1213 L: I went to five thirty
1214 P: where you talk about firstly it is assumed that the mother does not
1215   have an independent effect find that ((pause))
1216 S: hm
1217 L: okay
1218 P: on the processes within the family but that she is accounting for
1219   the influence flowing from the father's level of educational
1220   attainment and occupational status consequently there is a consistency
1221   in the values orientations and practices of the two parents wow I
1222   thought how do you get there ((laugh))
1223 L: well uh
1224 P: number one how uh- what's behind your first statement and then how
1225   do you get from that to the fact that there is uh this consistency?
1226 L: uh many but not all of the studies that have looked at children's
1227   aspirations and achievement motivation achievement actual achievement
1228   in schools disciplinary practices these kinds of things categorize the
1229   family by the father's education and occupation and they end up with a
1230   three or two class division of families they then examine disciplinary
1231   techniques or various social psychological factors of the family and
1232   they assert that people who are blue collar do this and people who are
1233   white collar do that and it's implied in the assertion because of the
1234   methodology for classification that both of them do it
1235 P: and you're just accepting that then? ((pause))
1236 L: and they often do not ask the mother they simply ask the father

1237 A: I don't think you've heard Lee's 'er Lee I don't think you heard
1238   Pat's question said are you just accepting what all those people have

1239   have asserted?
1240 L: no I'm rejecting it and saying the mother should be identified as
1241   an individual and her own occupation and educational experiences
1242   should be examined as well as the father's and not to classify the fa-
1243   the family by the father's uh social class characteristics
1244 P: okay yuh that wasn't entirely clear as a matter of fact this is
1245   incompatible with some of the things that you say in your last chapter
1246   in [which you say earlier where you- you had focused um-]
1247 L: [yuh I was in essence rejecting uh-] the methodological tradition
1248   which prevails but doesn't completely dominate the literature
1249 P: uh huh
1250 J: do you have any suggestions Lee for how you would modify that uh uh
1251   procedure as methodologically or theoretically? ((pause))
1252 L: I think that we simply have got to stop uh classifying families by
1253   the father's education and occupation when we're interested in
1254   internal functionings of the family
1255 J: so how would you uh what would you substitute? [uh]
1256 L: [I would] I would
1257   simply if you want to use stratification variables I would take those
1258   of the father and those of the mother as two independent social actors
1259   and look at their relationship to the particular factors which you're
1260   uh examining and as I indicated at one point it would seem to me that
1261   uh that it- it's tricky statistically and I didn't do it and I think
1262   it's one of the it's a varied limitation and that is the comparison
1263   between them occupational status comparisons educational status ((S:
1264   between husband and wife)) the degree of inconsistency now when I ran
1265   the regressions I did not follow the Burke-Jackson argument in the
1266   sixty-five ASR I did not control for the status of the occupation and
1267   the effect of the education in the regression with which included the
1268   inconsistency ((S: mm hm)) uhm I did not do that because I did not
1269   think that was a major factor- facet of the dissertation I was really
1270   doing it in exploration of the possibility that the mother's
1271   characteristics had some influence and I was tremendously interested
1272   in the effect of mother's mobility particularly in occupation and I
1273   chose the discipline of doing the dissertation as a time for exploring
1274   this possibility
1275 S: one possibility Lee uh would be rather than and as a matter of fact
1276   I think strategically uh uh much more sensible than than treating
1277   husband and wife's status characteristics independently is is uh
1278   through some sort of configurationist approach now clearly it makes a
1279   difference uh uh the distance between say husband and wife or or the
1280   relative uh status of-of-of-of the two on- on an education variable
1281   and on an occupational variable ((L: yuh)) family background variable

1282   uh so that that the al- although there may well be some dependent
1283   variables in which there is independent influence of husband and wife

1284   but my guess is that by and large it's the configuration of husband
1285   and wife [background variables that have the major impact]
1286 L: [I- I- I would agree and I think] in a way it might mean
1287   setting up a classification system in which you have a group of
1288   families in which there is complete consistency and then a group of
1289   families in which you have moderate inconsistency and a group of
1290   families in which you have high inconsistency and you might want to
1291   elaborate on that by then the consistency being at high medium or low
1292   status or high and low status ((S: yuh)) uh it and because you in some
1293   way you have to get back down to a more parsimony parsimonious uh
1294   classification system which is what the stratification variables of
1295   the father had permitted in the first place ((J: mm hm)) but I do
1296   think it means introducing a system which takes into account
1297   characteristics of both the mother and the father and I haven't
1298   thought beyond that point with it
1299   [uh in terms of- of a method- methodological problem]
1300 J: [yuh not many people have I just thought maybe you had]
1301 L: I was simply trying to find out if it was worth thinking about an-
1302   and worth exploring ((pause))
1303 P: you talk about breaking down some of the work that you've done in
1304   here into smaller areas and then going developing uh specific research
1305   designs to tease out some of the factors that we've been discussing I
1306   think one of the things you've done here Lee that I like is to deal
1307   with the perceptions of these people of the consistency within the
1308   family or the the contributions of the mother or the father because it
1309   really doesn't matter ((L: whetehr the ah-)) too much whether or not
1310   those ((L: yuh)) actually existed ((L: mm hm)) and the perceptions and
1311   the impact upon upon the daughter is what you're trying to measure in
1312   this particular approach and this may be one of the philosophies of
1313   earlier studies you see if they just go ahead and- and uh stratify on
1314   the basis of occupational variables father's occupation they may be
1315   missing the perceptions ((L:mm hm)) in fact almost certainly are ((L:
1316   yuh)) missing the perceptions
1317 A: yuh but perceptions uh- may be closely related with ((P: they may
1318   indeed be)) with with uh outcomes but
1319   [they're probably not yuh they're not]
1320 P: [but that you'd want to investigate too certainly
1321 A: not randomly associated with with what structures are ((P: right))
1322   I mean this is one- one of the- with these really y'know you ask how
1323   she got from Williams to Sherzer ((J: chuckles)) and I can't ((S:
1324   through Galbraith)) yuh ((general laughter)) I really y'know it- its
1325   kinda hard ((P: laughs)) for me to realize that that I've somehow been
1326   associated with something people that are interpreting as being social

1327   ((laughter)) psychological ((general laughter)) and uh when I when I-
1328   but of course what I see is and that which lies behind my response to

1329   you ((to P)) is that that behind these perceptions or behind these
1330   this cognition of structural constraints there are indeed as we all
1331   realize structural constraints that are very real in the world and
1332   that- uh how it may very well be that that those constraints are
1333   themselves mediated by these other kinds of things that is th- that is
1334   the perceptions are a consequence of two things the reality of the
1335   world and the kind of experience the young woman ((P: exactly
1336   exactly)) has had in getting there and I think that
1337   [that's where you ultimately come down]
1338 P: [but there is a possibility that] the two are not synonymous on that
1339 A: yuh I'm sure they're not ((pause)) do you have anything you want to
1340   ask us before we send you away
1341 L: uh in rather specific way do you any of you see anything in here
1342   which would lend itself to an article?
1343 S: oh my god ((pause))
1344 P: you put that in the singular?
1345 A: [((laughter))
1346 L: [pardon?
1347 P: you put that in the singular? ((laughter))
1348 S: uh
1349 L: I would hope that I would have a couple of answers
1350 A: I don't know serialize it in some journal ((through laughter, J,P:
1351   laugh)) ((pause))
1352 P: well you have different different things in here you have the uh the
1353   testing of the three theories you have the assessment of background
1354   variables as they contribute to radical behavior radical attitudes
1355 S: you have an article in this last point you were making ((P: yuh))
1356   namely the the critique of uh of familial charact- characterizations
1357   based on husband's status and some evidence that it makes a difference
1358   when you introduce the- the- uh spouse's status characteristic but I
1359   don't really have an answer to your question my- my problem was trying
1360   to grasp this as an entity ((J: yuh)) and I didn't I the tru- I-I- I
1361   tried in a sense not to react to it in discrete pieces but it uh so I
1362   I don't really have a direct answer to your question but it would
1363   shock me if there weren't uh [a half-dozen things
1364 L: [let me frame it an-] let me frame it
1365   another way uh in your judgement do you think the theoretical
1366   grounding and the methodology is sufficiently sophisticated to justify
1367   uh contributing to the literature by producing articles out of it?
1368 S: there's no question about that Lee uh when one thinks of the well
1369   you you review the literature you know the literature out of which
1370   the- these theories come you know the kind of data against which
1371   they've been cast uh do you think your data suffer by comparison? I

1372   certainly don't or analytic techniques certainly not no I-
1373   [I personally don't have any question]

1374 A: [although you better] think about Tukey ((chuckling))
1375 L: ((chuckles))
1376 S: I personally don't have any don't have any question about that
1377   ((pause))
1378 A: ((sighs heavily)) ((pause)) well shall we uh
1379 S: send her out
1380 L: I'd like to say something else before I step out and that is I have
1381   certainly enjoyed I've thoroughly enjoyed doing this research and I've
1382   appreciated all of your people's help uh and I say that in the context
1383   of a forty year old woman trying to do ((J,P,S: chuckle)) something uh
1384   but it's really been probably of [all the experiences I've had
1385 S: [I would never have known
1386 L: huh?
1387 S: I'd never have known
1388 L: well I
1389 S: not the enjoyment ((laugh)) [what the hell limitations are
1390 L: [heh heh- but of all the experiences
1391   I've] ever had this has been the most completely satisfying experience
1392 A: I want to know what the hell is it that you've never known Sherm?
1393 P: ((laughs))
1394 S: I would never have known that there were limitations ((L: from
1395   age)) forty year old woman or it never would have occurred to me Lee
1396 A: ((chuckles))
1397 L: but y'know I just have
1398 S: that was the implic-
1399 P: ((laughs))
1400 L: yuh I just have
1401 S: in responding to the implications of her research go ahead
1402 A: you'd better stop I'm sorry I asked ((laughing tone))
1403 P: [((laughs))]
1404 S: [I-I don't think I'm on uh bad ground]
1405 L: but I- I find myself being atypical when I talk to graduate
1406   students who have gone through their doctoral research because I kept
1407   saying well y'know I'm really having a great time
1408 A: well don't they all?
1409 L: no
1410 A: well why have they never told us that ((J,A,S,L: laughter))
1411 L: but I just I really found it to be a fascinating ex-experience
1412 J: would you advise other graduate students to collect their own data
1413   like you did or
1414 L: absolutely ((pause))
1415 J: do you think that's part of the problem on- that is why some?
1416 L: using canned data out of the uh computer banks I think takes two-

1417   thirds of what you're doing away from [you
1418 S: [uh-uh doesn't it really

1419   depend on what you find to be the fascinating problem? uh ((L: wha-))
1420   clearly for your kind of problem extant data they didn't exist in
1421   [the first place
1422 L: [no it didn't] no it didn't
1423 S: and you you have had to resort to inferences ten miles long to
1424   connect y'know the data with the kinds of concepts you had in mind you
1425   had no choice but
1426 L: let me answer it this way if you frame your question independent of
1427   the available data and the data is in the data banks I don't think it
1428   makes any difference but if you start with what's in the data banks
1429   and let that direct your research interest uh unless you happen to be
1430   very interested in what research problem manages to come out of the
1431   available data then I think that th- that the data and the research
1432   associated with it is less valuable I-I guess what I'm saying is that
1433   framing a question that you personally are interested in
1434 S: yuh
1435 A: and you're still interested in this aren't you?
1436 L: oh yuh very much so
1437 A: I don't know how I felt the day after I finished ((J,P: laughter))
1438   bu- I didn'- whether I went right off and started ((J, P: chuckle))
1439   chewing it up
1440 L: yuh but I think that's the key James it's it's the degree to which
1441   you we- are curious about the thing you're researching
1442 J: mm hm
1443 A: ((sigh)) okay why don't you go get a drink and there's a room up
1444   here y'know right at the head of these stairs that has comfortable
1445   chairs in it although I I mean I don't know how long we'll be but just
1446   so I can find you because this building is
1447 L: I'll be in the room at the head of the stairs
1448 A: it's it's a maze but there's a- there's a drink down there where
1449   Sherzer told me to go before
1450 L: good then
1451 J: ((laughter))
1452 S: where have I told you to go Adam?
1453 J: ((laughter))
1454 A: you told me that I ((J: the heated room)) should have been ((S: oh
1455   oh dash seven)) more observant yes and I figured out how it was that
1456   you managed because we all paused there and talked for a moment and
1457   you happened to be facing that direction
1458 S: that's right
1459 A: whereas I was facing another direction and that explains why uh why
1460   you got ((S: oah)) okay so ((P: yuh)) how do you ((J,P,S: sigh)) do
1461   you wanta make some uh you got some reactions James? ((pause))

1462 J: well uh I mean she's it's quite clear uh- what she said that she
1463   liked that she obviously enjoyed this and it came through I mean she

1464   could not have written seven thousand pages ((A, J: laugh)) if she
1465   didn't thoroughly enjoy it and uh in terms of what a dissertation
1466   should be a a a learning experience in which y'know the student pulls
1467   together everything that they have learned and tries to be creative at
1468   the same time and tries to point toward further on-going work
1469   obviously this uh this meets all those criteria and I would certainly
1470   be in favor of uh y'know passing her obviously with the kinds of
1471   suggestions we'll have for revision and so forth
1472 A: are you going to have some some some suggestions for her in writing
1473   or just more general?
1474 J: more general more oral kinds of things I mean there were a lot of
1475   th- thing that Pat mentioned where she didn't always communicate
1476   clearly like that statement that you ((to P)) picked up about mothers
1477   you know one had to read that three or four times before it became
1478   clear that really wasn't what she was saying at all and there's a lot
1479   of that uh- of course sociologists are afflicted...
1480 A: . . .when a number of them turn out to be negative and so that
1481   you're going through all this I mean we are led ((J: heh hm)) inch by
1482   inch through the whole intellectual process there ((J: mm hm)) I mean
1483   I talked to her about ways she could y'know I said can we break it up
1484   can we use y'know white space or big letters or something ((J: heh
1485   heh)) so that every once in awhile you have a feeling of its you know
1486   ((J: or pictures)) that they're shifting gears and it ((J: yuh))
1487   y'know I had this experience when I was doing my I started to write up
1488   the Poona stuff I got into one chapter was two-hundred and twenty
1489   pages long and I wasn't finished and I took the last page out of the
1490   typewriter and I said I'll come back to that in twenty years y'know
1491   ((P: laugh)) this could go on forever so you say pass
1492 J: oh yuh
1493 A: and di- ah- di- is that a uh uh that's a neutral term
1494 J: I'm [not] sure
1495 A: [I mean] I [know it's
1496 S: [we don't need no uh what are you looking for
1497   [Adam?
1498 A: [well] I'm I'm I-I-I just I guess I have in the back of my mind
1499   that that I want to be able to convey some sense
1500   [of of how the committee's response]
1501 S: [oh the committee's response to the enterprise as a whole]
1502 P: hm
1503 J: well I think my sense is that uh she has done a good job and she
1504   certainly has uh I mean th- this project for her has been everything
1505   and more I think that a dissertation should be and at the stage of her
1506   professional development I think this is really a g- good job and she

1507   ought to be commended certainly she ought to be commended for the very
1508   thing th- that Pat mentioned no stone was left unturned I think in the

1509   future she'll have to develop some sense of what stones aren't worth
1510   lifting you know ((A: chuckles)) but but that may just come come with
1511   ex- obvious she can't she can't publish a monograph of [that
1512 S: [problem]
1513   ((P: laughs)) with that in the dissertation James is that she didn't
1514   turn them someone on this committee ((P: yuh)) would have said ((J:
1515   yuh)) shouldn't you have examined? [((laughs))
1516 P: [right right yuh
1517 J: [right but I think I think ((A:
1518   yuh)) though she felt this compulsion though tha uh
1519 S: herself
1520 J: yuh her fell- herself she wasn't really worried about us looking over
1521   her shoulder ((S: uh)) and so she probably has to develop that sense
1522   but I think that'll just come with uh you know with more more research
1523 A: oh I I think part of it was that you know that the questions th-
1524   that you ((to P)) raised early on and some of the questions that I
1525   raised she got to thinking about kinds of questions not necessarily
1526   about specific things but I-I mean I think she's learned something
1527   about the kinds of questions that as Sherm says people would have
1528   asked ((P: mm hm)) Sherm?
1529 S: uh it's a fine job by my lights uh I would have wished it were
1530   shorter ((through laughter)) I have some sympathy for the twenty-five
1531   page psych dissertations [it's th- d- uh] us the uh uh Lee th-
1532   P: [((laughs)) right]
1533   the one comment I'd have ha- has to do her writing uh these up uh uh
1534   her th- the dissertation was written wri- was written within the frame
1535   these are the extant theories let's use these to derive hypotheses and
1536   get some data and cast them against against the theories and that's f-
1537   that that's fine uh but it's also uh a limit uh because it leads her
1538   uh for example not to ask such questions as the kind of thing I was
1539   pushing her on a little bit uh what alternative meanings might be
1540   given to the uh the the class variable other than the socialization it
1541   is true that in this literature the class variable is interpreted as a
1542   socialization variable but that's not necessarily the case if you
1543   start from the more general question of how can we explain radicalism
1544   rather than the more particular question of given the theories
1545   currently used to explain radicalism uh uh uh she could I think write
1546   some of this stuff up within the more limited frame it'd be better it
1547   seems to me if she would expand her vision a little bit uh so that
1548   she's she's not necessarily limited although I I well let me take it
1549   back in the longer run I wouldn't want her to do that in shorter run
1550   I'm not so sure it it may be wise to restrict her vision in order to
1551   uh to to get some things done and out I think it's important ((J:

1552   yuh)) for her to uh to quickly move to get at least one ((P: mm hm))
1553   piece out and in the literature just to give her the confidence that

1554   she can do it uh I reacted to that forty-year-old woman comment uh
1555   because I think that's that's the danger for Pat for Pat for Lee if
1556   she thinks of herself that way she may well not think of herself as uh
1557   as uh you know a young person initiating a research career getting
1558   things moving and so on that that-
1559 A: well I can tell you what her view on that is ((S: what?)) and that
1560   is I'm older and therefore I'm in a worse competitive position
1561 S: but I'm [smarter ((laughs)) yuh] yuh
1562 A: [and I and] I've really got to produce and I'm going to
1563 J: Adam (A: yuh)) along those lines does she see the length of time it
1564   took her to finish this thesis as predictive of what she her perder
1565   [production record)]
1566 A: [actually it's] it's not all that long given the norm in sociology
1567   ((J: mm hm)) that I think that the uh the first draft of her proposal
1568   was less than three years ago and then she did collect you know a
1569   substantial amount of data while she and she's been working full-time
1570   and I don't know that uh uh given that she did collect her own data
1571   and did as we all can see a tremendous search of the literature uh and
1572   a tremendous amount of analysis I don't know that it was that slow I
1573   mean I don't think she was dragging her heels very mush
1574   [in this period ((pause)) yuh ((pause)) yuh]
1575 S: [uh James may be ((P: mm hm)) thinking more of her total graduate
1576   career]
1577 P: uh huh
1578 A: but I- I do also yuh ((J: oh yuh yuh)) that's true and I and I
1579   think she's aware of this and I think you know she I think one thing
1580   that will happen is that I think that uh Mel may encourage her and
1581   [I think that'll] be all to the good
1582 S: [mm I would hope so
1583 P: mm hm ((pause)) to what extent are these the three theories that
1584   she selected truly representative of theories in this area?
1585   [they are indeed]
1586 A: [that's it ((pause))] that's it
1587 S: yuh yuh [no more theories]
1588 P: [oh they are] the theories?
1589 A: [that's about it
1590 S: [yuh yuh [they are th-]
1591 P: [they] are not really representative then?
1592 S: uh [well they there are there are variations]
1593 A: [ah [well th- yuh]
1594 P: [((uninterpretable)) a sample of one? in each ok]
1595 S: there are variations on themes uh but cl- uh but I don't know of
1596   any major contender there may be bu- I don't know of anything that

1597   looks much different from the things she's she has looked at in this
1598   [dissertation I mean there's nothing]

1599 A: [no well except for the sense that]
1600 P: so nobody nobody would attack her on that ground then if she
1601 S: [no no ((P: mm hm)) no]
1602 A: [oh no I don't think so] I think the only thing that would be
1603   substantially different would be a real social structuralist who would
1604   say you don't have to worry about cognitions what you have to do is
1605   find the location of these people in the social structure and then
1606   you'll find out how they're going to behave without having to get into
1607   their heads at all and that hasn't been tested ((P: mm hm)) uh except
1608   in very gross kinds of ways with macro-data which is generally
1609   [not been very satisfactory ((pause)) yuh]
1610 S: [right Spilerman's stuff mm hm]
1611 A: so I can ((P: yuh)) tell her that [I I] yuh
1612 S: [she's won]
1613 J: [((J, P:laugh)) she's overcome]
1614 A: [I I I tol- I tol- I told her that] the story when I when I took my
1615   uh my orals uh I was Big Jack Bismark and uh uh Jedley Stillwell and
1616   they came out of the oral and Stillwell says "you're going to have to
1617   tell him Jack" ((in a whisper)) and Bismark says "oh no" he says uh
1618   "go on you tell him Jedley" ((in a whisper)) ((P: laughs)) uh it was
1619   this this whole bizz but I she ((P: laughs)) already knows so there's
1620   no point in te- let me let me go get her and bring her in
1621 P: yuh it was an- an excellent job I think ((pause)) uh
1622   ((noises, something dropped))
1623 A: ((off mike)) figure out how to get out of here
1624 S: ((chuckles)) [someone help Adam
1625 P: [((laughs))
1626 J: hm
1627   ((pause and Adam leaves))
1628 S: ((sigh))
1629 P: she's been teaching new courses too every semester hasn't she?
1630 S: yuh [she has] they teach I think nine hours
1631 J: [yuh they really work her over there]
1632 P: mm
1633 J: for awhile she was in danger of losing her slot wasn't she?
1634 P: or wasn't the position originally just a one [year position?
1635 S: [yuh it wasn't it
1636   wasn't that she was in danger of loosing the position it was that the
1637   [position was in danger of being lost]
1638 J: [position yuh yuh]
1639 S: and uh in point of fact I think it was opened on the basis of an
1640   appeal which says this is just too valuable a person to lose she's an
1641   ((P: mm hm)) absolutely first-rate ((P: yes yuh)) teacher really very

1642   very good I must say that uh uh her nineteen-sixty-eight story uh uh
1643   shocks me [and I I sp- I I] uh

1644 A: [so we have something for you to sign
1645   ((pause as Lee and Adam enter, sound of walking and sitting))
1646 L: couple of somethings
1647 A: yuh
1648 S: Adam there had to be female AI's pre-1969 ((P: laughs)) I just
1649   don't believe I-I spent the ((A: sighs)) fir- you know th- of
1650   [after that
1651 P: [you were in ((A: th-)) shock there for
1652   awhile [((laughs))
1653 S: [I was as a matter of fact]
1654 A: [there there there were there were certain] people who were
1655   uh T.A.s [Carol Collins] uh Debbie what's her name
1656 S: [but no AI's?-]
1657 J: Sue Phillips
1658 A: yuh well [she]
1659 S: [these] people taught classes for us?
1660 A: well
1661 S: I'm absolutely cert- I'm going back and check but
1662   any[way go on]
1663 L: [okay] do and I think you might find they were married
1664   ((pause))
1665 S: mm I'll test that hypothesis too yuh I
1666   [I- I'm curious enough to check]
1667 L: [and then I think you might (uninterpretable)] and then tr- check
1668   on another one check who was acting chairman when they received the
1669   ((pause))
1670 S: an appointment?
1671 L: an appointment
1672 S: I will check that one
1673 L: I think you were
1674 S: well I-I
1675 L: 'cause I think you were acting chairman in sixty four were you not?
1676 S: uh I was in at some point yuh sixty-four [sixty-five yuh yuh]
1677 L: [some point there before yuh]
1679 P: Dis[crimination in favor of married women Sherm? ((pause, laughs))]
1680 L: [Cli- wh- ((pause)) th- the gal whose hus]
1681   [band was in anthro][pology
1682 J: [((laughs))
1683 S: [I don' know
1684 P: [((continues laughing))
1685 S: [I don' know]
1686 J: the gal whose husband's in anthro[pology?
1687 L: [she's] now down at the state unit

1688   ((S: yuh Clifford Clifford)) down'n River City she was teaching before
1689   I taught

1690 J: oh yuh and didn't Jennifer Bird teach?
1691 S: Jennifer? I'm sure well uh again I don't know ((L: I don't know))
1692   I'm going to check [I don't remember]
1693 A: [yuh I- I think she taught] but then I'm not sure
1694 L: but Jennifer was married wasn't she?
1695 J: yes
1696 S: no not at [not at that time] no mm mm
1697 A: [well not at that time]
1698 L: not at that point? check it because uh it see [the the reason
1699 A: ((off mike))   [can we use this?
1700 L: I presumed that women were [allocated to those positions]
1701 J: [do we sign release forms too Adam?]
1702 L: is [because Clifford's teaching]
1703 A: [oh did you already sign them?
1704 J: no I didn't sign them
1705 A: that's right we've got something else ((S: you know)) for you to
1706   sign too
1707 S: uh what you what you're implying may indeed be true but if it is I-
1708   I am shocked by the fact I'm also shocked by my lack of awareness
1709 L: ((This is a reconstruction)) Well, Ann Wilder is another woman who
1710   experienced discrimnation when she was single. She also wanted to
1711   teach, but obtained teaching only after passing her comps. Before that
1712   she had to support herself in other ways, first by serving as a
1713   residence halls assistant and later through an assistantship in the
1714   Mahler Institute. When Ann started to look for jobs, she was told that
1715   since she was married she would just go wherever her husband did. She
1716   finally appealed to the social science department; whatever assistance
1717   she was given came from social science.
1718 S: that's not true because I did ((L: well)) when Ann went on
1719 L: when you came they went out but see she was looking about
1720 S: before that time?
1721 L: yuh before you were in there
1722 A: Ann?
1723 S: [Wilder]
1724 L: [Lowell]
1725 S: Wilder
1726 J: did she teach? I thought she s-
1727 S: no there's this [there's a further uh]
1728 L: [oh Ann eventually taught too yes]
1729 S: there there's a further assertion
1730 L: but that just is not descriptive of the situation any more and
1731   I [I- y- you know]
1732 S: [no but I- but uh] uh uh I- I don't I- frankly I don't like

1733   what's being said it bothers me it disturbs me uh i- in the sense that

1734   I prefer not to believe it's not really true

1735 L: okay fine [((laughs))]

1736 S: [yuh] that that's tha n n you know I and uh therefore I

1737   shall look for evidence that it's not true ((laugh))

1738 P: ((laughing continues through next utterance into A's laughter))

1739 A: and ((S: and I may)) he'll find it Goddamnit he knows how to be a

1740   sociologist ((A, L, J: laugh))

1741 S: and ((laughs)) and uh it may turn out that I won't find that

1742   evidence and then I'll [really be up-

1743 L: [well you] may find it and if you do look

1744   for marriage as the uh ((S: okay)) differentiating factor

1745 S: and but if I do [find it I- I will tell you]

1746 P: [have an unusual effect then] if that's the case

1747   [but it's helpful isn't it?

1748 L: [well I've never been able] to sort out the discrimination I've

1749   received as a woman from the discrimination I've received as a single

1750   person they they get intertwined and they interact with each other

1751   sometimes ((long pause))

1752 A: well and there may be others too other kinds of discrimination as well

1753   ((L: oh)) you mentioned age you that ((L: oh yuh)) that's clearly a

1754 S: yuh but that would not have been [uh relevant]

1755 L: [this] this is not for signature

1756   this one's just a double copy I wanted a copy ((S: mm)) of of what I did

1757 S: then it's this and this just the two [things?]

1758 L: [yuh one's the abstract]

1759 A: just two things?

1760 L: [yuh one's the abstract and one's the acceptance]

1761 S: [well that that'll be ((pause))] that will be presumably duplicated

1762   you'll need multiple copies of this uh

1763 L: yes and they will accept a xeroxing of it

1764 S: good they save signatures ((pause))

1765 P: ((uninterpretable))

1766 S: hm

1767 L: well that may have been a personal thing but the reason given

1768   wasn't based on [personal]

1769 S: [no] no hm ((pause))

1770 A: okay ((long pause))

1771 S: the uh i- in that sense it's interesting how the uh climate and

1772   circumstances have changed that is to say if if indeed there were a

1773   personal reaction negative the last thing in the world they would be

1774   rationalized in terms of ((J: laughs)) would be y'know the fact that

1775   it was a female or what not at this [point in time ((laughs))

1776 J: [((laugh)) yuh

1777 A: oh well what's really critical is that all those changes depended

1778   on how some mother's behaved in 1937 ((J, L, P, S: laughter))
1779 A: okay thank you three muchly you did an awful lot and we appreciate

1780   that [you did so well]
1781 P: [no more than everybody else]
1782 A: you did so much we're going to start sending you many more students
1783   ((P, S: laughter))
1784 L: uh James I have one
1785   [request could I borrow]
1786 P: [uh you'd better extract some promises at the beginning]
1787 L: back th- the copy of the dissertation so that my typist can have
1788   one copy ((J: sure)) and I'll have my copy while we go through the and
1789   I'll return it to you
1790 J: okay yuh I'd appreciate that
1791 A: yuh well what what is the drill on this now now she gets she'll ask
1792   each of you presumably if you have anything written that she should
1793   change and I've got some notes on what happened today but now she just
1794   gets it typed up right? and gets it bound and
1795 S: submit it to the graduate school that's all yuh
1796 A: okay and then you get your degree and I will write a letter to your boss
1797 L: if you would write to Debrun do you want me to give you a note on that?
1798 A: uh uh I'll write it down would you but you'd better give me the
1799   address and his real name I mean his name is more than Debrun
1800   ((chuckle))
1801 J: ((laughs))
1802 L: yuh Maxwell ((pause))
1803 A: and he's the chair?
1804 L: chairman we're getting a new chairman in September
1805 J: really? who-who is it?
1806 L: Bill Himes [he's we we] were required to stay inside the department
1807 A: [((Bill Himes))]
1808   ((J: uh huh)) selecting a new chairman ((pause))
1809 A: then I know the name then from the Ohio valley I guess uh ((L:
1810   yuh)) because the name sounds familiar
1811   S: Pat what do you know about
1812   offices available for retired
1813   faculty?
1814 L: the department of Soc and   Are there can I who do I check
1815   Anthro   with at this point?
1816   Rock State
1817   Henry and George Diller and uh
1818 A: isn't that Rock, Ohio?
1819   and Dave Joiner
1820 L: Rock, three three four two   all have offices on our floor
1821   four   and they've been permitted to
1822   wha- that

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1823  A: Three, three
1824     four two four                    to return last year and they had

1825                             then because
1826     Lee finished                we had persons who we knew had
1827                                 positions and so there was no
1828                                    point
1829                             P: mm hm
1830     how long do you think that's   S: shifting their offices (unin-
1831     going to take                  terpretable) and so on
1832  L: I have my typist's time     P: but you now have people coming
1833     reserved and she says she        in who will need those offices?
1834     thinks she can get get it done    I'll have to check
1835     by the end of July and then    S: and and ideally uh what I would
1836     the binding I understand takes    like to try to find is a set of
1837     two to three weeks and I         offices contiguous to one another
1838     hope to submit it by the first    so uh
1839     of September
1840     now as I understand it the     P: uh how many of those (uninter-
1841     board does not officially grant   pretable) now?
1842     degrees at its September       S: four in all okay
1843     meeting so it'll be October    P: yuh now I don't know if he'll
1844     before they award the degree      bounce it back to the Williamson
1845  J: that should-                   Committee or not but I see no
1846  A: I know they they have some        point in giving it to the William-
1847     kind of there's- there's no       son Committee because ((uninter-
1848     problem                           pretable))
1849  J: in terms of- your sal- now    S: no no no
1850     in terms of your salary          yuh that's right they by the rules
1851     there that what you mean at       elab- by the rules elaborated
1852     Rock?                             by the Williamson Committee retirees
1853  L: no no see I have rank and salary   can't be in the building or at
1854     which is not dependent upon the   least they are very low on the
1855     degree                            priority listing and we
1856  J: oh not dependent on it          haven't had enough rooms to meet
1857  L: but I'm going to be reviewed for   the first priority which is for
1858     ((J: tenure?)) a three year       our full time faculty
1859     contract no a three year       P: yuh
1860     ((J: three year)) contract and  S: so uh
1861     that will be dependent upon the
1862     degree
1863  J: yuh yuh
1864  A: the time you've already spent does that count towards tenure?
1865  L: yes mm hm ((pause))
1866  S: right ((A: right)) Lee congratulations
1867  P: [see? you won]
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1868 L: [thank you very much]
1869 S: good job yuh a good job

1870 L: thank you
1871 P: terrific
1872 S: uhm ((pause))
1873 P: uh ((A: okay)) Lee I have a number of little suggestions ((A: yuh))
1874   as I ((chuckles))
1875 A: ((to S)) d- you do you want a ride?
1876 S: yuh I'll go home
1877 A: all right I'll take you home
1878 S: because I I prefer not to
1879 A: James thank you very much
1880 J: you're welcome very much
1881 A: and uh I won't call on you for awhile you can
1882 S: ((chuckles))
1883 L: give you a rest ((pause))
1884 A: okay ((pause))
1885 P: I thought your first statement on page one saying that
1886   subordination of women to men in a social relationships and the
1887   limitations on a women's opportunities and activities are un
1888   challenged ((laughs)) was a bit ((uninterpretable))
1889 S: the- the fact of ((P, S: laugh))
1890 A: [read that again]
1891 S: [the fact that]
1892 A: wh- what are you?
1893 P: read her her lead off sentence ((pause))
1894 S: ((laughs)) aah- is that the way it reads? ((pause))
1895 P: two of the few unchallenged descriptions of ((pause))
1896 S: oh descriptions well that's all right
1897 P: [now]
1898 L: [I was saying] that no one disagrees with that as a description
1899   [(uninterpretable)]
1900 A: [oh well there] are some some women that would disagree with that
1901   these women in this organization that says that they like the way it
1902   is and they're not really subordinate
1903 S: oh no what they say is they're subordinate that's the way it should be
1904 P: yuh depends on the [organization they're in right] ((laughs))
1905 S: [((laughs)) okay]
1906 L: so you would like that to? uh
1907 P: well I think they are in the process of being challenged and
1908   certainly you're going to be challenging some of them
1909   [aren't you?]
1910 A: [(uninterpretable)]
1911 L: no I
1912 S: but the [the descriptions

1913 L: [the sentence] may not say it correctly I wasn't saying
1914   that they're not being challenged but the desc- the fact that women

1915   are in a subordinate position
1916 S: and that there are limitations on women's
1917   [opportunities is an] unchallengeable fact
1918 L: [is not challenged]
1919 L: that women are in a subordinate position and they do experience
1920   limitations [and that's just a] fact
1921 P: [(uninterpretable)]
1922 S: oh as a description of the way the world is not as a description of
1923   the way the world ought to be from some points of view surely you
1924   would I mean why else equal opportunity? if [if uh]
1925 P: [yuh] yuh
1926 A: but there are people who ((P: I I)) deny it I think is part isn't
1927   that part of what you're your saying Pat?
1928 P: yuh yuh why don't you think over the ((L: okay)) the wording of
1929   that ((S: yuh)) because I think that's the problem then there is
1930   something on page 67 its ((sounds of pages being turned during the
1931   rest of this utterance)) a word spelled d-o-c-e-d and I looked at it
1932   and I looked at it and for the life of me I couldn't figure what it's
1933   supposed to be [obviously a y'know] its a
1934   J: [was that page 67?]
1935   typo or something well yuh I dog-eared these pages ((pause)) boded
1936   maybe? [but boded in there] but somehow that didn't seem right
1937 S: [what?]
1938 A: [compromise was]
1939 L: that's decided ha ha
1940 P: decided?
1941 L: yuh I didn't catch it
1942 P: oh okay
1943 A: no that doesn't make sense
1944 L: no wait a minute [the use of majority vote and] compromise was
1945   A: [compromise was dec-]
1946 A: coded
1947 L: coded yuh
1948 A: coded
1949 S: the 'c' and the 'd' [got interchanged
1950 P: [right yes yuh
1951 L: yuh
1952 P: yuh ((long pause))
1953 A: there's a name for that in linguistics but I don't
1954   [know what it is]
1955 S: [there must be] there's always a name for it in linguistics
1956   ((laugh))
1957 L: you know it intrigues me that that he's still taking the social org

1958   perspective because the work he's in now is
1959   [is so embedded in] [symbolic interaction]

1960 S: [I know but that]
1961 A: [I haven't signed this yet]
1962 S: damnit all [did- has Williams ever done] anything but social
1963   psychology?
1964 P: [((laughs))]
1965 L: no
1966 J: [((laughs))
1967 S: [do you know] of anything he's ever published that hasn't been on
1968   attitudes of somebody or the other?
1969 L: no
1970 S: [I don't] well what the hell is this nonsense?
1971 J: [((laughs))]
1972 L: ((S, J, L: laughter)) as a matter of fact I had my graduate
1973   assistant go over and do cards on uh the studies social psychological
1974   studies using stratification variables ((S: yuh)) and dependent
1975   variables he just came back with everything Zeb Williams
1976   [did ((laugh)) knowing no connection or anything else I just]
1977 S: [((laughs))]
1978 L: gave him [the criteria for selection ((laughs))]
1979 S: [((laughs))]
1980 J: ((laughs))
1981 P: well why don't I just give this to you Lee you can forget this this

1982   last one that's the one we already talked about but with some of these
1983   I thought that they were either a little unclear or now now in this
1984   particular case I wasn't sure that that those were indeed the numbers
1985   you had used because when I looked at the tables it appeared that two
1986   was associated with with always admire and one was associated with
1987   this part of the time phenomenon and zero with the the always dislike
1988   ((L: that's right)) rather than the way well it's not stated that way
1989   on page 46 ((L: okay)) you'd better clarify that
1990 L: this is the order then of presentation
1991 P: mm hm and page sixty uh three I uh some of these could be explained
1992   a little more
1993 L: okay ((pause))
1994 A: ((off mike)) I'll remember
1995 P: if you just read through those I think you ((long pause)) some of
1996   them aren't really some of them we've covered now and you won't have
1997   to worry about them ((pause))
1998 J: I guess there's nothing more
1999 L: I appreciate your [taking the time to do this]
2000 A: [uh I'd like you to stay] for just one- one more
2001   minute you've got to [we've got to settle up with you]
2002 L: [and uh what I'll do is in terms of writing]
2003   address the questions [uh of presentation and these]
2004 S: [they want uh some (still pictures)
2005 L: [in a way we] talked about
2006 J: [uh oh oh okay sure]
2007 FM: [Adam there's release forms over here]
2008 P: [(uninterpretable)] your uh
2009 A: okay
2010 P: uh ((S: the uh)) oh yes here (uninterpretable)
2011 S: uh [that's a quiet camera]
2012 L: [you'd like that added right?] okay
2013 P: I don't think its [its so essential that you get it in this]
2014 S: [how can I release before I see] the film
2015 P: but if you [write it up]
2016 J: [we get to] see it right Adam?
2017 A: yes you do
2018 P: uh if you write it up for publication in any way I think that may
2019   indeed be important
2020 L: to something I want to ((P: yuh)) include but not ((P: right))
2021   necessarily redo ((A: current address)) for the dissertation
2022 P: yuh well it would do [no harm if you're] (uninterpretable)
2023 S: [what address?]
2024 A: any address you want will be fine I mean as long as its a legal one
2025   ((J: laughs, S: hm)) and no funny names ((sighs))
2026 L: by the way I was totally unaware of the camera today no
2027   intervention with me
2028 J: Adam we don't need the statement on here about our right to uh look
2029   at the stuff?
2030 A: no you do- unless you don't trust my word
2031 J: I trust your word Adam

2032 S: where's the statement?
2033 A: what a fool ((A, J, S: laugh)) ((long pause)) and today is the
2034   thirteenth Friday the [thirteenth as I now] discover
2035 J: [thirteenth this was the
2036 P: mm hm
2037 A: thirteenth of June
2038 S: yuh
2039 L: I just thought that was symbolic

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Recording Duration: 113 min.
Recording Date: June 28, 1999
Recording Equipment: TASCAM Digital Audio Tape Recorder with two external microphones
Language: Primary Discourse Mode: MIX Native Speaker Near-native Speaker
Participants: Number of Speakers: 7 Number of Participants: 9
S1: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Graduate Student; Gender: Female; Age: 31-50; Restriction: None
S2: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Male; Age: 31-50; Restriction: None
S3: Native-Speaker Status: Near-native speaker; Academic Role: Senior Faculty; Gender: Male; Age: 51 & over; Restriction: None; First Language: Korean
S4: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Male; Age: 31-50; Restriction: None
S5: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Male; Age: 31-50; Restriction: None
S6: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Male; Age: 51 & over; Restriction: None
R1: Native-Speaker Status: Native speaker, American English; Academic Role: Staff; Gender: Female; Age: 17-23; Restriction: None
SS: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Unknown; Age: Unknown; Restriction: None
SU-M: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Male; Age: Unknown; Restriction: None

Setting: Conference Room, Advanced Technology Lab

S1: any questions any of you want to get out right now before it, it's official?

<SS LAUGH> <P :12>

SU-M: (xx) to that?

S1: yes, we we [SU-M: does it work?] first put it on the table but figured it would hit, the heads of the committee members and so we decided not to do that

S2: that's one strategy

S1: yeah. well yeah, that's true.

<SS LAUGH>

S2: it's called a defense strategy.

<SS LAUGH>

S1: hm i should have brought the plane that runs down. have it, try to take off in that direction.

<SU-M LAUGH>

SU-M: take a bullet

<SU-M LAUGH>

S1: <SOUND EFFECT> exactly.

<SS LAUGH> <P :06>

SU-M: i'd say the key to a good defense is a good offense.

<SS LAUGH>

S1: mm, that's basically what this is for is humor so i can_ it really serves no research purpose. <P :22> so if you want more details on what happened to this airplane nobody, i- this is not part of the defense so i'll tell it now [SU-M: okay] so, basically last Thursday we w- went out on a test and, this is our trainer plane all of us, um s- grad students and s- so forth who've been working on the project never really knew how to fly, model airplanes before this and so, we had this trainer that for the past two years we've taken it out and flown it just manually occasionally. last Thursday we lost radio c- communications with it and it flew around for a while by itself and, promptly crashed into a tree, and uh, the wing came off in the tree and the, fuselage came down and hit the ground so

SU-M: wow

S1: but we got good data on the research airplane

SU-M: the motivation for your work.

S1: <LAUGH> yeah, right...

S3: this is the what? what is this?

S1: oh this is our trainer airplane. last Thursday it uh, had an incident with a tree.

S3: so it's broken?

SU-M: oh yeah <LAUGH>

S1: oh yeah, this is broken this is not the research airplane <SU-M LAUGH> yeah this is, structurally this is the same as the last one.

S3: c- can we pass you?

SU-M: you can have part spatial constraints as well as temporal constraints.

S1: <LAUGH> yeah. <LAUGH> he's the he's the last committee member so, he needs to fill out the form i guess

R1: yes there should be an extra stack sitting over there somewhere.

S1: mkay

SU-M: here it is.

S2: yeah i think so, yeah.

SU-M: so if you wanna fill that out um, the tradition is that before we get started, everybody else leaves and the committee meets

S1: oh it's on tape. yes, i'll be talking to you later.

R1: oh

<BREAK IN RECORDING>

S1: kind of in two parts the first part which is the major part of the research is talking about the generation and execution of, real-time plans, and then we talk about an application which i have a particular interest in, namely autonomous flight... so, the overall research problem that i have been studying is, how do you get safe autonomous operation when you really are looking at a real, system, um which re- well for for the main that requires real-time response. um, in particular when your system has, limitations such as computational resource limits which often people don't really pay attention to even though they're always there, and, when you have a complex hard real-time system where you require safety guarantees, um those two things don't always go together naturally because, w- when you have a hard real-time system

you really, have to, talk about deadlines and meeting those deadlines, because if you don't meet them then you might compromise safety of your system. so uh, at this point i'll briefly mention the show-and-tell, device that i've brought here. which uh, i'm going to be talking about airplane flight and um, i'm going to claim that airplane flight is inherently dangerous. so, this is an example of an airplane flight gone wrong, which basically um, we lost communication with this airplane last Thursday when we were flying it manually so, our flight was neither safe nor autonomous, and basically what happened was, um it was equivalent to having, a very long delay without doing anything, in which case the plane had plenty of time to fly into a tree, so, if you think at the extreme limit of where you have a resource-limited system, and, you end up in some processing loop or you're doing something and not paying attention to say where your airplane is flying, this kind of thing could happen. so, anyway i won't talk about the airplane anymore don't, let it be too much of a distraction. so the final, um aspect of our problem that complicates is is that whenever you describe a problem that's, fairly complex you don't always get everything right. so, in some cases you have imprecise knowledge in other cases you may have incomplete knowledge. or both put together. so the worst case, you have to make trade-offs. the three specific uh, types of trade-offs that we focussed on, are first of all if you have a real-time reaction set which would ideally keep you safe all the time, and it doesn't fit on the resources that you have, you have to do something you can't just say oh well we'll assume that it fits. so we study that trade-off. um basically, in order to make that trade-off sometimes you have to relax your safety guarantees from absolute, to some other, um method of guaranteeing the system. um a natural, way to look at it is to, maximize the probability that you're going to succeed. so that's what we look at is to decra- degrade, safety guarantees to probabilistic when necessary, and then, since we degraded those guarantees and since we, allow incomplete knowledge, we have to recognize and react when we, reach unhandled states. basically unhandled states are those that, have been ignored due to incomplete knowledge or, probabilistic guarantees... so, two aspects of our approach first the, an overall view of how we look at plan generation and real-time execution, is that we separate the planning process from the plan-execution process. and in doing so it allows us to use, a lot of the powerful but computationally intensive, planning algorithms, to develop the plans, and then also schedule them, so that, we know they will fit onto our limited resources when they execute. we began this work, by, considering a system that was designed specifically to do that, namely the Cooperative Intelligent Real-time Control Architecture, called CIRCA, which has, a planner and a scheduler and, to develop the plans and then uses, um what it calls a real-time subsystem basically, a special module that has carefully designed um, knowledge of its resources and how, uh worst-case properties of, the various items that might be in the plan to execute those plans. so given that architecture ideally, you would build perfect plans that would execute in hard real-time for all situations but as i spoke of before, you have to be able to make, trade-offs and our, um approach is to try to be as intelligent about them as possible. so the first thing we did to allow us to make probabilistic guarantees is to incorporate a stochastic planner. so our goal was not, to, get the most accurate probabilities and optimal plan, but rather, it was designed first to select actions and their deadlines that would allow us to preempt all possible catastrophic failure modes of our system. and then it was also used, um to give us these probabilistic guarantees by, basically setting a threshold and ignoring the states that were less likely than that. so, during the planning process we have to converge on a schedulable plan. what does that mean? that means that, you have a planner it says, here is what i wanna do. that may overutilize the execution resources in which case, um, the scheduler says no i can't do that, and, at that point, it, provides feedback for the planner that will help it guide its efforts toward replanning. at that point we have a plan that may not be complete, but it's the best we can do given our resources. so at that point we, um, find that it's necessary to be able to identify and react to

other states as they happen. uh basically, um, we look at, classes of important, unhandled states, and respond to those by adding additional plans so that we end up having r- a, reactive system that has multiple plans, each of which react in real-time, to, um, the r- dangerous situations as they arise. <P :07> during this talk i'm gonna first, um describe at a very high level the, CIRCA-two architecture which is the extension of the CIRCA as it was originally developed, then i'm going to talk about the uh, stochastic planning and temporal model that we currently use um, in CIRCA-two, um, the procedures that we use to detect and react to unhandled states, and then, um how we, get our planner and scheduler to negotiate efficiently with each other tow- to trade-off um, um, basically task, to to select tasks to trade-off when, everything can't be scheduled. and then i'll talk about, automated flight, using the CIRCA-two architecture... and of course the, concl- conclusions and future work. so before i get started just so everyone knows what i mean when i say hard real-time system. a lot of times in the planning and plan-execution committee they'll think of real-time as meaning, best-effort or soft real-time. in that kind of system, you only get the maximum reward if you, meet some sort of deadline but, if you pass that deadline it's still okay to, to keep going and do those tasks. so this curve represents, um the do- dashed line represents a soft real-time task where, if you don't finish it in time the reward degrades but, it's_ your system is still okay. we're talking specifically about a system where if you don't meet the deadline, you will catastrophically fail. so, we require absolutely, to meet that deadline and say our system is not safe if it does not. so the two methods that are typically used to do this, um, one is to use, um real-time scheduling algorithms, which it, specifically put tasks on a timeline to prove that deadlines will be met. the other method is to demonstrate your system is fast enough. a lot of people use this approach, and it has been shown to be successful in a lot of applications however, it is very difficult to prove, that, all of your testing is comprehensive so you can guarantee deadlines will be met. <P :06> for our system, we have a specific definition of what we mean when we say plan. we mean real-time control plan. there are two parts to this plan. the first part is what we call task action pairs which specify, the set of tasks or actions that we want to do, um as part of the plan, and the tasks which basically describe, which states, you will be in when you actually do those actions. um, th- the set of, of TAPs as i will call them, is divided into a guaranteed set and a best-effort set. the guaranteed set, um is the set that's_ are, the hard real-time, um tasks and they have to be scheduled, so that they will meet their guarantees so they come with a deadline that you have to schedule them with. the best-effort tasks basically execute whenever there's time so they're the soft real-time tasks.

S4: do the um, tests overlap between different, um TAPs?

S1: uh no, the planner is set up so you can only choose one action for each state.

S4: so wait assume these tests are things like sensing. um

S1: yeah so so basically if you start with a description of a plan as, a list of states, that go with an action, then we basically pass that list of states into the I-D-three decision-making algorithm and it comes up with, tests that uniquely describe that set of states, versus all of the other states that you don't do that action in...

S4: okay so y- so any kind of overlap is handled by that process not by, [S1: right] not, when it's, not at scheduling time.

S1: right no. that, this is, so basically part one is done by the planner. and the planner also comes up with the deadlines. and then part two, the development of this TAP schedule on a

timeline for, the guaranteed TAPs is done by, the scheduler. and it doesn't know anything about tests versus actions it just knows, the worst-case execution times, W-C-E-T there for each TAP which is what it assumes when it builds the schedule, but then as you see there there is this average-case execution time so, any time one of the TAPs takes less than its worst-case execution time, you can reclaim that time for all of the best-effort TAPs, plus any time that remains, once everything is scheduled.

S2: so is this a a partition of the sensors basically?

S1: no it doesn't pa- no you might use the sensors, um, in any of these tests so, say you had a feature, altitude for example, you might use it, in every test that you have.

S2: let me take all the sensors and put them together, let's call that the sensorium okay?

S1: okay.

S2: is, are, do these does the un- do the union of all these tests, if you if you look at the on of all of them [S1: mhm] is that, does that recover the entire sensorium or are there parts of the sensorium which are not?

S1: if your plan does not require, knowledge of a certain sensor value then, you'll never care about it in this plan. is that what you're asking?

S2: i'm asking i guess, you've rejected, you've referred to this paper in the, in your thesis that [S1: uhuh] talks about how stupid universal plans are. [S1: oh yes] is this, if if you didn't have this scheduler if you just had this planner [S1: uh'uh] in, is this, has this planner come up with a universal plan (for this state?)

S1: no it has not because it only considers states starting with, you you have knowledge of your initial state. and it looks at all the state transitions and comes up with the set of actions specifically for those which it considers reachable from its initial state. so, um, if you never, think that a state is reachable then it won't put that into, into this list.

S2: i was confused i thought you didn't deal with states i thought you dealt in se- in outputs and in perception in per- and in perceptions and then you imputed, families of states to those perceptions that's right?

S1: right. right. so it's possible that you will accidentally do one of these tests for a state that you considered unreachable, because, what you end up with when you plan is a list of states that you consider reachable, that map to, each of those fa- states map to one or zero of these actions. at that point that list of states is fed into I-D-three, so that it comes up with these tests. so you know that for all of your reachable states, only one of these actions will be done. or zero of them. but if, your system, reaches some state that you don't have one of these tests for, then, it might do one of these, actions by accident. the presumption here is that, as i'll talk about later, we worry about the unhandled states basically those that, you haven't considered reachable that reach failure, very quickly. but, the others, we don't really worry about in (delta) plan.

S2: are we, are we equating states and sensor outputs so that, there's nothing wrong

S1: no no, not at all. [S2: not at all] no a state is, the typical, A-I planning sort of, um set of features and values that uniquely describe the world.

S4: so, the plan execution idea you don't have, there's no_ states aren't there. you just have to

S1: no the plan ex- execution system doesn't know anything about states.

S4: okay. but, su- suppose TAP-one involves checking the altitude and TAP-two involves checking the altitude, [S1: right] and that takes, you know a few milliseconds or something, [S1: yeah, mhm] does the schedul- can the scheduler in some way exploit the fact that uh, [S1: well, not, not] you could, you could, get (surrounded) by doing them both, or?

S1: not as part of the architecture but, for the architecture we have, for our U-A-V, um, we separate the low-level-controlled state estimation processes from the stuff that CIRCA does, so that it actually_ the feature tests are virtually instantaneous because, the state estimator already goes out and reads all of the features and stores them in memory, at a- which time any of these tasks have access to that memory. so for that specific case, feature tests mean reading something from memory. this is not generally the case because in previous versions of CIRCA there have been, robots that really haven't had any underlying, control mechanisms where feature tests meant actively going out and looking at something in the world. so, as far as the architecture is concerned all it knows is there're some functions do feature tests. and

S4: they don't take time? i mean

S1: hm?

S4: they don't take any time? (to do the)

S1: no, well, in the U-A-V they take a very small amount of time but we still have to account for the amount of time it takes to read something from memory. um for, the, general case they could take time and, the the times that we use to schedule these TAPs, include the worst-case execution times for both the feature tests and the actions...

S3: does this uh the attack classification, stay, static or change, depending on, where your control system is in?

S1: for any particular plan it stays static.

S3: why should it be though, if you're talking about aircraft landing problem or, aircraft control problem?

S1: well, the way we've designed, uh w- the aircraft control problem versus landing, what's the difference? <LAUGH>

S3: well like the good example the uh, the altitude the sensing, [S1: yes] uh when the airplane is uh thirty-five thousand feet above above the ground [S1: right] is not as critical as, when

S1: well we assume for for th- okay so, i'm hoping not to cause confusion here we have, for our unmanned aerial vehicle, specifically, designed the low-level controller tasks and state estimations and so forth so that's a unique situation for CIRCA. if you talk about that

particular situation, we assume that the state estimator, is sampling the world fa- th- fast enough to maintain an accurate, state estimate. so it can, figure out if it needs to sample the world frequently, on landing versus not very frequently, at high altitude and CIRCA does not concern itself with that. in general, CIRCA, would, assume that, for any particular plan, a TAP, the TAP schedule is constant. however it can split up the space into different subgoals. meaning that you can have one plan for high-altitude flight, and one plan for landing, [S3: mhm] in which case, if it worried about, um how quickly you need to actually sense the feature to avoid failure, that would have to be, um integrated somehow into the transition model in terms of how quickly you could fail.

S3: but it seems to me, the uh, altitude-sensing and elevator-control TAP, [S1: mhm] uh, could be, classified as, a best-effort TAP, or, the guaranteed or time-critical TAP, depending on which phase of your flight it's in.

S1: well i would have a tough time seeing that elevator-control could be best-effort but, um, so pretend that you don't care about altitude when you're at high altitude although actually i would care about that too because otherwise you could end up in this dive or, severe climb, so i would s- i would argue and say that they we- they were all supposed to be guaranteed.

S3: for example you can miss deadlines for several periods [S1: right] when you're in hi- high altitude whereas, in the

S1: right i mean with our particular airplane, that's not the case to the extent that we could make our airplane unstable because, once we enter a spin our controller, is not necessarily gonna be able to recover from that because we don't have a, full-state space controller that can recover from everything. so.

S3: okay.

<P :08>

S1: so anyway the CIRCA-two is what we use to generate those control plans and then to execute them. the, it's divided into two parts the planning subsystem and the plan-execution subsystem. the planning subsystem is in blue because, it's executed in soft or best-effort mode, meaning that, it takes as long as it needs to to come up with an accurate plan, that's scheduled, and the plan-execution subsystem is, the the part that, we require hard real-time response for. i'm first gonna go into the, planning subsystem algorithm, very briefly, so, when we start up the system, it first, reads in the user knowledge base which contains the state transitions the initial states goal states and so forth, and at that point, um we have a very simple algorithm right now that just, goes down through a list of subgoals and plans for them in order. so we select the first subgoal. at that point we run the planner, which basically starts with the initial state and um, develops the, the set of TAPs that it needs, um to avoid failure and achieve the goal, and it develops the deadlines for the guaranteed TAPs, which are then turned into a schedule by the scheduler. if the scheduler succeeds that plan is downloaded and everything's happy and we're all done. otherwise if the scheduler is unable to schedule all the TAPs onto the timeline that it has, it generates feedback for the planner, which then has to, make trade-offs to, alter the plan so that it can be scheduled. so that's what happens in the planner. um, i don't have a separate slide for the plan-execution subsystem because it's basically, a dispatcher which processes messages between, the planning subsystem and the real-time plan executor, and it also accesses the plan database, um which contains all of the

plans that it needs to retrieve in real-time for failure avoidance. i'll talk a little more about that later... so this is a simple example of something that might be generated by the CIRCA, planner. um, the oval talks i- is the, what i'll use to represent the initial state. so, this has three features, um, a navigation setting, a location in space and, um, an altitude. and these are heavily discretized just for the example purposes so, don't look at this and think that somehow the airplane's gonna fly itself with just these states. so, if you start out in the state S-zero, um we have what we call temporal transitions which are things that, can occur over time and actions which are represented by the dashed lines which um the, the planning, uh uh CIRCA has control over. so in state S-zero in in fact from any of these states, we have a temporal transition to, somehow you can lose altitude. this would correspond to, hitting severe wind shear or, something like that. and if that happens then you end up with low altitude which if you do nothing you're going to crash. um, the, there is one action we have to, avoid that which is to climb and that action has to be guaranteed in all of the states where the crash could occur from. so you also see that this, represents a cyclic state space um, and uh, also you see that there are temporal transitions to occur in a sequence of states which we we'll call dependent temporal transitions. so basically the, if everything goes well, you will, tr- traverse the top five states which is to, um set the next fix and then to wait while you fly to that fix and so forth until you get to your goal. <P :08> so, why do we want to have some sort of probabilistic planning in CIRCA we, first of all, um, we want to pri- prioritize states by, some measure and the likelihood of them occurring is the measure that we currently use. this enables us to use best-first search which currently, maybe it's not absolutely necessary but in the future, one of the things we're going to be looking at is actually placing bounds on planning time, um, wh- at which case best-first search will become more important. the others we

S4: search for what?

S1: hm?

S4: search for what?

S1: best-first search.

S4: what are you searching for?

S1: we're searching for all of the ways to avoid failure primarily, um in all of the states that are reachable from the initial state and then also, um at least one way to get to our goal state. <P :05> so, yes

S4: but but all the things that you're prioritizing are things, are are the, the ways things could go wrong, right so, best-fir-

S1: well, prioritizing here is strictly by state probability. so

S4: right but you don't, this this search is not, concluded when you've, found a path right because you you need to find, want to find all of the

S1: all of the paths to?

S4: to failure.

S1: well, that's what we're, when we relax our probab- guarantees from absolute to probabilistic what we say is that, we can truncate the search, and everything after we truncate the search, has some nonzero probability but, we didn't have time to think about them.

S4: okay so it's best-first search but instead of stopping, y- y- you're y- you're, proceeding until you hit some, some limit

S1: yeah, some some numerical, limit for, searching. [S4: th-] well although, i mean so right now we don't, have real-time planning so, i can't just say we're gonna plan till the time expires and then truncate that search because that can leave states with a ninety percent probability. so we have to think more carefully about how to do that and not have some ridiculously low probabilistic guarantee. that's the the hard trade-off that we haven't done yet.

S4: see that's not why i'm, i'm not sure i'm not sure, there's a probability, of_ involved with how, uh much of a plan you've been able to find, [S1: mhm] and the probabilities of the thing actually succeeding, when you execute it, and these are two, completely different things aren't they? so which which one are you, um?

S1: are you talking for the for the real-time plan or are you talking about strictly for

S4: which one are you prioritizing?

S1: well, so we're prioritizing the probability of ever visiting a state. so that we end up, cons- expanding first the states that we expect to visit with the highest probability.

S4: okay this is is this is as for priority for whether to put it in the plan, or priority whether, to be thinking about it in plan- during planning time.

S1: well, whether to be expanding it during planning, you don't put a state in a plan you put an action in a plan. [S4: right] so if you don't expand a state, then you don't have any action for that state. and you don't have to schedule an action for that state. so the idea is that by, setting a threshold and removing, uh basically we call it removing the states that are lower than that priority, or probability but effectively what's happening is that, we are just not expanding those states therefore we don't have any actions for them that are put into the plan.

S3: so sure to be plan time

S1: well, so

S5: would you, would you would you come up with a different plan if you, ordered them in some other way tha- assuming you still ignored ones that fell below some threshold.

S1: no i, yeah. that's, right now you would not come up with a different plan, because, the motivation for best-first search, right now, is, not really, as as strong as it will be when we try to restrict planning time. so right now if you, had the search ordered totally differently, and as you got to states that were unlikely just threw them out instead of searching, uh i- instead of expanding them you'd come up with the same plan. so the motivation for best-first search is really for in the future, to, be able to think about having real-time planning bounds.

S3: uh actually Mark has a valid point though. what what you're doing is attaching probabilities to states, [S1: yes] and therefore you can prune state-space, with uh, thresholding these probabilities properly, [S1: mhm] uh but you know it doesn't, give, the uh, probability of uh finding right plan,

S1: well, we haven't even really def- defined what the right plan is.

S4: so, i uh just to_ so, the reason you have to prioritize at all, [S1: yes] is somehow you can't do everything is the reason you can't do everything because you don't have time to plan for everything?

S1: no it's because y- you can't

S4: or because you wouldn't have time to execute the plan (accurately)

S1: cuz you wouldn't have time to guarantee execution of the plan with the deadlines that you have.

S4: okay so, is, probability prioritization necessarily the right thing? uh, for that, purpose?

S1: if you want to say that you're, ignoring unli- so you have to have some prioritization and, we haven't, any, in any way proven that probability's the best measure, for deciding what to ignore and what not to ignore. but, we consider it to be, at least advantageous if, you're going to ignore things to ignore unlikely things.

S4: (so often)

S2: so, so sketch a scenario ca- could you sketch a scenario where, this would be a very wr- a very wrong kind of way to

S1: the, where this would be a wrong kind of way?

S2: yeah, yeah

<SU-M LAUGH>

S1: well, i mean one one of the things that i claim CIRCA is not useful for, is in a domain where achieving goals is just as useful as avoiding failure. so, s- that's

S2: wh- what, what i, let me, let me offer something [S1: yes] i'll be, tell me tell me whether this is, uh uh i, y- one can imagine a situation where the, um, there are some events that are, somewhat less probable [S1: mhm] than other events. but the computational cost to extricate oneself from those events is so much less, that it might have been wiser to put your, the the ensemble of those, [S1: right. right, so so] tasks might be a wiser thing to to you know, you don't [S1: mhm] always want to search where the light is but sometimes it does make sense to search for your keys where the light is. so does that, is that?

S1: right. right so a little, yeah. well so a little bit later i'm going to talk about two different mechanisms we have that the scheduler directs the planner to, backtrack. the one that i have have mostly talked about here which is the one that has been fully implemented and tested in

CIRCA, is by generating this threshold for removing low-probability states. the second one that we've thought about at least from the higher level, how it works how the scheduler and planner talk to each other, is to identify a bottleneck task y- that doesn't, um that uses a lot of resources but it may not necessarily. it considers the probability but it doesn't focus only on that. so i think that kind of gets at what you're talking about, which is that maybe there's some task that's expensive and you wanna consider removing that instead of the threshold.

S2: so did you, pa- try to work up, a representation of the p- i mean, seems to me that there's a fun- there's a more fundamental problem, [S1: mhm] that, i don't hear you articulating, that we're, that, i don't, i'm not sure i know how to articulate it, [S1: right] but, i i don't believe that, i'm not sure that you've really, done your job in looking at the various ways that you could make the decision without having proof. and i think that, if not, pro- possibly not this month but [S1: mhm] maybe in the next couple months as you settle into your new, [S1: right.] situation you might, you might really make it, a more fundamental contribution by, trying to work out, what the pruning dimensions are. how how do, what are some of the, what, almost formally, what are some of the dimensions along which you could prove this. you know, large expan-

S1: well, so there's two basic dimensions, one is relaxing the deadlines for tasks and the other is removing them altogether or replacing them with a task that requires fewer resources. so the difficulty is, uh mapping that back to, the planner which thinks about states and actions to select for those states. whereas in the planner, basically the only control you have is over directing the backtracking and selecting different actions. um, we have, i- in, the dissertation i talked about two probability thresholds one is, uh, threshold where locally, you consider a transition to be preempted. which i called P-thresh or something like that. if that threshold was not, wa- you had to not exceed that threshold. so that speaks in terms of what deadline you're going to compute for an action. we haven't really come up with a principal way to vary that dynamically, so we set that originally and in fact in these tests we set it to zero, um because we have our simple, transition models for probability, but uh, in future work we hope to address changing that as well as this threshold for removing unlikely states. so that al- addresses the problem at least considering deadline, changing the deadlines in addition to, um, just ignoring states altogether... but okay so, let me move on then, since, i'm sure i'm gonna, at least approach two o'clock in finishing. okay so, i haven't said anything about uh, wait. i didn't even finish this slide let me finish this slide first, sorry. so, we have motivation. um, i think, so the requirements that we have for our planning um, model are to select actions compute their deadlines to preempt temporal transitions to failure, this threshold that i was talking about is kind of a, a line that you draw that says if the temporal transition to failure is, um, i- i- less, has less net probability of occurring then, um it's not go- you can consider it in planner, planning to be preempted, and then to account with dependent temporal transitions, which effectively state history effects how long has a transition been active, um. so, uh desired properties we want for our model is to, minimize knowledge-base size because a lot of the models, the knowledge-base models that um one has, are, uh very impossible to really think about that some expert in that domain would be able to sit down and make it. so we want to at least start to think about making it easy for them to create a knowledge base. and then also we want to uh, think about maximizing planner efficiency which we really have not come close to yet, but we wanna at least think about how to do that so when we talk about real-time planning in the future we'll at least have a start. so given that we started with CIRCA, why not just use its model. well it uses a nondeterministic model which, was very nice in terms of minimizing knowledge-base size, and uh, also in how it represented the state-space, um, with cycles and so forth, to guarantee failure avoidance. it assumed worst-case transition

properties, where it had a minimum delay where, transitions to failure you had to finish any action before that and that was totally inflexible, and it had a maximum delay for, reliable temporal transitions. um, you really couldn't do any state prioritization, because, you had no, notion of what was more likely than another state or really, and you had no flexibility of those deadlines in those delays either, and for the state representation it was either reachable or it wasn't reachable. since we're focussing for a tr- in trade-offs in this work, um we thought, okay well, if we had a stochastic planner we could think about things like, relative likelihood of states, and um how they change deadlines and so forth. so in our stochastic planner that we've come up with, um we, first assign, knowledge-base temporal transitions, um what i'm calling temporally dependent unconditional probability rate functions. basically what those are are histograms, of, for discrete time steps how likely something is to occur. so here's two examples of these rate functions. in one case there's a temporal tran- uh transition to failure which, is preemptible because there's some delay before it's possible. um i'll call this hit, hit collision-course traffic, after it's detected on radar so at time zero you detect traffic on radar, at that point it's at the edge of your radar so you have some time to, get out of its way, and based on where it started you have some maximum, probability of it actually hitting you which, eventually it'll pass if it doesn't hit you. another example of a temporal transition is a reliable transition which, all else being equal if you, have a c- a course set, and you're flying towards that, particular location you'll eventually get there.

S4: what does the unconditional, mean, in the, in the (plan)

S1: so the unconditional means that, if you have... two temporal transitions that could happen at the same time like s- in state S-one there, you have both fly to fix two and lose altitude that could happen at the same time that function that i showed you for flying to fix two, basically said, you're gonna get there. there's no question about it so it doesn't consider the fact that you might lose altitude. at, from that same state. so, we try to combine those effects to, give an overall, um, uh representation of, well if you go to state S-three then, obviously you're not gonna go to state S-four because, um, so we try to combine the unconditional, functions into conditional representations

S4: so you could actually, call it conditional on no other transition.

S1: right. <SS LAUGH> yes, you could do that. <LAUGH>

S4: okay as a r- is it also conditional on, uh, no action?

S1: uh, yes so if you put an action in then that also alters it its probability. in fact we rely on that because, like this crash, um transition will have some, function that shows that it's going to happen if you don't do anything. but beyon- you have to change that by having an action in, that says well actually, i'm gonna get out of that state, S-two and before a crash will happen so that effectively, causes the crash's conditional probability to be zero, at all time. so that's what we're trying to do with those. <P :07> and speaking of, how the action is specified, um we have, a very specific way that we think of a guaranteed action. now, if you remember from the plan, it was not an ordered set of actions so, um, one could show up, in a certain state at any place in that cyclic schedule and you can't predict in advance where that will be. so, worst case, you'll go all the way around the schedule and just barely meet your deadline. um that's represented by this max-delta which is the deadline. so, we represent the probability of, the guaranteed action occurring at the given time step by, this function which basically gives us, an equal probability of occurring between the current time step and when the deadline's gonna

happen. we don't really have a good representation for a best-effort action because, we don't really know, um, we haven't yet incorporated average-case execution time and haven't iterated between planning and scheduling to, try to guess at what the best, um function for that is.

S4: okay so this is confusing so, what does it mean to have a probability of, the action, i mean after all, you're contr- the action is what you're controlling. so what does it mean to take the?

S1: right. well you're controlling the action but you can't control where you are in this s-cyclic schedule when you do, so yeah, (where's my plan.) so, say you need to do TAP-three. if you first reach the state, at time four, on the schedule then, you will do, this TAP immediately so it will be_ happen within the first time p- interval. however if you are at time unit five when you first enter, um the state where TAP-three needs to be done, then, you won't notice that you're in that state until you go all the way around the schedule. so that's kind of the, the unpredictability of the

S4: so this is, so the p- so in a way you're modelling the planner's, unpredictability about what the scheduler's gonna do, or about how the, how- uh,

S1: w- about how the plan is going to be, [S4: about when the, when] uh where you're going to be in the plan when you execute.

S2: well it's the trajectory, you don't know the exact trajectory right, different trajectories are going to incur different, actions and consequence of what you have essentially a closed loop o- one second

S4: but essen- but essentially what the planner's controlling is just, does this thing get into the schedule. but given that

S1: well the planner controls whether it's in the schedule. and how

S4: right but it doesn't control, [S1: yeah] anything else, about when it happens.

S1: right. because the plan-execution is gonna

S4: so it so in deciding whether it's gonna get approved in the schedule it's figuring out, um, you know and with and with what parameters to put it in the schedule it's it's having to make some, prediction under uncertainty about, how responsive that thing will be, in some [S1: right.] executing schedule.

S1: right.

<P :05>

S4: so the actual choice the planner's making is, should i put this on the, schedule mkay.

S1: yeah.

S5: should i put it in, and, [S1: yeah] how frequently should i [S1: right.] ask it to be scheduled, so that i [S1: mhm] can guarantee that, between_ if if it just was tested and it was

false and then we just entered the state, how much time could elapse before we do the tests again and take the action.

S4: okay. so why...

S2: in a situation where tests are free, [S1: mhm] [S3: i-] would you even, would you do this at all.

S1: would you, instead of searching through all the states?

S2: yeah.

S1: well, the tests are almost free. but even searching through memory if you think of the exponential, worst-case set of states that you're gonna end up with they're not free anymore. so when i said they were free i meant they were free relative to going out into the world and looking at each sensor value each time you look at a feature value. so we're not willing to go back to the representation where you have, just the complete list of states because even in our simple little problems we have, uh potent- we have hundreds of states that we would have to look at. certainly in more, complicated problems we would have thousands or, more states. so

S2: but tho- a thou- a thousand, thousands of

S1: well s- it could be, i i hesitate to put a number on it because i mean this is an example that a grad student sitting, in front of a computer trying to do too many things comes up with for a model that,

S2: well no , you actually had a motivating implication [S1: right] i'm asking a question about that motivating implication.

S1: but we have not finished that model yet, and it's hard to say how many, well, when we, fly our airplane and it flies autonomously, we're gonna be looking at two emergencies, engine failure and airframe icing. and i'm, nowhere close to saying that's all you need to consider. so for each new problem that you add into your system i'm, i really don't have a good handle on how much, state-space complexity that's gonna add. <P :06> so, um <P :07> so anyway those were the state transitions that we assigned which we call probability, rate functions. um, initial states, we could have more than one, all the examples that i present have one, but you could have more than one in which case, we assume they all have equal likelihood cuz we have no representation of, how you got to those initial states. um, as i said before we do best-first-state expansion which right now is not, absolutely critical but in the future it might become critical as we, move to real-time planning. um and we, update all of the reachable state probabilities during each state expansion step. i'm sure the, members of the committee have, seen most of the set of equations in the thesis so i i feel like it would take me an hour just to go through those so instead i'm going to summarize and give an example, of how we compute the probability. so for each state that we expand, we first, estimate the conditional cumulative probabilities for the outgoing transitions, temporal and, the selected action for that state. we estimate the conditional probabilities from those unconditional, um, uh transition probabilities that we start with, and then we calculate the cumative, pro- cumulative probabilities by summing those, from time zero s- time step T-zero to when they, meet the convergece, convergence criteria, basically when, they're not gonna change very much, in the future. um the, we compute the action maximum delay which you can think of as the deadline for that

real-time schedule, to preempt any, temporal transitions to failure. um and, then we look at temp- dependent temporal transition effects also. second state after re, yes.-

S4: okay so okay so, sorry. what i don't understand is what exactly your, is this probability you're computing. this is, from a given state, [S1: yes] uh, given that you don't do any actions? what's

S1: no given, given that you, if, okay so first you decide if you need an action. that's a separate algorithm before you ever, talk about probabilities. if there's temporal transition to failure from the state, then you have to select some action or else you have to show that there's a reliable temporal transition. um otherwise, um, so so, before you ever calculate the probabilities you either have one action or no actions. [S4: okay] um at that point you have, probability rate functions for all the temporal transitions as well as, any action that you've chosen. and that would be_ so let let me go into the example and then i'll_ okay, no. okay, no.

S4: oh no no no no no no <LAUGH> no i really want to understand, you know, i i think i've, been getting part of it i want to get all of it. [S1: alright. okay.] so, uh you're gonna choo- given a state you've got a black box that gives you the action for that state, [S1: yeah] based on, just the local information at that [S1: right] state temporal transitions to failure or whatever okay? [S1: mhm, mhm.] so you can assume that, if you're executing the plan, you're gonna do that action. and you know there may be some uncertainty about, time. [S1: yeah.] of course there may also be some uncertainty about, [S1: right.] also making transition out of that state before you get to that

S1: yes that, we don't talk about that in this particular work it was, briefly referenced in, uh the original CIRCA but, the challenges_ so so in this particular work when you get feature tests for free, uh most likely i- if you start doing the feature tests you will end up doing the action and everything will be fine. however if you never, if it's a best-effort action in particular, yes you might transition out of that state without doing that action first, which is represented by the probability rate function, in terms of, you don't know exactly what time step you're gonna do a particular action so if you don't do it then one of the other transitions will occur.

S4: okay that's in this, model too so,

S1: that's, yes that's in this model

S4: so in this model you've basically got the, probability distribution, over the possible next states, uh and their ti- and the time of the transition, [S1: yes] given that you, will have sche- you will have planned to do this particular action, [S1: yes] and, that has some probability of happening, [S1: right] various times. um, okay.

S1: okay and the probability that we're computing is very dependent on, for the guaranteed actions what we set that deadline to because that affects, where that, max-delta on that rate curve is going to end up being, so.

S2: the- um, if i i didn't understand but i i when i pretended that i understood [S1: okay] what i said to myself was this noisy-or, [S1: yes] was a way of sh- short-circuiting if if you were gonna do a Markov chain, [S1: right.] then you've got a, transition matrix, [S1: yes] and in

some sense what this noisy-or is doing is it's picking up, some of the numbers in the particular row of that Markov, transition matrix.

S1: well it may not actually pick up any of them.

S2: it may not pick up any of them, i understand [S1: yes, but it could pick up] i understand but it's it's picking them off, it's [S1: it it would] it's pruning off, [S1: yeah.] for the particular s- for the particular uh, [S1: right.] uh expansion it's pruning off some of the, [S1: mhm] columns for that row [S1: right] some of the entries in the column of that row, [S1: mhm] maybe all of them. [S1: yes.] is that roughly what what's going on?

S1: yes, yes

S2: so it's it's a heuristic way of collapsing at the,

S1: yes and n- so it's a it's a heuristic way of, approximating both the state history effects [S2: uhuh] and, looking at the deadlines dif- for the different actions, and um, combining that so that you, don't have to specify this large matrix.

S2: so you you could have but, chose not to, [S1: right.] look at a cartoon version of this in a make_ completely made up, [S1: right.] problem [S1: yeah.] s- to understand situations where this is a very very, poor, we- well you really lose badly that way, that you would have been better off actually

S1: right well, you wouldn't necessarily lose this way because it's up to the user whether they, uh want to pr- want to fake conditional probabilities, into this knowledge base they can pretend they're unconditional but they can specify extra state features effectively, that make them allow, uh uh uh that allow them to have, more than one row or column of a Mar- of a Markov, matrix.

S2: you're colle- you're aggregating states, essentially. [S1: yeah, mhm] and,

S1: well it's not aggregating states it's aggregating, uh, conditional probabilities, and then trying to get them out.

S2: okay you're aggregating transitions from and to states essentially, right?

S1: yes, mhm, right. which, the motivation for that being that it's, it would be very difficult- i- it's more easy to think in terms of, state transitions where you have preconditions and postconditions,

S2: w- th- i guess what i'm trying to, the- there's a lar- there's a growing literature [S1: mhm] on factoring, [S1: mhm, mhm, right, yes, mhm] you know on aggregating factoring, Markov chains [S1: yes.] you turned a blind eye to that literature.

S1: i, referenced a couple of papers but then i didn't go into details of what they're doing.

S2: w- wh- why were you convinced that that was the wrong way to go?

S1: well, for several reasons one because they talk about aggregating, states in terms of, abstraction and feature extraction things like that but they they don't really consider plan execution and making that real-time at all. so they don't they don't produce step, part two of the plan, they don't think about deadlines, so in order to think about deadlines you first have to guess at which deadlines you needed, and then you'd have to consider those as separate actions. for your transition matrix.

S4: well, i i actually i don't understand that answer cuz, this particular question, this is a subproblem you've got it has nothing to do with the actions, right, it's just,

S1: what question is that?

S4: the question of what is the, uh relative probability of achieving these certain states conditional on some particular plan.

S1: well uh it's, it does have to do with deadlines.

S4: which is, essentially, you're essentially fixing your ch- action choice, and then saying what is the likelihood of various trajectories through state-space. [S1: mhm] okay, so, the fact that those people don't consider planning is kind of irrelevant right? because they just have machinery, for talking about,

S1: those people don't consider planning?

S2: aggregation, aggregation

S4: the people who look at, aggregation and whatever [S1: oh okay.] Markov chains are [S1: mhm] because they're just answer asking questions about, how do you effectively compute, trajectories and state-space with very large state-spaces by, you know, factoring into events and (actions) and so on. [S1: mhm] um, so you know might uh you know if someone handed you a black box that was good at that kind of thing you know, w- wouldn't it address your problem?

S1: i, would need to see the black box to be able to answer that, um i have looked at this mostly from the Markov process literature in terms of, using it for planning, not in terms of using it for, a particular domain as a black box. so, i- thi- the the stuff that i've read about Markov decision processes and, using them for planning, made it clear that you had to think about, the deadlines separately in order to generate this type of real-time plan and that it would be a problem if you didn't know what those were in advance. not to mention the fact that if you have to think in terms of state history then you have to add a lot of extra features in order to, uniquely specify the conditional probabilities. so, if there's some way that they get around all of this and still end up with real-time control plans then i'd certainly like to, be pointed to that.

S4: well, i don't think anyone would suggest that they solve your whole problem for you, [S2: right] okay, the question is whether s- you know, some of the technique, that comes out of that literature, uh, is, related enough <LAUGH> that, [S1: right.] that you you steal ideas from them.

S1: right. yeah, no, n- i feel like this is not done i mean if, you can ask my advisors that every other week i come into a meeting and say well, we can do this with a Markov decision process and the fact is we had to choose one particular route for this, work and i don't feel like it's done yet so i personally plan to continue to look, at this literature and see what happens.

S2: were you driven to make these decisions because you had an application, or were you driven, i mean w- w- why wouldn't you [S1: well, one of the reasons] wonder over this, this seems like a pretty central, issue.

S1: right. the, but one of the reasons that we made this decision was because, we were not, out to get the optimal plan we were out to get something that, was sufficient for our_ the guarantees that we wanted that was able to reach the goals. and so

S2: but wouldn't that vary with that domain, from domain to domain?

S1: what's, what would vary?

S2: your decision about what, which way to go. i mean if you're not going to take a fundamental view wouldn't your decision vary from application domain to (xx)

S1: right so, yeah so so one, future, um un- when i talk about unhandled states which hopefully i'll get around to eventually, um, i- one of the things that it talks about from a general perspective is how do you plug in different planning models, depending on how much time you have. so the way i would see it, this would probably be the slowest, version that we would have. in terms of uh, when we start talking about real-time bounds so one of our motivations was to think in terms of something that, we could later say okay we're gonna stop here now the- i know there are, um, ways to impose time limits on, Markov planning models but, it's difficult when you start exploding the size of things in this type of way to think that it would, also be able to come up with any sort of accurate plan. so...

S6: i have a question of a quite different sort, uh [S1: yes] relating to the way you bring in the world model, the environment and and the probabilities that are somehow associated with your, [S1: right] operation within that [S1: mhm] and thinking in terms of for example the icing context. uh i mean, um do you envision that you would actually have information about weather patterns and, spatially and temporal distributions and that that would, provide you some information about the, a priori probabilities that go into the Markov decision model?

S1: right that's, well, regardless of what kind of planning model we have, the original, but so

S6: that's right this this, i'm talking about the the way you find these probabilities that set the_ that provide the data for the problem.

S1: well the the motivation, for originally developing this kind of, um, where you'd have time intervals and probabilities within that, those time intervals was me going out and trying to find out the probability of engine failure for c- a Cessna, propeller engine tha- that's, o- over its life span cuz there has a break-i- a break-in period and then a b- some long period of time where it has about the same and then, as it approaches overhaul the probability increases again. so, the same would be the case with other transitions but, uh i mean i haven't studied meterologi- meteorology enough to know what they would be but that would be the idea is that, based on those reports you would have different, transition models.

S4: there's a particular issue here too cuz you're, i thi- weather is something that you would get, you get, uh execution-time information. [S1: mhm] about, and you're all talking about using plan-time, probabilistic. all this information you have here is plan-time probabilities.

S1: plan time? what do y- what do you mean by plan-time?

S4: in other words you have these models that use, [S1: mhm] alright planning time, okay?

S1: this is not planning time this is the amount of time that

S2: y- y- y- you're using

S4: you you you're using you're using this probabilistic information to make decisions on planning time.

S1: at planning time, yes.

S4: at planning time. [S1: uhuh] but whereas, weather informa- you know, weather [S6: well, you'd have both, probably] information that you would use, maybe have a planning time but [S1: right.] also execution time [S1: mhm] you'd find things that would change the, probabilities of different [S1: right.] temporal transitions which would change the actions you'd want

S1: right. so so right now what we would assume is that we would take a current forecast before you would ever take off and use all of the the transitions associated with that to develop your plans, and then during flight, um, this is something for future work, if any of those meteorol- meteorological events change substantially enough, that it invalidates your plan then that's when this real-time planning would be very important. to bring back in. but since we didn't do the real-time planning we also didn't focus on, what happens if these change during dynamic, execution. because we weren't ready to approach the real-time planning problem either.

S6: but there are a lot of interesting issues, uh that relate to what, for example flight-management systems, mostly now they just store data [S1: yes] so they can record it. [S1: right] and and and what, i guess one of the issues that i'm interested in is how, w- how your, attempt to incorporate some of this information in terms of planning, what that says about the kind of information that should be made available what kind of information do you really need about the [S1: right] environment about the world, [S1: mhm] uh because i don't think people understand that very well at this point and, probably

S1: no actually when when uh, i went off and tried to find out what the probabilities were for engine failure we called everybody no one would tell us.

S6: that's because they don't think about [S1: right] this higher level of planning that you're [S1: yes] addressing here and so and so, uh, these issues, well they just aren't thought about.

S1: right, mhm. right. so so, i think to summarize and then move on because i'm not going to finish otherwise, um, the, regardless of what planning model we have, i mean this is our current model, we haven't discarded Markov decision processes as a possibility i think that was obvious from the pages and pages i had at least talking about it in the thesis, and, we

think this sort of representation is appropriate because, the alternative is that you somehow have to, relate all of the different events that could happen to you, in order to build up, the conditional, probability representation before you ever start. so, this is our current model and, i'm certainly open to suggestions on what, (should happen to)

S3: uh uh Lisa c- can we do something in the middle like if you look at the cruise missile type thing where you, store some static information of terrain data right?

S1: of train data?

S3: of terrain terrain.

S6: maps of the terrain.

S3: maps of the terrain.

S1: oh terrain, okay. <LAUGH> oh i'm sorry.

S3: whereas you're dealing with a highly dynamic, you know unpredictable environment. [S1: right.] and, there, can we conceive of something in the middle...?

S1: i, can you define what you mean by in the middle? what is it in the middle of?

S3: it would have the meaning that uh, would try to use, uh static information as much as we can, but provide the provisions, for, these unanticipated

S1: well, right now, what hel- the events would have to be modelled as state features which is not unreasonable to think of, so to handle it with our current architecture we could model, uh one of these events occurring as a state feature and have that, be something we would react to dynamically. so that's kind of the next, part that i'm gonna get to here. so, i was gonna go through an example that talked about the computations of these probabilities, um, basically, in this simple example, i start out, um, having two temporal transitions, the blue lines talk about their probabilities, um unconditional, and the red lines talk about the conditional probabilities when you consider the probability of both of them occurring, um in the same state. at that point, um, we can calculate the cumulative probabilities which is that summed, from the time step zero to see what happens, um over time until they converge, basically until the sum of them approaches one or else, there is no probability that anything'll happen later, um which gives us these cumulative probabilities of sixty-five percent and thirty-five percent. and, um that also for this very simple example since it's a tree structure, gives us the state probabilities for S-one and S-two... so at that point since it's a best-first search we would go to S-one and try to expand it but in this, extremely simple example we'll pretend there's no transitions out of S-one. in which case then we expand to S-two. so, in S-two there's a probability of failure, so, we have to select an action which is the climb action, that preempts this failure and then we have to calculate the deadline, or max-delta to avoid that failure. initially we set that to infinity because we don't know what it's supposed to be, in which case we determine that it w- it will fail. so, then we identified, what the minimum delay is, for, T-T-F-zero, um which is five as you can see from the, um probability rate function, at which case we can calculate, um that the max-delta or deadline for the action has to be five also. that gives us these state probabilities for the entire state-space. um one interesting, the table on the center shows well what if you couldn't meet that deadline at five? um what if you, fail during scheduling then,

um at that point you would have to relax that deadline perhaps, or get a new action. this shows how, computing these state probabilities would, allow you to at least get a sense of what your probability of failure is so, at this point if you chose a deadline of six you would have a one percent chance of failing from that state, and if you chose a deadline of ten you'd have an eighteen-point-seven percent chance of failure. <P :08> so this is all very qualitative because i didn't want to run one example and say oh this is absolutely the way this curve looks, but looking at how this um stochastic model improves, um CIRCA's ability to succeed um when resources are potentially overutilized, for CIRCA it has a hundred percent chance of success and then, it can't schedule, things to preempt all variance in which case, it doesn't really know what to do next. um in CIRCA-two it has this ability to make these trade-offs which means that, its guarantees do reduce, from a hundred percent to some smaller number, but um, it still is able to have some, ability to continue and to develop a plan, however if the resource capacity really, gets restrictive till that it can't schedule anything then it will eventually fail too. so, so i mean it's, this is just acknowledging that if you don't have any resources then you obviously can't succeed...

S3: o- one more thing c- can't you handle more TAPs by using uh CIRCA-two architecture as opposed to original CIRCA?

S1: more TAPs?

S3: yeah more TAPs. [S1: well,] probabilistic i mean...

S1: if you relax their deadlines substantially you could. um it's hard to predict for any particular domain whether you'll end up with more TAPs with longer deadlines, or whether you'll end up with the same number of TAPs that just have, smaller worst-case execution times.

S5: well you do have, [S1: and have smaller deadlines] at times you have the, alternative way of getting out of a of a tight situation, [S1: right.] of letting the other transitions, take you out, [S1: right.] and the old stuff if none of those was reliably going to be able to do it then you were stuck but if the [S1: right.] combination of a bunch of those now will, [S1: right.] probabilistically take you out, [S1: right.] avoid having to schedule some.

S1: right. we we certainly have that but, i, it's, that gets kind of fuzzy because now at least the people at Honeywell claim they have this reliable notion of a temporal transition so that's.

S3: well i was i was thinking of the schedulability of, uh deterministic TAPs versus probabilistic TAPs, or the uh like the uh you know real-time tasks hard real-time and soft real-time. [S1: right.] if you allow some of the uh probabilistic,

S1: well so part of the future work that we want to do um i i did some separate work on quality-of-service negotiation, that hasn't really been put into CIRCA but the idea with that is that you would, degrade the sched- the the the the plan not only with the planner but also with the scheduler. um that hasn't been connected because we haven't drawn the line at, when do you let the scheduler trade things off versus when do you make the planner trade things off? when the planner alone is trading things off it really doesn't have any, mechanism to automatically say i want to make this a soft real-time task. um, however, in future work we hope to allow the scheduler to look at how it can degrade task execution to help it schedule things.

S3: okay.

S4: let's see um in your domain, i'm wondering how you actually get down that curve, um you've uh, you stated very clearly in your thesis that, safety above all, mkay [S1: right.] that you know you guarantee safety and only when you actually can't then you, sort of relax

S1: then you re-- relax, yes.

S4: so you, one of your states is i'm on the ground, [S1: mhm.] uh and if you reali- if you ever have to adopt a probability threshold, <S1 LAUGH> less than one why do you ever choose to take off, yeah.

S1: why do you ever take off? and actually that's one of the things i had trouble with when i first started working with the simulator is it said no i don't wanna do it. so i mean, uh eventually what i ended up putting into the system is it said well i'm gonna do what i have to but i'm going to fly, so it doesn't have this notion that, it gets scared when you have to relax

S4: so in other words it doesn't really believe you were lying about that safety deadline

S6: there are some people who operate, exactly in this way, because this <SS LAUGH> pe- people operate in this way they never, <S1 LAUGH> they never fly i mean, [S1: right.] you know, there are probabilities but they

S3: i'll give you i'll give you

S4: no no no but there's also this, this class of people that go around saying, safety is, of [S2: is gonna defy the opposition] uh you know is is is isn't really important and then they still, get on airplanes so

<SU-M LAUGH>

S3: i'll i'll give you an <SU-M LAUGH> example F-A-A gave [S1: yeah.] uh what the uh, the three-billion-dollar contract to I-B-M to build uh the uh next generation the uh automatic traffic, [S1: yeah.] air-traffic control, [S1: yeah.] control system? [S1: right.] and then they get the uh, halfway of the project, uh they cancelled it but legally stated restructured. the reason was the requirement was, probabilistic guarantee of safety, with uh seven nines. okay, point-nine-nine uh seven nines. and they couldn't really verify there would be this seven-nine requirement. they couldn't. and so they uh devised the requirement to six nines and five nines eventually said what the heck let's give up.

S1: okay. so

S3: so you know the safety is not really determinable.

S1: yeah. so so anyway i'm getting worried about finishing here so, real-time deadlines are requiring that i move on. so um, the second part, of the three parts that were the main part of CIRCA architecture, is talking about unhandled states. what happens when you ignore things or when you have an incorrect model, um well first of all as we said in no_ in great detail, you may not be able to schedule everything in one plan. in which case, um you have to be able to detect and react to important unplanned-for states as they occur. so, what we basically did was

to look at all the state classes that you could have and uh selected subclasses of those that we thought were important to detect, and then, implemented algorithms to do that. so... this is this picture of world state subclasses that's been floating around for a while um at the very outside we think all the world states that could possibly occur but then we acknowledge that we might not have, the model for everything, so the modelled set is within that, that all-world state set. um if something happens that's outside our modelled set since we can't even represent it we can't hope to do anything about that. within the modelled set we have those states which we've called the reachable states, um that we've planned for um there are some of them that can reach our goal states and some of them that can't. but anything that's planned for we've thought about avoiding failure so that's all um, that's all been taken care of. the other two sets which are the focus of, really the focus for, thinking about real-time catastrophic failure avoidance, are removed states. those are the unlikely states that we've talked about, where if you have some unlikely transition then you're gonna end up in the state that's not very likely in which case, that plus all the downstream states are not, a- are basically thrown out, of consideration because we're ignoring unlikely states. however since those are something that could occur we find them, certainly important to detect and react to. the last type the imminent failure states are those that, um we acknowledge that our model, may not be completely precise, so, basically, uh... if there is a transition that has not been put into your model and you get to one of these states, then it's very important to detect because otherwise you'll fail. <P :07> so, to detect these states we use the same, I-D-three algorithm that we use to minimize our, TAP preconditions that i talked about earlier, to bui- to d- build TAPs to detect each of those classes of states. um the TAPs for detecting removed imminent failure states are guaranteed because, one requires hard real-time response to those and the TAP for a dead-end state detection is best-effort. so reaction to when one of these states is identified, is to notify the plan dispatcher, which pulls a contingency plan to um execute if it's available otherwise, dynamic planning happens. so, at a very high level, this talks about the transition between different plans. so, say you start in this, um planned-for-states box. then something happens that takes you out of that set of states, um if it's something we call unstable, meaning that it's uh something that can lead to failure, then we detect that as imminent-failure removed state, and currently we require there to be a cached plan, um that we c- can recall in time to react to that state. um, alternatively, um if the departure from the planned-for states, is something that is stable meaning it won't fail but you don't know what to do about it then, we do dynamic replanning for that. so, looking again at how this, trade-off curve appears, um we had the original CIRCA and then we had, the CIRCA-two was just the probability model but no, um no plan cache, um which was, we talked about after the last section, now with the plan cache we're able to extend that out so that we um can, have fewer resources and still succeed however, um ultimately we'll run out of resources anyway, even with the plan cache in which case, um, that, is represented by, it eventually degrading also. and this this region when it first starts to degrade with the plan cache is where we have the motivation for real-time planning, because one of the modes that, could require real-time planning is if the plan cache is populated enough that, just searching and retrieving a a plan, um compromises the guarantees... okay, that was a lot quicker. so, the third, um item that we really addressed was how did the planner and scheduler talk to each other, when, a p- the proposed plan is unschedulable and how does that help um make the trade-offs. so the approach that we used is to guide the planner backtracking toward the schedulable plan. so, we actually did two kind of separate projects on this the first one is we presumed, the existence of a single-processor plan-execution platform, um which meant that the only resource we were trying to schedule was one processor. um in the second part, we looked at, what if you had one more than one resources, and uh, um basically like uh communication channels or, um more than one processor or whatever, and then we also looked at, well now that we have more than one

resource how can we think of fault tolerance in terms of, computational system failures. um and we also talked about uh, in the future, maybe this approach is not enough maybe we should have, the, um, uh, the trade-offs divided between planner and scheduler at which case, we look separately at, um how do you, um allow the scheduler to actually degrade the quality of service of tests, um, this work, i'm not going to discuss during this presentation because it doesn't fit into the CIRCA-two framework but uh, hopefully it will soon. so first, um we looked at the case where we have one processor and when the scheduler fails, on the uniprocessor execution platform, we first use the overall, processor utilization, which is basically the sum of the worst-case execution times for the tasks, which we represent as T-sub-I um, this is the same as TAP, um i talked about TAPs earlier, and divide that by the, separation time which is really, effecti- effectively the deadlines are max-deltas that we talked about earlier. when that number is greater than one you know that, you can't schedule, um all of the TAPs on the resources furthermore, since we have non-preemptible tasks, we also might have task pair conflicts, which occur when um basically the worst-case execution for a TAP is so big, that another TAP with a smaller deadline or separation constraint can't fit. with both of them at the same time. so based on, the probabilities of ever executing each TAP, we recommend a probability threshold for removing, um um or ignoring states (below it.) so this is, kind of algorithm one which i've referenced before in terms of, ignoring unlikely states. so this is also, so, as we moved forward in this we said well maybe, that threshold isn't really exactly what we wanna do, so especially when we, generalize and have a multi-resource um allocation and scheduling platform where we have, multiple classes and instances of the different resources, it's not so straightforward to compute one number and say well this is the number, that we want to somehow c- treat as a threshold and ignore everything. so, instead, at this point of course if you succeed then the schedule is sent to the dispatcher and everyone's happy but th- the interesting research case is when you fail. um with multiple classes instances of resources, you end up with a utilization matrix, for each class of resource, and over the set of tasks. that the scheduler can provide. <P :05> at which time, um we have an algorithm it's it's, to identify, the bottleneck resource, associated with each task which is basically saying, if i execute this task which resource does it use the most of? or, and and at that point, we have an algorithm to combine, task priorities which at this point are equal to probabilities but we do acknowledge that, maybe it should be more than probabilities when we assess priority, and also the, utilization for that bottleneck, resource to select the cost of the task, um that we then recommend that the planner, um, somehow change when it backtracks the next time so this is an alternative to just ignoring, states instead we now say hey planner if you can do something about this task, it will help make the plan schedulable.

<P :07>

S4: i- is there any, um sort of best-effort, uh in the schedule? i mean, a- a- the scheduler uses the worst-case, [S1: yes] times for everything, [S1: mhm] so, i would think that more often, that that that quite often there's a lot of slack in the [S1: yes.] actual schedule [S1: mhm] when it's executed. [S1: mhm.] uh, what does it do? during this time?

S1: what what do you mean what does it do?

S4: what does the actual execution system do, during the slack time?

S1: well so, during any of the slack-time intervals, it basically, inserts best-effort TAPs. so, there could be tw- there are two types of slack-time intervals some are, if, they're actually just holes, that result after everything else meets its deadline, then it executes those in there but

then also, y- you see here there could be a difference between the worst-case and average-case execution times and it also fits those best-effort TAPs [SU-M: the actual] into there but it's not, i- i- yeah so this is actual, that's not actual, i keep saying that.

S4: so, uh, whe- in this case when you're doing this relaxation, do y- do these, what were before the guaranteed tasks become best, treated as best-effort, TAPs?

S1: the, what relaxation?

S4: when you decide not to, do all your tasks, because you can't fit 'em in.

S1: uh, so right now the planner all it is capable of doing is, either selecting a different task which it hopes might, facilitate scheduling cuz in many cases it'll have a choice of actions that it can do, or else it, changes the threshold that it will look at.

S4: no no right but [S1: but] that determines, so at the end you've got this particular schedule, [S1: right.] how does it decide_ there's lo- there's lots of best-effort TAPs how does it decide [S1: right.] which ones, what priority to, to do those best-effort, um

S1: oh the the best-effort? so that hasn't really been a big, research issue for me i've kind of said well i'm looking at failure avoidance, goal achievement is looked at, separately so, we have this thing called

S4: no but once you're in the r- once you're in the realm of doing this trade-off, [S1: right.] you're, you're still also, talking about failure avoidance.

S1: right. so, right now th- th- the way that we do that is to say, we're going to split the actions into two plans so that we have a contingency plan and a nominal plan, and then all we have to do is schedule this, TAP that will detect this unhandled state and will go off and pull, this other plan and that specifically, is responsible for reacting to that unhandled state. so it's it's, that's that's all we do now in in future work we might do that.

S4: but but that only works when you just ha- fortuitously uh, detect the, (optimal plan)

S1: well it's not fortuitous if we have, uh i mean we build a list of the states that we hope to, uh uh that, at least have been identified as reachable and, then it's not fortuitous that we actually detect it when

S5: cuz those are the detection and response are guaranteed TAPs?

S1: right. mhm.

S3: well, we looked at it i i don't think it, this will work?

S1: what's that?

S3: no we looked at it the the testing for TAPs <COUGH> excuse me. [S1: right.] the other the other idea though you didn't address and you didn't really look at this overbook. because, the worst-case execution time is quite often you know the uh hundred percent more even one order of magnitude larger than actual execution time so in reality if you have a lot of slacks so

you can overbook in that case it's what's most you can guarantee it is not an absolute guarantee anymore, if, everybody takes worst-case execution time right?

S1: well, so so one of the things that i was hoping with the quality-of-service negotiation in the future, is uh to actually, provide mechanisms in the plan execution system that it will truncate execution of a TAP if you don't finish so if you degrade its quality of service, that might simply correspond to relaxing its worst-case execution time, to something that is closer to the average execution time which would allow you to schedule it and it would allow you to do it most of time but then if you ran out of time then you would truncate its execution.

S3: then you would have a somewhat of a imprecise computation model is what you're saying right?

S1: right. mhm, right... so, going back to the last slide so basically, we're now talking about the multiresource scheduling, and so for this system, um, we've started also thinking about, fault tolerance in terms of what happens if the com- computational resource fails. so to do this instead of having a general model that says okay as it occurs we're going to dynamically, um, decide what to do, instead we think about it in advance, by thinking about specific faults that could occur. so, fault F-zero would be everything works, fault F-one would be some resource of some sort fails, uh progressively worse through fault F-sub-N. so, the idea with this is that we improve, the response over a traditional real-time task-execution, system because we explicitly deliberate about what if this is the case what if we don't have, that many resources anymore. so we haven't implemented this in CIRCA-two so, if you ask implementation questions i'll say uh well this is how we hope to do it, but uh we're in the process of converting the plan-execution system so that it can handle multiple resources in the future. so i'll give a very simple example. um, this is an example of a s- the features uh, the uh features the uh airplane is on course, no obstacle and has normal status. uh two things can happen it can deviate from its course or it can, detect um an obstacle that it may collide with. both of these, we'll say, could result in failure by a temporal transition to failure so, we have to guarantee actions for those. so our single timeline's now exploded into multiple, timelines one for each instance of a resource the top two are for processors and one for each, class of resource the bottom one is a communication channel. we have at this point divided the TAPs into different modules which go together, to form that task this is, um more how the real-time, community thinks of tasks to split up into spe- separate parts, and fit them on the timeline so that they'll meet the deadlines... so, what if a processor fails? tha- that's the the one fault that we, think about with this particular example. well, since this, schedule, was obviously very much overutilized if you tried to map everything here onto this top timeline, you had to do something, so, at this point for this very simple example the planner determines that it actually can't do either action that it originally planned and this is, by several backtracking steps. so that it decli- decides that if it declares an emergency that, avoids the failures in all states. and at that point it's effectively trading off, um using lots of processor resource time, or using the communication channel to get air traffic control basically to tell it where to go next... okay so that example's leading into the next section which is, what we've actually done with CIRCA-two, towards autonomous flight. CIRCA-two had nothing to do with this airplane. so basically, uh the first thing we did was we, grabbed an, a simulator, shareware simulator called Aerial Combat, um and put a simple linear controller on it that allowed, gentle maneuvers take-off landing so that it was able to, fly around a pattern. so, the simulator basically looks like this it's uh, has a heads-up display and was originally designed for basically a human to play games with. but we, basically took all those inputs, sent them through C- through CIRCA to get it to control it instead... and, the simple tasks that we had it

um flying was to take off, going south on the runway, fly in a rectangle and go back so, as far as goal achievement its goals were very simple, flying to the next fix, um which is kind of what you've been seeing in the examples so far. so, during these initial tests we, inserted some emergencies basically by pressing keys on the keyboard, um that allowed us to think about what happened if, we failed gear-up on approach to landing, and what happened when collision-course traffic was detected. and we, carefully engineered the worst-case execution times and so forth, yes we engineered them we didn't compute them accurately, to uh allow us to make things not schedulable, to test the ability of the system to make the trade-offs toward, basically bumping, gear-up failure detection and collision-course traffic detection off to contingency plans, and testing the response of the system that way. so that in, the next set of tests, basically at this point, um um some researchers at Honeywell who were basically, working also with uh the original version of CIRCA, um took the simulator and uh, adopted it, as an unmanned combat aerial vehicle so they, kept the flight controller basically put in a bunch of missiles and targets and things like that, so that uh, they could demonstrate, the utility of the system for that, and i know the picture turned out terribly in the dissertation but this is, the idea is that there are various targets that you want to destroy, and radar threats and infrared missile threats... that you want to avoid... so i'll talk about, the example that, illustrates how CIRCA works with that, and then i'll talk about our ongoing research to automate the uh University of Michigan, Uninhabited Aerial Vehicle. <P :05> so for the, unmanned combat aerial vehicle this is again a simulator, we basically had a very specific, um trajectory that we were following so we didn't even model that within CIRCA itself. um, we had a waypoint ge- trajectory generator and it, basically identified the different targets that it would encounter on the way. so for CIRCA we specifically looked at failure avoidance. so, for the first test we looked at, how would the original C- um CIRCA system work. well basically if you took the original CIRCA system as is, it wouldn't generate any plan because, infrared threats and radar threats could not be, together scheduled on the variable, uh on the on the available resources. however, if someone manually went in, and then said okay, i'm looking at the likelihood of infrared threat versus radar threat and well since the, infrared threat is more likely i'm just gonna ignore radar threats. so this is a manual, computation that s- basically throws out this transition. at which case it is able to develop a plan to handle, infrared missile threats and, schedule those actions. however if i- a radar threat then occurs then, it has no model of that so it fails. <P :05> so in the next, generation of plan, we said okay we're gonna put this, CIRCA-two, stochastic planner in and see what it comes up with, but we're not gonna use a plan cache we're gonna make it fit everything that it can do into one plan and see what happens. so at that point, the, stochastic planner decides that, instead of ignoring the infrared threat, instead of ignoring the radar threats it's going to ignore the infrared threats because there's a very low probability of ever reaching, a state, a low-altitude state where, the infrared missiles can find the airplane, at which case it has a higher probability of success but it still fails if those are reached. <P :05> so, in the final iteration_ oh those are ugly, handwritten numbers, oh well. in the final iteration um, we put the plan cache back in, in which case the planner is able to plan for both sets of states by putting, the response for the, infrared threat into the contingency plan, into a contingency plan which is stored and retrieved when necessary. so this shows the probabilities for the various states, um to illustrate that, the reason the infrared threat is, less likely is because, um there is a low probability of going into this state. <P :06> so to summarize the trade-offs that have happened, um CIRCA alone with someone manually saying, okay i'm gonna remove this, um radar-threat transition from consideration, has a twenty percent chance of succeeding. basically, because, there is an eighty percent chance that this radar threat will happen in which case, it will fail because it won't do anything... with a single plan, CIRCA-two has, a chance, has improved the chance uh of succeeding to seventy-six percent, because this

S2: um how did the, how did you arrive at these numbers?

S1: uh basically by looking at the state diagram and looking at the probability that it'll enter, into one of these states that has, one of the threats that you wouldn't respond to...

S2: so, this is again, thi- this is not an approximation it's a s- this is the, this is a fact about the (statistics.)

S1: well, it's uh well it's an approximation, given that our stochastic model approximates the real world, but it's what our stochastic model is telling us is the guarantee, so. if, our stochastic model were, completely accurate then that would be the statistical, chance. so, and then with the plan cache since we're not ignoring anything we still have a hundred percent guarantee, and that's not approximate because we are reacting to everything...

S4: so actually, why do you even think of it as a plan cache i mean it's really just, uh the overall plan has [S1: yes.] (multiple) you know switches modes and um,

S1: you c- you can think of it like that um, we think of it as a cache because we're actually, um, have this definition of a control plan that includes a schedule and you have to le- have to basically throw out the old schedule and put in a totally new one.

S4: right but that, that switch is actually, specified in the plan actually, [S1: yes.] pretty directly as

S1: mhm. however you could use, the same contingency plans for multiple, nominal plans. which would mean that you would be effectively having one overall plan for your whole system if you wanted to think of it that way. i mean a- at this point when we get into terminology which would be saying that like, P-R-S has one plan for the entire system, or, WRAPS has one plan or, however you want to think of it. e- effectively yes, if you think of the whole system as using one plan then that's absolutely correct. but, in our terminology we think of whenever we switch schedules, that we're switching to a new plan. and it's not just schedules we're switching, a set of actions that get done also. <P :06> so briefly, i've been spending a lot of time working on, the University of Michigan un- uninhabited aerial vehicle, which the purpose of it is basically to, combine a lot of different technologies, for online identification, fault detection isolation recovery, and we can figure a little flight control to, fully automate the airplane. CIRCA's role in this, um is to be for, mission planning and fault recovery... so, here's a picture of the airplane note that it's not this airplane so it's still alive... and, very briefly, it has, lots of instrumentation and that's what's really slowed us uh, down a lot is, getting all of the, thirty-odd sensors and actuators to uh, actually be calibrated and, reliably talk to the airplane and, so forth. i'm, rushing through these fast cuz, it's not really CIRCA re- research i guess. so, the software, this this gets at, how, i was before saying that the feature tests were virtually free. the software processes on our, U-A-V, consist of not only, CIRCA, but also, the other support algorithms which, i i'll call them support algorithms but, each one of these boxes, some of them can be thought of as entire research disciplines in themselves, so we have a very set, architecture but um, the airplane has two processors on it and that's not subject to expansion so we certainly have computational resource limits. one of them has, a set of processes that, do the control and state estimation and, detect the faults and then they pass that information over, to the other processor which, contains the more high va- variability processes such as model I-D, and the CIRCA-two plan-execution system. on the ground, we basically have a G-U-I and then the soft real-time planning of CIRCA... so, so i've

talked about this um, the one processor in the U-A-V has a very fixed schedule, and does all of the fast real-time processes. the other processor does the slower real-time processes but they're still hard real-time processes. um, and then on the ground is the, soft processes where we really don't know the worst-case execution times. <P :05> so, instead of presenting res- results i am simply presenting a a test plan for the future because it became clear, several months ago that we weren't, actually going to be, um getting to the point where i could, use any high-level algorithms for quite some time because the, the low-level controllers and state estimators are still not in place and, of course CIRCA re- relies those, relies on those to do anything. so, we're in the process right now of, completing the tests to identify the dynamic-model parameters, and uh, the next step will be to verify operation of the high-altitude controller. although it didn't make it into my, thesis, um i hope to at that point, use CIRCA to think about, uh one-dimensional, trajectories and, one-dimensional emergencies to kind of get a, just uh a flight in, along the X-axis, and then an altitude to, get the con- the, airplane to react to, very, contrived emergencies in that way, and then at that point, um they will also introduce a lateral control the other researchers that are working on it. ultimately we hope to look at, engine failure and icing, and hopefully by that time, i will have a, better model of the actual, statistics, sto- for, um, the probability rate functions, for those kind of, um situations. so, to summarize, i've talked about, CIRCA-two, to generate and execute in hard real-time plans, that, hopefully will ultimately lead to safe a- lead to safe autonomous system operation. i've described a, probabilistic planning model, that has been used to prioritize states, and to, remove improbable states, um, when schedulability considerations require it. i've talked about detecting and reacting to unhandled states resulting either from these schedulability trade-offs, or from imprecisions in the model, itsel- i- in the knowledge base itself, and then talked about how, the, planner-schedule negotiation at this point feedback from scheduler to planner, can guide the schedulability trade-offs, during replanning or for backtracking during planning. then i've talked about how CIRCA-two has been used so far to, fully automate, um simulated and real uninhabited aerial vehicles... kind of a summary of contributions, um, to stochastic planning, it's not, uh of course future work, needs, remains to make it a convincing argument but, um, we believe this is an alternative to, Markov decision process, specifically for real-time plan development, um, when problem domains are so complex that, it gets difficult to think about specifying the problem for an (M-V-P.) um, we have looked at how multi-layer architectures can benefit from, thinking about detecting and responding specifically in real-time to unplanned-for states, and then we've talked about how, we could use, the ben- the capabilities of the planner and the scheduler together, to guide trade-offs and then, although we haven't really, fully automated an aircraft, we have begun to think about the problem, well, other than the simulator we began to think about the problem of, how to use such high-level reasoning mechanisms to, augment, um, the system response for emergencies where current flight-management systems would fail. <P :06> we have quite a bit of future work to, to look at um, in, all of the different disciplines. in planning in particular i've talked about, um, how to impose real-time planning bounds because in the worst case we can't store everything in advance and we, really have to rely on some dynamic, replanning. also although i didn't talk about this in detail, um right now we specify a list of subgoals for the planner, and we'd like to be able to dynamically develop those too. um, we also would like to continue evaluating our stochastic model, because it, at this point it's just, kind of been proposed and implemented but, we need to do further evaluations specifically to compare it to, Markov methods. so, for the planner and scheduler as i said before we'd like to, to combine the quality-of-service negotiation techniques with, the, right now the the planner backtracking to find a a schedulable plan. to look spec- at specifically the trade-offs of, when you should, degrade the task lev- Q-S level, and when you should do the backtracking, in the planner. um, for pl- plan execution we have been migrating CIRCA, toward a real-time operating system in the past it's

run on UNIX which, we could get kind of, guesses at worst-case properties at best, so for the U-A-V in particular, we're running everything on the Q-N-X operating system, and a- in parallel work we've been migrating the entire, um CIRCA-two architecture over to that platform. at the same time we will have things like thread support, and, that will allow us to be able to do better, um, multi-resource platform consideration within the plan-execution part of CIRCA. and then of course with autonomous flight we have, all kinds of things to do to think about, really, what features and what values do we want and how do they interact with the, flight dynamics and also how, can we look at, specifically the engine failure and airframe icing emergencies. that's everything. okay, that's it.

S1: any questions?

S5: questions <S1 LAUGH> from the committee?

S6: just a, personal question, [S1: yes,] i know you plan to, have some continuing contact with the, U-A-V activities here but, [S1: yes.] have you identified a successor from the A-I Lab who might uh, be interested in, continuing this?

S1: no i haven't, and i don't plan to because i plan to work, on it myself and i don't wanna be replaced.

<SS LAUGH>

S6: ah, okay okay, okay.

S3: that's a good answer.

S1: so we, we've talked about it a lot, and uh, they're gonna of course keep the airplane here because our expert pilot is here but, since my role is in large part doing software, and we are close to having MATLAB simulations of what we believe are the dynamics for the airplanes we can do a lot of the, uh software testing remotely. and then if there are major flights i hope to come back and, go out to the field and test it.

<P :07>

S2: did, did any of your implementations work? um, a-

S1: what do you mean did they work?

S2: well how would i know, ho- i, what i'd like to s-

S1: well i can bring you the video.

S2: well no, [S1: well it's <LAUGH>] i don't mean, i mean i, y- had, not not with the, i- i- not with any hardware but you had two different simulation [S1: right, mhm.] requirements and, the only, quantitative, i didn't see any quantitative measures of, performance or, or capabilities at all, [S1: right.] i saw a few numbers that you scratched on your, transparencies but i have no idea whether, these are good ideas bad ideas, can you help me?

S1: right well, that's something that i've been struggling with for a while and, the problem is, what do i plot what do i what do i, what do i show because, it doesn't really tell anything to show_ so you saw in the Q-S negotiation section i had controller response which made sense for that because we were varying worst-case execution times, for things like the controller and seeing what happened eventually became unstable. for, thinking about, whether CIRCA succeeds or fails, uh, these are such high-level responses that, plotting the trajectory of the aircraft really doesn't seem to make a lot of sense. and, since these are, high-level discrete values, the most i have been able to do is to come up with, here's the plan and, i could give a video on showing it flying.

S2: but you could stress, you could stress your plan in a variety of ways many many different ways i presume, i i mean what you

S1: well i can change, i, so that was the idea by uh, [S2: you have three] changing the deadlines [S2: you had three] and so forth

S2: you had three different scenarios i think right?

S1: yeah, mhm...

S2: uh uh

S1: so,

S2: so, wha- what would it, suppo- you know suppose you're running the F-A-A, in ten, twenty years let's suppose you know,

S1: well they don't like, <SS LAUGH> yeah they would want more numbers than that before they would give me a shot at running the [S2: um,] F-A-A but yeah,

S2: what are you gonna say to, people, are you gonna, you know next year you're gonna be writing, grant proposals. [S1: mhm.] um... how do you, how do you convince people that these ideas are, at least worth trying out some more?

S1: so, there are two, separate, ways that i am looking at this i mean one, avenue of me getting more plucks is to put this in with say the simple longitudinal controller, for, not only model identification but overall, what happens when you, uh detect this problem and do some, so so... i'm not

S6: are you saying you need a truth model somehow i mean a- to to really make, performance comparisons in some way. i mean you've got to have, something to compare with, [S1: right. s- so] and

S1: so far i've been, doing this kind of high-level comparison of CIRCA to CIRCA-two and, in the future i hope to_ the reason i keep talking about these Markov decision process models is that at least for that part i want to compare, the accuracy of that

S2: well i guess that's what i'm asking is what's, i'd like to understand how, i- in one particular application [S1: mhm.] if it's more rudimentary than your [S1: yeah.] most rudimentary one,

[S1: mhm.] how we can assess the goodness or the badness of the design decisions that you've made and i don't see that you've

S1: right, so... in terms of, calculating probability accuracy i think that the answer to that is to actually, implement the, Markov decision process planner in CIRCA and let it run and see what happens with all the complexity that it has. our current probability model is recent enough that we just barely have it working which is why the numbers were scribbled onto that slide, and it's not all that trivial to think of taking Markov decision software off the shelf and putting it into CIRCA because we have to customize it to compute all the things we want. so, and we don't really have, we're not really

S2: is it possible that you could articulate a tiny tiny tiny, scenario, and actually give (xx) some sort of (xx)

S1: well, i hesitate to draw these trade-off curves for a tiny scenario because i think that what we would end up with is two data points and we wouldn't be able to say anything about what they would look at_ look look like in a more general case because we're not, our goal is not to prove one, particular example works it's to show that the system somehow improves on previous results so, i have purposely hesitated to come up with a simple example and say look here is how it degrades because... the curve would basically have a very limited step-function appearance and would not be representative.

S6: l- let me add i mean the curves you have there of, [S1: mhm.] i guess uh, perform, the vertical axis performance versus

S1: yeah, resource capacity.

S6: uh yeah resource capacity. i mean, presumably if you actually had this implemented in some system for example the U-A-V, [S1: yeah.] one could do a whole variety, a whole scenario of test flights with a whole, grou- i mean you'd have to do, almost something like a Monte Carlo simulation, [S1: mhm.] to really build up, [S1: yeah.] the real cur- you know, to to get an experimental, [S1: right.] or a, simulation of the, [S1: mhm.] of that cur- that that rook or i i mean i i'm not, i think Don was asking something, more broad than just that measure but but it, i mean that's a measure but, [S1: right.] what you have is only an inkling of what those curves look like.

S1: right. yes, [S6: not] i i hope that came across, i- that, this is what i, would expect the shape to roughly look like but that it's not something that i am able to compute. because of the complexity of actually computing the the points on the curve and, the, how they would differ between different examples. so, i- i am not ignoring this problem, but i was, i've been thinking about that problem for quite some time and have not yet come up with a good way to quantitatively, measure, what's going on in terms of, making these trade-offs except to say well look here's the probability that we have in this case and here's the probability that we have in this case. and, here's how the schedule changes and so forth so with a simple example i can show different schedules but, i- the the jump that i have not made is in, getting some sort of, trend, or defining a simulation that even makes sense, to vary these parameters in because, when we have a simple domain that has two or three actions, and, two or three transitions, it's not going to give you a smooth curve and neat resource capacity it's going to give you jumps. because you remove one task, a- or you, change the deadline for that task, and it's gonna suddenly jump, along that curve. and so if i do one simple example that gives me a couple of

jumps and then i present that that's not representative of what we're gonna get for another example.

S4: but i think, you know you've got that overall curve but that's actually a composition of two separate things which themselves might be, analyzable, [S1: mhm.] individually, uh, (missing) so one of them is the probability estimation part, [S1: mhm.] which is separate. [S1: right.] mkay simulate, <LEAVES SU-M> you know, [S1: mhm.] uh, the transitions and then simulate and then your

S1: right and in fact the, the person who just left, is actually that's part of his research is he's, uh has a stochastic simulation where he actually, uh estimates, the probability errors of our model relative to the stochastic simulation where he, puts the rate functions into that simulation.

S4: okay so that's one piece [S1: right.] the other piece is, um, [S2: (xx)] models of resource availability and how that trades off with value for different thresholds that we need. and, presumably e- even that is up to the simulation (properties) is coming up with some parameters that we can vary. and i think that the overall result is just the composition of those two things, um, we

S1: okay... uh i'm not quite sure how to get that second part the first part i i can get for specific examples but again i'm not sure how that generalizes and

S4: see but the second part it doesn't matter actually what the states are you know it's it's really, [S1: mhm.] um

S1: it matters, [S4: it's] what's, s- the problem is [S4: you need you need] th- th- the variables here are the shape of the probability rate functions, i mean we've presented bell distributions and, reliable transitions and so forth but what is the generic shape we've had constant values, um we can do a generic shape for an action because we know how we model that but, for a temporal transition, should we use a coin flip or should we use something that, looks like an action that's reliable or should we use a, bell curve and [S4: so i w-] and then wha- what do you do?

S4: so i would take the results you know suppose you had a hundred actions they were all coin flips, [S1: right, <LAUGH>] you know and these are, the distribution of the, of the parameters and, um

S1: but it makes a big difference like, we have this model of dependent temporal transitions, how does that fit in and what does that, how does that benefit us?

S4: okay but then start from start from (xx)

S2: but you kn- but you know nothing you know nothing apparently right now, is that true?

S1: which we, know what?

S2: you know nothing right now really about the performance of your, unless you're here you are, w- uh, um working on these very very, [S1: yes.] demanding, difficult, physical, [S1:

mhm.] limitations, [S1: mhm.] without, much idea about how your, framework is gonna, perform in, some, over some variety of, settings.

S4: so i mean we wanted_ showing that it works well under favorable, assumptions all across the board, [S1: mhm.] when there's no, [S1: okay, mhm.] complicated temporal dependency (fulfilled.) [S1: yes.] that's a that's a starting point. [S1: mhm.] and that's sort of all the evidence okay now let's, you know investigate further (xx)

S1: so this is talking about, using a stochastic simulation to compare the accuracy of the results, as one part and then the other part is to, show that it actually, i- i mean what am i trying to show, that it's (xx)

S4: so so that's, so that these so that these trade-offs are relevant over a broad range of parameters, um

S2: that you got the right, that you that you got the right, levers here, you know? [S1: yeah.] i ha- i don't understand reading the thesis, thi- things are complicated enough that i, just don't have, a- an idea about, [S1: okay.] whether the choices were right or wrong, and in what context the choices would be right or wrong, [S1: mhm.] and, i think for future, for future, articles for future [S1: oh sure.] funding, [S1: no i agree.] for your own, you know to prevent you from, um going down, a costly, road, uh, in in the in the written application, which is even more painful than software i think, you know, um, i, it seems like it would be really critical to think through, [S1: yes, mhm.] what, what the system wants to do and whether it's doing that...

S1: so, i, thought i presented what the system wants to do,

S2: no i don't think [S1: but] you have, if you can't, [S1: okay.] if you can't, if you can't state test scenarios, if you can't provide s- s- test scenarios, or even, [S1: so,] come up with a range of Monte Carlo simulations where you stress i think

S1: the test scenarios were, intended to be, uh, the planner coming up with the plans and, showing that they meet the deadlines effectively, proving that given that particular, set of constraints that it can satisfy them and will work

S2: but we didn't see, we, you didn't you didn't have, y- you didn't parametrize those, stresses, you came up with one stress or another stress and what you, would want, i think what you would want to do [S1: mhm.] is you wanna study, the ways in which your decisions are wrong or right the decisions about what to prove and how to prove, are wrong and right, depending on the way your environment changes. you're [S1: okay.] trying to understand whether the_ you made some choices right you [S1: yeah, mhm.] deci- you took, you took something which you p- arguably model in a in a Markov, fashion. and you said i don't have time, i don't have the, i don't have the the the the, computational power and the time, to, to compute, uh uh in the, controlled Markov chain, style, [S1: mhm.] much less to analyze what would happen, [S1: right.] so what i'm going to do is i'm going to, i'm going to do a kind of aggregation, i think of it as [S1: okay, mhm, sure.] aggregation but i'm really not sure what you did. [S1: mhm.] um, the aggregations that you perform, have the effect of... i- y- you know the- they're right for some kinds of, [S1: mhm.] environments and wrong for other kinds of environments.

S1: okay so right now you're talking about the, [S2: the planner.] testing the abilities of the planner [S2: yeah] to come up with the correct, [S2: yeah] stochastic [S2: yeah] process uh,

S2: or or in situations where the, time rou- if you, revise the time cost, of processes, [S1: mhm.] um, whether the, planner, whether the, whether the, heu- heuristics that you're (introduced in) the planner could keep up with or could could track, um, those sorts of, changes in in resource capability. [S1: mhm.] i i don't know how to do [S6: but but] it, but i think it would be worth your while to put a a fair bit of time into this.

S6: but but there are so many levels of, of uh i mean there [S2: but] are so many factors here that, i mean that's a, certainly a key one but there are others such as, how well does your knowledge uh really, your, probability knowledge really map the real environment within which the system's operating, it's kind of a robust issue there,

S2: but the claim, but there's a claim, there's a claim for a contribution,

S6: uh so so so so, but but, but so so in some sense to average all that out, to do some test, the

S2: but that's not the claim that's not where the, [S6: right.] we've got the value-added is, the claim is not that we're coming up with better models, that's not what you're claiming to do what [S1: no,] you're claiming to do is come up with better approximations.

S6: no but there is a there is a question about how sensitive, the planes you come up with are to the data upon which they're based and that's one which, only by sufficient testing we might be able to get a handle on. and the hope is that, yours are not too sensitive but, who knows...

S1: i mean one of the challenges with me somehow running, uh a whole group of simulations, on, the aircraft simulator that i have is... uh quite frankly we haven't even been able to accurately characterize worst-case execution times because the simulators run on UNIX. and they have since i've had them, and so if someone else logs in then, the models suddenly become totally inaccurate. and, <S6 LAUGH> so, i... to fight that situation, i and everyone before me who has ever used CIRCA, has basically, padded the worst-case execution time enough that, on a good day you won't get that behavior. um, so, the thought of, somehow trying to, uh span, uh that, that sort of actually varying, resource capacity and things like that on that kind of platform is, not something that i find to be straightforward. now my hope is that by moving to the real-time operating system, and, which you can characterize a lot more accurately, that we can even do more dummy sort of, nonsensical, feature tests and have random number generators for tasks and things like that that sit there and wait for, varying periods of time that would show us when we met our deadlines and when we didn't without actually having a domain, to work in, but that requires, that CIRCA first be fully implemented on, the real-time operating system. an- which is very close but not quite there so i certainly have intentions to do those kind of tests once we're there, um but that will not be, with respect to the aircraft. so, um, hopefully that answers your question a bit better, um, it's not all that trivial to totally migrate, the CIRCA plan-execution software to the real-time operating system. um, we have kind of a special-purpose version that works with our U-A-V given that it has one processor and no more, um, and given that it has a specific set of tasks not a general set. um, but

S6: you've just identified your own limited resources.

S1: right. <S6 LAUGH> yeah. but [S6: trying to meet deadlines] we haven't been able to test them much because we don't even have model identification

S4: so let me ask you something cuz you know cuz the- all these answers seem to c- always be coming back to well i can't do it all, [S1: right, yeah,] together, there's always going to be something, well that's [S1: yeah, mhm.] going to be true forever, actually, not just the, it's not just the limits of the dissertation. [S1: right.] and, i guess what the committee keeps pushing, pushing back on is, well it's still possible to provide, pieces of evidence, [S1: right.] her- you know, about aspects, that will be, [S1: right.] admissible evidence even though, they don't capture some aspect [S1: right.] that's in your grand vision. [S1: well so] and you've got to sort of embrace that i think to

S1: right so the, f- the idea with the the n- the next generation of CIRCA student that's working here in the lab is that he's comparing, our current stochastic model with, um, uh the, stochastic simulations that he's running based on the actual probabilities and that should be able to yield some comparative results of what, you would actually see, versus what our model's predicting and he's, beginning to characterize that error but then, that's not my work. and, hopefully i can reference that work in the future, um, b- but i don't necessarily see myself repeating that work because he's using exactly the same model. um, i do see myself, i mean i hope before i wo- leave here, to have, CIRCA running on this airplane. which, would give me a specific set of limited computational resources to work with, and a specific set of software to work with it on, but, i didn't see myself spending the next two years waiting for all those processes to be available, so that's why, i want to leave now, <LAUGH> so, um, i i agree, and, i certainly plan to work on it. that's, probably the best i can say now.

S5: right.

S6: i've got to leave shortly so

S5: okay, we've got all the important, at least questions asked? correct? (xx)

S1: so if any of you want to talk to me, later, i'll certainly be around... [S5: okay] so

S5: thanks a lot

S3: thank you

S5: and i'm afraid we have to, (xx)

S6: (xx)

{END OF TRANSCRIPT}

Title: Fossil Plants Defense
Academic Division: Biological and Health Sciences
File ID: DEF305MX131
Publisher: Michigan Corpus of Academic Spoken English, English Language Institute, University of Michigan

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Recording Duration: 57 min.
Recording Date: January 31, 2001
Recording Equipment: TASCAM Digital Audio Tape Recorder with two external microphones
Language: Primary Discourse Mode: MLG Native Speaker
Participants: Number of Speakers: 9 Number of Audience members: 30
S1: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Female; Age: 31-50; Restriction: None
S2: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Graduate Student; Gender: Female; Age: 24-30; Restriction: None
S3: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Male; Age: 31-50; Restriction: None
S4: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Male; Age: 31-50; Restriction: None
S5: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Male; Age: 24-30; Restriction: None
S6: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Male; Age: 24-30; Restriction: None
S7: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Male; Age: 51 & over; Restriction: None
S8: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Male; Age: 51 & over; Restriction: None

S9: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Female; Age: 31-50; Restriction: None
SU-3: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Male; Age: 31-50; Restriction: None
SS: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Unknown; Age: Unknown; Restriction: None

Setting: Lecture Room, Chemistry Building

S1: here for Elizabeth Behenski, and i'm here to announce the, defense of um Beth's, thesis. and um i'd like to share with you something that um Josh Allens said and i think this had to do with completion of dissertations although the exact citation was not, clear. what he said was, <READING> consider the postage stamp. its usefulness lies in the fact that it sticks to one thing until it gets there. </READING> <SS LAUGH> so, (xx) that situation. Beth came here several years ago as a paleoceanographer, and um she completed a degree in the geology department, uh, a masters degree there and then wisely, saw that her interests really, lay in, terrestrial plants. and both her personal and her professional interests actually lie in um, terrestrial plants. and she's, been working in Ecuador for several years, in a basin where, fossil plants were known to exist but nothing had actually been presented um, in publication form, on on thos- those plants. um, she turned her interest, then from paleo-oceanography, to interpretations of, climate based on, fossil plants, and she's also interested in, how plants are affected by, uh mountain uplifting and, mountain building. and she's taken, advantage of the sessile nature of plants rather than being constrained by the sessile nature of plants she's taken advantage of that, um to determine paleoenvironments of the past. so how does that actually work? well i think Willa Cather actually explained this again, in a single sentence. what Willa Cather said was, <READING> i like the trees because they seem more resigned, to the way they live, than other things do. </READING> and i think Beth will explain, <SS LAUGH> how that actually works, a little bit more clearly so, i'm gonna let Beth go ahead.

S2: thanks Robyn for that introduction. um, guess i hafta, for the first time, <TURNS MICROPHONE ON> is that working?

SS: yes <LAUGH>

S2: (you all) can hear me sorry. um, what i wanna start with, i- basically is to say that, you know Robyn has been working in South America for a long time now and um, you know she sorta disappears for a while at a time, and i've gone down with her a couple of times, and one of the things i've noticed is that every time she introduces herself to people down there she says, my name is Robyn, people kinda look at her funny cuz Robyn's not a real common name in, South America and she'll say, you know, like Batman and Robin. <SS LAUGH> so um if i could have the first slide, uh, i finally figured out exactly what Robyn's been doing down there in South America every time she goes, and it turns out, um, <CHANGES SLIDE> <SS LAUGH> that she's been hanging out with Batman. <SS LAUGH> and i think actually that, with this light here you can't see very well, could you, get that so that, we can, see the slide? <LAUGH> sorry. instead you get to see Batman and Robin for, quite a while now.

S2: oh yay

SS: ahh

S2: okay. so obviously i cut and paste but i just couldn't resist. <SS LAUGH> um, so, we'll get into the um, talk now. obviously every, dissertation, that you go through as a graduate student you hafta thank a lot of people who get you there, so first i'd like to thank my committee, uh chaired by Robyn who, definitely helped me through, quite a bit. um others on my committee who helped me as well are Rick Golden who's from Duke University. Bill Williamson who's in the biology department works in the herbarium, Bruce Jameston Catherine Bagwell and Peter Half all in geology, made made up my committee and helped me, just, tons on this defense. also hafta thank a few people who helped me in the field get all my fossils, um Jim Behenski my dad who i dragged along, as a field assistant one year. i'd recommend that to anybody. <SS LAUGH> bring your parents as your assistants it's wonderful. um Gabe Townen who i dragged another time down there, followed me around and took notes, Dan Delaney who, came at the beginning the very first trip to the Nabon Basin with me and Robyn and collected just tons of fossils he's great at it. and Bill Rathert who, showed me how to use the air scribe and without it i would never have nice clean fossils to study. so thanks to them. also need to thank the Ministry of Agriculture in Ecuador, who gave us fossil permits to collect, and also to allow us to bring the fossils back to study, and the herbaria at Michigan, Field Museum and Catolican University in Quito, um, who, let me use their herbarium specimens to compare to fossils in also to score for some of the other work (um) we did. and of course, every graduate student has a slew of people behind them to help, just discussing their work, helping them day to day and, these people are mentioned here i'm not gonna go through the whole thing, um, one of the things about coming then taking time off is that, everybody that was here when you got here is gone by the time you finish so there's many many other people i didn't mention that, also helped me through. and then also my family especially my husband John and, my family and my in-laws who, were there with a lot of support. so now we'll start. so today what i'm gonna talk to you about is, the middle to late Miocene environment of southern Ecuador, and in particular what i'm going to do is use fossil plants sort of like Robyn said, to get at the temperature and elevation, of a particular basin, called the Nabon Basin, which is located in southern Ecuador... so just to ge- to orient you geographically, this is South America, topographic map of the continent you'll see that the Andes Mountains, run along the whole western, coast of South America, all along here, the whole length of the continent, and just as an aside, th- the Andes mountain range is the longest mountain range in the world today. and what we're going to do is we're going to focus in on one area in Ecuador here, in the northern Andes. so now we're drawing in a little bit on the northern Andes, and what i (had) shown here, along in Ecuador and Peru, are a number of intermontane basins that formed and filled during the Miocene, during the initial uplift of the Andes mountain range. and these basins are basically all similar in age, and they're all filled with, many many plant and animal fossils. and the basin that we're going to, talk about today is the Nabon Basin it's this very small basin located here. and a couple of the other basins in this area as well, um we've collected fossils from and are, in the process of studying as well so, s- at some point we might be able to have a really robust picture of what's going on in this area. here's a picture of the Nabon Basin, it's approximately a hundred and twenty kilometers square. and, um the basin sediments, were deposited over a period of, approximately four million years, starting thirteen million years ago in the middle Miocene and ending about nine million years ago in the late Miocene. and there are several types of deposits that are located throughout the basin. there are many, um sequences that indicate syneruptive, um, deposition, such as this, which is, basically ashfall... there are also lots of riverine sediments these are, a, wide series of channel fill and overbank deposits there's also a couple of coal layers in here, and these are, have abundant plant fossils deposited throughout. and finally there are

lacustrine sediments located in one are of the basin, and this particular site comes with its own fossil collectors. <SS LAUGH> so this slide, will basically set up what the rest of the talk is going to be about the broad, questions for this talk. we know_ and the bottom isn't focused very well. um, but we know that, basically twenty-three million years ago when the Andes started to uplift, that, the whole area of northern South America, was basically lowland tropical rain forest and that's what it says even though it's hard to see. <LAUGH> and, the Nabon Basin which is what we're ta- going to be talking about is located geographically approximately here. this would be the Pacific Ocean, and the, Amazon Basin is this way. and we know that, during the early Miocene this whole area was tropical lowland forest in a couple of ways. several uh, researchers have looked at the plant fossils that are, found throughout the northern Andes, earlier than, the early Miocene, and have found that they're typical of lowland tropical rain forest and, other types of forest, that are lowland, and also, throughout the northern, South American, area there's extensive deposits of, marine sedimentation which indicates that there were marine incursions happening during this period of time. means that the whole area was low enough, to have marine waters come in and not drain off immediately. so we know that it was pretty, low during the early Miocene. this is a cross-section of the Andes today, where the Amazon_ where the, Nabon Basin is, and you can see that it's a lot higher, the Nabon Basin is, approximately twenty-five, hundred meters, above sea level. and on the western edge of the Andes mountain range in, Ecuador. you can see um based on this diagram that i've shown the different vegetation zones as you go up mountains, that it's montane forest, basically today and, y- you go out into the Nabon Basin now you'll see that it is indeed montane forest. um, and down by sea level and in these lower areas up to approximately a thousand meters you do get, tropical lowland forest, and the intermediate is the submontane forest. so, how does this set up what we're gonna talk about? well, you can see i've got two time slices the present and, the early Miocene which is when, uplift began so, what happened in the middle? what'd it look like? how high was it? what was the temperature like? i mean today, the Nabon Basin is at twelve degrees Celsius, which, um for comparison Ann Arbor, has a mean annual temperature of about, nine degrees Celsius so it's a little bit warmer. but we know if it was tropical lowland in the early Miocene it had to have been a lot warmer than that. so, what temperatures were we at, in between? what elevation were we at? what type of vegetation existed, in the intermediate? the Nabon Basin, which was deposited between thr- thirteen and nine million years ago, will allow us to sort of see where exactly we were, in the sequence between lowland and upland for the Nabon Basin, for one specific time slice during the uplift of this basin. so how are we gonna do that? we're gonna look at plant fossils. there are very, numerous, um, localities in this basin that give you, beautiful plant fossils some are very well preserved, others are not. but just t- to give you a f- a few examples of the types of fossils that we find here, this is uh, probably a member of the Fabaceae which is a bean family... we also have, leaves that are toothed like this here, see the teeth along the edge, this is a um member of the Proteaceae which is the same family that macadamia nuts are in, and it's very common in southern hemisphere, floras today. and here's another one a member of the Cecropiaceae, it's a a, South American and African, family that's, very common, and tend to be pioneer trees. so, the way we use the plant fossils to estimate first paleotemperature and then we're gonna get into elevation from there, you can do, one of two things. one is you can use leaf morphology of your plants to determine temperature. and the way you do that is, basically by looking at the, characteristics of the leaves that you have in your flora. and, as Robyn had mentioned earlier, plants because they, are sessile and they, don't move, are thought to have, evolved, so that they can fully, exploit their environment the the way the leaves and the trees look, is_ h- helps the plant to fully exploit its environment and so what you would expect is that, leaves would look different, in different, environments. so what we do is we, use that relationship between the, shapes and

sizes the leaf morphology of these leaves and climate to determine what the climate was in that area. the second way that you can, figure out, uh temperature using plant fossils is using the, nearest living relative technique. and what this is is, to_ what you do for this is you, take all of your plant fossils and you figure out, the species that you have in your flora. and then, you figure out the closest modern species, the the one species that is related most closely to that species. you take the modern, plant and look at its climatic tolerances and then you infer that the fossil species because it is so closely related has the same climatic, tolerances. and if you combine a whole bunch of these together you can get an idea of the, temperature or elevation or rainfall, of the fossil flora. what i'm going to, um present and what i've done for this thes- for this thesis, is the leaf morphology method of estimating paleotemperature, um mainly because the, taxonomy of the fossil plants in the Nabon Basin are not well known, and so we can't really, um use the nearest living relative technique... so if you go outside, in Ann Arbor, in the summer, a lot of the plants that you're going to find, look something like this you might recognize this as a silver maple, and you'll notice that, there are lots and lots of teeth, on every single one of these leaves. if you look around a little bit more you'll also notice that many of the other plants that you see in this area have, lots and lots of teeth on the leaves as well. turns out that, that leaves with teeth on them are very common in temperate, cool environments. however if you go to a warmer environment, say Florida, south of there, what you'll find are fewer and fewer plants with teeth on the leaves and more and more plants with entire margins like these plants here. like this which is a magnolia. so, basically what we see is is just a, sort of observational, trend as we just look at the plants. turns out that this relationship, though people have noticed it for approximately eighty eighty-five years, was first quantified in nineteen seventy-nine by Jack Wolfe, using East Asian data. and, what he did is he plotted up the percentage of species in any given flora with entire margins against mean annual temperature, and lo and behold, that observation that people have been having for the past eighty-five years holds true, that indeed when you're up at, high percentage (of a) high mean annual temperature you have high, percentages of entire margin species in your flora... so it turns out that not just margin state, changes with climate there are other aspects and characters of leaves that you can use, to determine climate and what i've got here are just, a few different leaves to sort of point out some of the different, characters that you can look at. um one of the characters is, is the, leaf lobed, like this leaf is or not. um, obviously margin state there are other characters you can look at with the teeth, are they irregular like the teeth here were they, more regular than this? um, is it long and thin like some of these leaves is it, short and squat like this leaf is? other aspects you can look at are the base of the leaf the apex of the leaf. its overall shape is it widest in the, um basal part of the leaf or widest in the middle part of the leaf. and many different, equations have been, calculated that use, up to thirty-one different characters that you can, look at from, le- from a leaf. not every leaf obviously has every character um, but there are thirty-one different ones that people have looked at to compose different predictive equations for temperature. so, there are many, leaf characters you can look at, but if you want to look at, the relationship between climate and leaves_ and leaf morphology_ um, you wanna look at specific areas. and right now, there are many different equations that have been, put forth in the literature to determine temperature, and they come from, databases that have, data in them from different regions in the world, and, you can see that, lots of the world is not covered here. that, equation i showed you earlier was from this, region here all the data came from East Asia. and these, purple areas, which have, floras in them that are all in the CLAMP database which is what it's named, is the one, database that is used primarily when determining_ uh calculating temperatures to determine_ calculating equations to determine temperatures and leaf morphology. and i'll just point out that, the area that we're interested in, which is the Nabon Basin here, is in an area in northern South America where, uh there is very little data, collected for these databases you can see

some in, southern, southern South America here, i mean in, in central South America, um, but in northern South American there's very few data that's collected so, the first question i asked was, which published regression equation should i use, in order to determine the paleol- paleotemperature of the Nabon Basin? so what i did, is i composed a data set of thirty modern, floras from South America, and i went to the herbarium, and from herbarium sheets i scored, every species that i could find in the herbarium, that was listed for each one of these thirty sites, and i got the species lists from the literature. and, i got a whole, whole lot of sites from Ecuador basically because that was my primary region of interest but i tried to expand it, through most of northern South America because, i thought it would be interesting and, that it would increase the data set. and, the data that i collected from these thirty sites i used, to test published regression equations. i tested seventeen either equations or methods of doing it. and, there are four types. i tested eight simple linear regression equations that use one character to determine temperatu- to predict temperature. and most of those use the percentage of species with entire margin, which is what i had shown you with that first, graph um to predict temperature. two others use leaf size, as their predictive character. i also tested several multiple linear regression equations, all the multiple linear regression equations are derived from data from the CLAMP database that was the purple, database in that previous slide. and they use different numbers of, sites, from that database and different numbers of characters to predict temperature. i also tested canonical correspondence analysis which is a multivariate ordination technique. and that uses all thirty-one of the characters that, have been scored and that i scored from each of the floras. and the, final method that i used was correspondence analysis, which is followed by a nearest neighbor resemblance function and i'll just call that nearest neighbor from now on. basically it's, a a multivariate ordination technique very similar to canonical correspondence analysis, but instead of using the results of all of the, data that you put into the equation, to determine the exact value of temperature, you use only the twenty, um sites that come out close to your test site, in order to determine it so the idea is that, um, you'll get a better estimate of temperature if you're just using the sites that are, close to yours, physiognomically... and this is a really busy slide, i'm just gonna point out a few things from it. what this is are the results of the eight simple linear regression equations that i, tested. along the, X-axis is the observed temperature the actual temperature of the site, the Y-axis is the predicted temperature, which is the temperature that i got, after running it through the equation, with the leaf morphological data. the uh, diagonal line is the line of unity, and the dark line which is, hard to see here, is the standard error of the equation, and i've plotted it this way, the_ a better way to plot it would be to put the, standard error, error bar on each point. but for a slide like that and with so many points it would be really difficult to see, which points fell, with the error bars over the line and so this is just an easy way to see, whether or not the sites fall within the standard error of the equation. so you can see it there's a couple of, trends i'd like to point out i'm not gonna go through all of these, but, i'll just point out that the, the sites with high mean annual temperature, tended to be, predicted, within this clump here so that some of the sites are predicted accurately within the standard error of the equation, and others tend to be either, pretty f- much overpredic- overestimated, or underestimated. and you'll see that two of these equations actually do a pretty good job these two here, at_ with the, high, temperature sites. the other thing i'd like to point out with these is that these five sites here, are overestimated by every single one of the equations. um although these two, equations that were down here tended to do a little bit of a better job, predicting those and these two, equations down here are, not using percent entire margined, species, in the data se- uh to predict temperature but instead leaf size. so these six you can see that when you're just using the percentage of entire margin species, they, do a pretty bad job of estimating the temperatures, of these low-temperature sites. and um, just in case you're curious that one, uh equation or graph i showed you earli- earlier that showed the relationship

between, mean annual temperature and, percent entire margin leaves is this one here and you can see it does a pretty bad job of estimating temperatures in South America. here are the results of the multiple regression, the canonical correspondence and the nearest neighbor and you can see basically, that the trend is the same. you get a big clump in the high, um, temperature sites and then the low-temperature sites are all overestimated again. and here again, there are a couple of equations that do a pretty good job at least at the, low-temperature low_ at the high-temperature sites but not at the low. so just to sort of um, give you an idea of why that might be this is a really busy graph but i want you to concentrate on these blue Xs here. which are, this graph is again mean annual temperature against percent entire, percent entire margin species. and what i have is that CLAMP database which are these open circles, and then many of the other databases that, um create_ that were used to create a- the equations that i tested. and i'll point out, um these, green diamonds which are the Australian, data set, shown there, and i'll just, show you one thing which is, why i think, all of these, especially low-temperature sites are overestimated, is that in general you can see that at any given temperature, these South American sites tend to have a higher percentage of entire margin species, than other sites, from, different databases. and because of that these, sites tend to be overestimated when you run them through equations based on this data here. and i'll just point out as well that, it turns out that all of these sites in particular, from South America, are high-elevation sites. they're, low temperature and high elevation. because i'm going to be trying to figure out the paleotemperature of an area which was experiencing uplift and i don't know what elevation it was at, i think it's important that any regression equation or other method of determining temperature that i use to determine paleotemperature of the Nabon Basin, takes into account, uh, sites at all elevations so that i can, predict temperature at these low-elevation sites as well as the high-elevation sites. and so instead of picking one of these equations i decided i would, create my own, since i had now thirty, sites worth of, temperature and, leaf data. so, these are the same thirty sites earlier that i had shown in red plus one very dry site in Venezuela that i added, and twelve sites from Bolivia that were, scored by Kate Gregory, since they fall in the same space that i had been pulling out, i thought it would make a, more robust, um data set in order to include her data. the first thing i did is try to do, a regression equation that uses mean annual temperature, against the percentage of species with entire margin, for just South America figuring, that it might work. turns out though that it doesn't and this is the, slope of the line, the regression line that you get, uh if you, run that calculation. and you'll see that, um, there's a huge scatter, the R-squared for this line is about point-one-nine so you can see it's, not a real good correlation between the two. and you'll notice um, or, i noticed something when i looked at this which is that the sites tend to fall into three groups. you have this group up here, which are all the low-elevation high-temperature floras, this group here, which are, high-elevation low-temperature floras, that are dry they have low amounts of mean annual precipitation. and this group here which is, high elevation low temperature and they're very wet. they have very high amounts of mean annual precipitation above, a hundred centimeters and and actually um, most of these are above even two hundred centimeters of mean annual precipitation, whereas these sites here have less than a hundred. and i- it_ i can basically see that, because they're falling in these different groups, this character in particular, did a very poor job of, estimating mean annual temperature of all the sites in this group. so what i did do was take all of my cha- leaf character data and the climate data that i had, and i, decided that i was going to calculate, a multiple linear regression equation because one character didn't work i thought maybe combinations of characters would. and i started with all thirty-one characters, and eliminated many of them either because they weren't correlated with mean annual temperature at all, or very poorly correlated with mean annual temperature, or because they were highly correlated with another character, that was, better correlated with mean annual temperature. so what i ended up with was um, a

small number of characters that i thought would predict mean annual temperature. and, i- i'm not gonna get into how i decided that this, in the end was the equation i've chosen i did, many many many, um calculations trying to, get the best mean annual, u- best multiple linear regression equation. but what i've chosen is one that uses three characters, out of the thirty-one, to predict temperature. and the characters are, um teeth close, which is basically, leaves that have teeth that are close together as opposed to far apart. um mesophyll one, which is a leaf size character, it's leaves that are approximately six thousand millimeters square, and length to width, less than one-to-one which are leaves that are broader than they are long. and, what we end up with is an equation that, you can see, um for at least the low-temperature sites, does a fairly good job, of, estimating, temperatures of some of the sites and not others. but you can see that it doesn't overestimate all of our sites, which is nice, because now we can, actually use this equation to, estimate temperatures at any elevation. you can also see that up at the, um high-temperature sites which are low elevation it does a pretty good job, brings that in and, more accurately predicts, many of those sites. um, just, to let you know even though it looks like there are a lot of sites in here that are, not predicted well still seventy-two percent of the sites were predicted within the standard error of this equation which is, two-point-six, degrees Celsius. now um, one other thing to mention about this is that mesophyll one and length-to-width, less than one-to-one have both been used in other, regression equations to predict temperature in the past. um, however the departure with this equation from any equations that have been done before is the use of the character, teeth close instead of, percentage of species with, or without teeth. um and i'll just explain why i think that is and, you'll remember in the last slide that there was a, grouping of, sites based on, their amount of mean annual precipitation, when you use the character, um t- presence of teeth. however, if you plot up, those same sites but use, teeth close the pr- the number of species or the pr-proportion of species that have teeth that are close together, instead of just, that have or don't have teeth, they form_ they they draw them in and they form one clump instead of the two separate clumps and so i s- think what we're, seeing here is that teeth close, is a character where at, low and high precipitations at high elevation they're very similar whereas percent entire margin is dissimilar, therefore it's, better to predict temperature from that character than percent entire margin. and the combination of these characters together does a better job, than any one character does, for South America. so now we've moved back to the Nabon Basin we're, no longer just in the all of northern South America, but, again in Ecuador, this is the southern end of the Nabon Basin, we're going to use the, temperature, predictive equation that i've just, um, explained to you, to predict temperature and then, eventually elevation of, the Nabon Basin. so what i have are plant fossils from twenty-five localities in the southern end of the basin they run through, um two formations, but we won't be looking at all of the_ all of those formations today... so the nice thing about the Nabon Basin is that it_ many of the layers have been dated. and we can place the plant localities within a stratigraphic framework, that's been dated. the dates here are argon-argon dates that were um done by Golden and colleagues, several years ago, and, i've plotted them up on the, stratigraphic column here and you can see that, at least the plant localities that i'm going to be looking at, were deposited between twelve and, eleven-point-two eleven-point-three million years ago. one thing you'll notice here is that i don't have all twenty-five localities on here. and the reason is because, predictive equations that you use to, to estimate temperature... have high errors, when the number of species that you, that you use, um to predict the temperatures is low. and so, what you should ideally have is twenty species in your flora, or more. the reason for this is just that if you have a, small number of species and you find another plant fossil of another species, that, the amount of change that that species introduces is pretty high and so therefore your, temperature estimates are gonna change a lot in between, um fin- in between the, estimating temperature from the first flora and estimating temperature with the flora plus the one species. when you have

higher numbers of species and you add one more the percentages, of any given character don't change that much and so you don't have, uh as much of a change in temperature so, basically your your error goes down, the more species you have to predict temperature. and so what i did is for several layers, for several stratigraphic layers like h- here where, two plant localities were very close together stratigraphically, i combined, the species, in each one, so that i would have higher species total and i did that up here too. and then took every stratigraphic layer with fifteen or more species in them, and used that to determine temperature. and, i realize two of these don't have twenty, um, Povey et al have suggested that you only need fifteen, in order to have, suitable error estimates, fifteen species in your locality but um, today i'd say the consensus is probably twenty. but i'm confident that the, error introduced by the low numbers of species here, is not real high. mainly because um, the diversity of these places is, p- is pretty low. i haven't found a lotta new species every time i've gone. so if we use the temperature equation that, i calculated from the modern, um, neotropical sites, and calculate temperature at the four stratigraphic levels, here's the strat column just for um, reference, you'll see that, what we have are temperatures that decrease as you go upsection i'll just point out that this is high temperature and this is low temperature down here. and just, to point out as well this one uh, site in red at the bottom, is from a site with only twelve species so the error is really high in this one site, and i'm not gonna be talking about that site at all but i'm just, illustrating it um, just to show you that if i did extend it out a little bit, you'd end up with the same trend but um, you can sort of ignore the one in red. so, so what i found is that, uh as you go upsection, the temperature, of the Nabon Basin decreased from approximately twenty-two degrees Celsius, up to, uh sixteen degrees Celsius so it's a change of about, um six, degrees Celsius. so now we have a, temperature estimate for this basin, we need an elevation estimate for the basin or, we'd like an elevation estimate for the basin so how do we do that? well it turns out there's a, really really good correlation between elevation and mean annual temperature, in the neotropics. uh once you get out of the neotropics you also have to take into account latitude, that influences temperature as well but when you're in the neotropics you can discount latitude, and you'll see that the mean annual temperature changes, very well depending on what elevation you're at. the, lapse rate which is the change in, temperature as you go up in elevation is, globally, uh if you average it globally is about six, degrees Celsius per kilometer and many people when they try to determine, elevation using temperature use this global lapse rate but i felt that, because lapse rates can change depending on where you are in the world, a better estimate of the elevation in this area would be, using a lapse rate from, uh sites in, the neotropics, so what i did here is i took uh elevation, and mean annual temperature data, from four hundred and sixty-seven, neotropical climate stations and plotted them up, and y- got a lapse rate of four-point-six-eight degrees Celsius, per kilometer, elevation you'd go up so you see it's it's a lot different um we'd get, very, different elevation estimates if we used the global average lapse rate. um, and this equation actually has a very small standard error because it's so, um, significant, and other, methods of determining elevation, tend to have much higher, uh standard errors. so using that equation, on the temperature estimates that i got used the, equation that i calculated before, um i, estimated the elevation of those same four stratigraphic levels. and you'll see, here that, um, as you go upsection in the basin, that the elevation increases from approximately nine hundred meters to almost two thousand meters, up at the top, of the um, stratigraphic column, that has plants in it. so, one of the things we can do given that we have this nice dated section, and we also have, elevation estimates is we can calculate an uplift rate for this area. oh and i'll just point out_ um sorry that i forgot this_ that the error bars that are shown here're actually wider in the three hundred and thirty-seven meters. and the reason for that is, that, i estimated elevation, from an estimate which had an error associated with it, and so i calculated out a new error for these, these error bars are almost six hundred meters which is a lot, bigger than either, the

eler- error you would get with temperature alone or the error you would get with just the elevation estimates alone. um, so, so i can calculate uplift rate here, um, and the uplift rate is different depending on whether you use the twelve-million-year-old, date down here or the eleven-point-six-million-year-old date, um, but what you end up getting basically is if you use the twelve-million-year old date, the uplift rate during the deposition of the basin, is one-point-four millimeters per year plus or minus one-point-four. and if you use the, eleven-point-six, date, um and this_ with the twelve-point-oh date that would be over point-eight million years. you use the eleven-point-six date, what you end up with is an uplift rate of, two-point-seven millimeters per year plus or minus two-point-nine, and that would be over point-four million years. so either way, you can see that there's been, uplift, during this period of time, and granted the e- error estimates on this uplift rates*(sic)* are high, um, basically because i had to, take into account the error of the temperature and elevation both, but i will point out as we're looking at this that um, this_ the f- the fact that uplift could be occurring during this period is corroborated by, other researchers who've been working in the northern Andes, and using geological proxy to determine elevation. um for instance, van der Weele and his colleagues have been looking at uplift rates in Colombia and found that at a period between, twelve million years, and about nine million years they saw increased rates of uplift during this period. and Savin, and his colleagues have found the same thing, during the same twelve to nine million year time period, in Colombia so, i think what this shows or, what this might suggest is, uplift was indeed occurring here during the basin sedimentation, just like it was to the north and south of it... alternatively because we have, an elevation estimate, for the time period of the deposition of the Nabon Basin and we know what the present elevation of the basin is, we can figure out uplift rates and look at changes, in elevation and temperature, and vegetation for that matter, uh since the basin has been deposited. so what i did here is i took those bottom three, stratigraphic levels all of wh- which are in the same stratigraphic member, and are deposited in the same type of sedimentary environment, and combined them together and got an average, temperature and elevation estimate for those sites. and what i ended up with was an average elevation for those has increased since the m- Miocene during the deposition and we've seen continued uplift since that period. um, i'll also point out today's, vegetation was montane like i had mentioned earlier. and based on the elevation and temperature estimates that we've, had, from the Nabon Basin, i'm going to suggest that the, vegetation of this area was submontane vegetation it wasn't montane like we see now and it's, too high and too cool, to have been home to uh tropical lowland vegetation during this period. so, first i'll apologize this is this that this, slide is in Spanish um, the English version didn't come out, so you get the you get the early Spanish version. um, but what this basically shows is, something similar to that slide i showed you earlier, with, with vegetation types, and as you go through this, elevation increases, or, you could also say, that temperature decreases, um, in this, diagram and there's also a a precipitation component, but, what we've talked about and what is, um, shown here also is that as you go up in elevation you go through different types of vegetation type, and so, uh in the early Miocene what y- we have is, lowland vegetation, what i think we've got based on the elevation and temperature estimates of the Nabon Basin is submontane vegetation and today in this area, we have montane vegetation. what would be really nice, and what would be a a a, great thing for me to do_ afterwards i'd like to_ is also if you look on this graph there's this precipitation component so, during the Miocene where were we wer- was it real wet, there? did we have um submontane, tropical uh_ did we have submontane rain forest or was it more desert-like in these conditions? and basically we could go through this whole exercise again, from the beginning testing, precipitation equations and trying to figure out the best way to, to estimate precipitation in this area. i think that would be a good, future, um direction. so what we have are, a couple of different types of conclusions. we have individual conclusions based on the s- the questions that we asked throughout this

talk, and i'll go over those now um, you don't have to read a- all of these obviously but the first is that, is that most published regression equations, um are unsuitable for predicting temperature of neotropical sites. and in particular they are unsuitable for, um, predicting temperature of the high-elevation sites, and this is not to say that they're all, bad for all sites in South America, um but, in general, um published regression equations don't do a du- good job of estimating temperature for, those um neotropical sites. secondly, um a simple linear regression equation based on just percentage of species with entire margin, doesn't seem to be um suitable for predicting paleotemperatures of the neotropical sites that are high elevation and high rainfall. and so, because of that because i want to be able to pre- to make sure that if the Nabon Basin was at higher elevations or at higher rainfalls, i've, recommended that, a multiple linear regression equation that, i've calculated based on three, different characters should be used, to estimate, paleotemperature. um, thirdly the paleotemperature of the Nabon Basin has decreased over the period of basin sedimentation, by about six degrees as you go upsection. and at the same time, i think the reason that the temperature has decreased is because the elevation of that basin, was increasing during that period of time and, we can calculate an uplift rate, during that, sedimentation which, indicates that, uplift was indeed occurring during this period. and then finally um based on elevation and temperature estimates, the Miocene vegetation of the Nabon Basin was probably not montane, like it is now, but submontane, and i also think it it probably wasn't, tropical lowland, like it would have been earlier in time. but we can also u- draw some broad conclusions from this which is, you know i, looked at, a time slice, in the uplift history of the Nabon Basin, about twelve to nine million years ago which is, halfway through, when the, uplift started and the present, time. so what we could see, by looking at this is that, by the time of the deposition of the Nabon Basin, um, uplift has occurred in this area. and, the, area's no longer strictly lowlands, and we can see this, by looking at the temperature and elevation estimates, showing that uplift has indeed occurred by twelve million years ago. and also, um in conjunction with this, by comparing the elevation and temperature estimates to today you can see that uplift has indeed, continued since the deposition of the Nabon Basin and that there have been changes in, vegetation since that period of time as well and um, that the present elevation in temperatures were not achieved, by eleven million years ago. so what i'll leave you with since you just saw a whole mess of blue slides one after another are, two images of Ecuador, um this is one of the tallest mountains in Ecuador, who knows, uplift is still continuing in South America maybe the Nabon will end up, this high. um, this is, a view on the way down to the Nabon Basin. and uh secondly, picture of my dad the field assistant, <SS LAUGH> hanging out with uh one of the, local Nabon residents who, wanted to share his room. so thanks um, and i'll take questions.

S1: before we start questions i just want to remind those of you who may not have heard there's a um, party at my house this evening to um, celebrate Beth's defense and there's maps here it's in Saline so please take a map and um see us there about seven-thirty. and, does anybody have any questions?

S2: (questions?) yes Mark.

S3: um you said, you didn't use the, nearest relative, thing because most of 'em weren't identified, for the ones that that you know more particularly what they were did they seem to fit in that they were, typically submontane or they're not that (specific?)

S2: what i'll say with this is the the, given the tentative identifications on, on some of them and others that i think are m- are, more robustly identified. it's impossible to really say, that

well, they don't contradict, the, temperatures and elevations that i've gotten from the leaf morphology data. the the the problem, i guess you could (that) it's not really a problem but, but the problem with that is that for those, particular um, species and genera, the range of tolerances is pretty broad, and so, so i could say yes they probably did occur in submontane but i can't rule out, that those particular species might have been lowland, and others partic- particular species, um, montane. but in general if you look at the whole, um range of the species that you see, y- you can't say that it wasn't submontane by looking at them. so it, you know... anyone else? yes (Bob)

S4: i have a, question it, not, it's related to your work, but it involves Africa cuz i'm more familiar with that. Jonathan, Kingdon in his book Island Africa suggested that, in the Miocene, there were times when it was considerably cooler in East Africa, and so montane species that you see, just at very high elevation now and places like the (Ruwenzoris,) that are shared species between these different isolated mountains now, managed to, travel managed to communicate, between these, mountaintops, by coming down only during these cool, times. but in your presentation you suggest that the plant, plants that you find at these, these cool temperatures are also, sort of limited to these, altitudes. so i'm a little unclear of how his story works and how it fits, with the conclusions you have. [S2: um, (you mean that)] in other words, is it possible, that he's wrong about how you get these species from one top to another? (xx)

S2: well it it, it's possible i i i don't, um, i wouldn't say that it's_ he's wrong though necessarily. i think, at high elevations in the Andes, what you're seeing is a period of, of uplift and so plants that were, that were present before the period of uplift, um may have evolved in place and actually Kroonenberg and his colleagues have, have suggested that, um, elevations in the Andes were too high, by the time the land bridge, um, was established between North and South America, to say that all of the high-elevation, species came in from other areas that were at high elevations. and that and that, basically the um, the plants that were in place had to have started to modify, based on their environment by then. and so i i think, there also during glacial periods, there there_ it has been suggested that, temperatures were decreased at lower elevations, in the mountains and so i- if that is the case, you know, [S4: you would be able to get there] um, you would be able to go from, mountaintop to mountaintop during those periods. but that was sort of they think restricted to periods during the Quaternary when there was glacials and (saline sea) got less. but the elevations were pretty high i mean in Colombia by the, late Miocene you see elevations that are, high enough that anything coming in over the land bridge or coming in from, southern South America where the elevations, became higher earlier, um could've come through, then on those, um (peaks) or at least you know (long ones) out there. yes.

S5: has anybody else calculated, uplift and sort of (timing of) uplift rates for that part of the Andes and how do your rates compare?

S2: yes actually they have and using, a bunch of different methods i, s- compiled a database which i didn't show here about thirty different uplift rates that people have done in that region. and one thing you'll notice is that depending on the time period you're looking at you know, like as i did when i calculated the uplift rate only during the sedimentation it was pretty high, and since since the deposition of the basin was low, and those, actually coincide with other, uplift rates that have been calculated throughout that, region during that period. so, tha- it's close. i mean i i- th- it doesn't raise any flags those rates don't raise any flags. yes Gary.

S6: was global temperature during the period of uplift that you're looking at, more or less constant so that you can attribute, changes in temperature to changes in elevation?

S2: that's an interesting question actually um and a very good one. uh, the estimates, at the equator in those regions in the neotropics, people have suggested that temperature may have changed in that region globally, from the Miocene to today but probably no more than three degrees Celsius. and so, there probably is a component of that, in the in the estimates i'm seeing, um the changes in global temperature. but what i, i will say two things one is the magnitude of the change i'm seeing is much greater than global change, and over a much shorter time period. so that, what i think it is really the change in temperature is primarily due to uplift in that area not necessarily the global change in (rate.) Greg.

S7: um, for those of us who've, (xx) spent thirty years living in the world according to Jack Wolfe, it seems like, leaf m- margin analysis is not particularly useful, or at least

S8: (what's he saying?)

S7: i'm talking about

S8: repeat the question please

S7: yeah, sorry Bruce. i'm asking about the uh leaf margin analysis that you didn't seem to find as particularly correla- is that, because of a phylogenetic effect, or because there's never been

S1: there's, Beth would you repeat the questions so the ones in back (can hear it)

S2: (Greg-) um, Greg's asking me if_ he was pointing out that Jack Wolfe, did a leaf-margin analysis where he used percent entire margin species to predict temperature and he's asking, why that doesn't seem to work in, South America, whether it's phylogenetic or something else. um, i i think there's a lot of components to that i think, one um component is probably that in South America it was isolated and you had, lowland tropical forest during that whole period and, from all suggestions you would expect then to have lots of entire margin leaves and then you have uplift pretty quick, and still no connection to areas where there are lots of toothed leaves and they're coming in. so i i think what you're seeing is probably a phylogenetic effect, because the plants that were in place to begin with, were adapted to warmer environments and then slowly are changing through time, possibly the elevation hasn't changed enough, uh during that period to influence the evolution of those plants, as much. secondly i think, you're also seeing that there's a short time period since, connections between North and South America which, pull in lots of toothed species and if you go now into these areas, some of the high-elevation toothed species are things like um alder which came in from North American and um, oak and other, species that you, would expect from_ that you don't [S7: (kay)] really find in older sediments. and, there're probably a lot of other reasons too it could just be, changes_ differences in rainfall, um seasonality in those areas and and things like that so i i'm not sure exactly why that is, i i'll also point out that Jack Wolfe now, doesn't use leaf margin, anymore he uses the, canonical correspondence and thinks that, because of the differences in different regions you you should_ and things like phylogeny_ you should look at many different, um leaf characters so he uses all thirty-one now. but it has been shown that for many areas of the world especially North America and, and parts of Australia and things that leaf margin_ just using, the percent entire margin species against mean annual temperature, does

work very well, in certain areas i just, found that in South America it doesn't seem to work as well... anyone else?

S1: i have [S2: yes] one question um, y- you have three, stratigraphic levels in the El Salado that are, different in temperature and i'm wondering if you think that those are, if that's a true reflection of, temperature change or what what you think about those three sites that are_ or three stratigraphic levels in the El Salado.

S2: i- i think actually that they probably are um, mostly reflective of, ta- actual temperature change and i_ and part of the reason is one, they're in similar environments that you would expect the types of species to be in, say, river environments versus um, forest environments to be, similar, of similar morphologic, um composition so i i think, a change in them, that you see, uh might actually reflect changes in the temperatures of those areas. um and, secondly i think that the amount of time that you see in those, in the El Salado member is much greater than you see higher up in the section say in the ash bed sequences and i think, what's happening is you're getting, small amounts of sedimentation or periodic sedimentation all the way through there, so that, so that the amount of time, represented between those layers is, is great, and that you could see indeed, temperature changes through those, that period. anyone else? yes Katherine.

S9: um, how i- thinking about um, relativ- about um, submontane forests, that you think might have been the original vegetation here, if you were to look at submontane forest today in South America roughly how many species would you expect to find if you could say census a relatively large area say a couple hundred square kilometers or what- [S1: uhuh] whatever would seem a relatively_ a reasonably large area to a, an ecologist.

S2: how many species, [S9: yeah] you would find in general? [S9: yeah] um... i can't give it a really great estimate of that i will say that, lowland areas in South America can have, upwards of three hundred and fifty tree species, and when you get up into the montane regions that the diversity decreases, [S9: mhm] a lot. and so some of the areas that i looked, at when i was compiling my data list you would find, maybe a hundred and fifty, or so, species in the submontane regions, which is sort of in between, but it depended also on the area you were in so if they had, low soil nutrients you wouldn't expect as many species even if you're at, the submontane region or, cloud forest which can occur at many different [S9: mhm] elevations, those tha- you know the, that particular precipitation environment also might, um change but i think in general you'd find maybe a hundred a hundred and fifty species on the high end in submontane forest.

<P :04>

S1: (okay) if there's no more questions let's thank Beth again and, (take a break) (xx)

SU-3: i have directions here also for those of you who are interested in going to the party (xx)

{END OF TRANSCRIPT}

Title: Music Dissertation Defense
Academic Division: Humanities and Arts
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RESTRICTIONS ON CITATION OF EXAMPLES: NONE

Recording Duration: 91 min.
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Language: Primary Discourse Mode: MIX Native Speaker Near-native Speaker
Participants: Number of Speakers: 6 Number of Participants: 6

S1: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Female; Age: 51 & over; Restriction: None
S2: Native-Speaker Status: Near-native speaker; Academic Role: Senior Graduate Student; Gender: Male; Age: 31-50; Restriction: None; First Language: German
S3: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Male; Age: 51 & over; Restriction: None
S4: Native-Speaker Status: Near-native speaker; Academic Role: Senior Faculty; Gender: Male; Age: 31-50; Restriction: None; First Language: Polish
S5: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Male; Age: 31-50; Restriction: None
S6: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Male; Age: 51 & over; Restriction: None
SS: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Unknown; Age: Unknown; Restriction: None

SU-M: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Male; Age: Unknown; Restriction: None
SU-F: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Female; Age: Unknown; Restriction: None
Setting: Small Conference Room, Moore Building

S1: alright well, welcome, all of you, to th- i think we shoulda got a bigger room, but we didn't <SS LAUGH> know. uh, we'll start off the the defense the way that we, typically do in in the department is to have the candidate, make a brief statement about, his involvement with the topic of the dissertation. uh, so, would you like to, talk about that, [S2: yeah] very, briefly?

S2: well, history of, of my involvement with the topic is, is a, is a personal story, and since the, uh, since that story has undergone obviously uh, the attempt of objectification, in the process of writing, i uh, chose to, to keep this, introductory uh, summary, personal, um, in the hope that that will, get us going, uh with the questions. <READING> uh i embarked on the journey of this dissertation a long time ago, when getting to know the music of Keith Jarrett turned out to be, an inspiring musical experience for me. i was a teenage musician in Germany, who was growing up with western classical piano training. like Jarrett himself, i was interested in improvisation, jazz, and various traditional musics of the world. i fiddled and played accordion, in an Irish band. i sang Yiddish songs and studied klezmer music. i composed some minimalist pieces a la Steve Reich, on my xylophone. i was fascinated by Ravi Shankar, and bought my first sitar. </READING> uh, stay with me here, for a second this is uh going to have to do something with, sitar but also with, Keith Jarrett indirectly. <READING> in order to learn sitar i contacted a German who had been recon- recommended to me, as the authority on Indian music in Frankfurt. i visited him and he accepted me, graciously as his student, under one condition, that i would give up all the other instruments i played, focusing exclusively on the arduous study of the sitar. this premise seemed absurd to me, and that was the first and last time i saw this man. i wanted Indian music to be part of my musical world, rather than my new and perhaps, better musical home. very innocently, i wanted everything. i was looking for differences, and multiplicity. i was searching for a collage of sounds, that i perceived as unusual and off the main stream. actually later on, i would study sitar with one of Ravi Shankar's disciples, who encouraged his western students not to aban- abandon their western instruments. it was in this climate, that i encountered Jarrett's music. the first record was solo concerts Bremen Lausanne. here was a pianist, but he seems to hear and play everything. he played the world and put it on a piano. moreover he played with body and soul, not with the kind of restrained classical de- demeanor i had been taught. his prize of ecstasy while playing gave voice to my own desire to find myself and to be different. as a postwar German i shared in a particular identity crisis with m- many in my generation. those of us who perceived the problem of being German, or perhaps, being German as a problem, had to figure out who we were in light of an unspeakable history, that had given all attributes of inhumanity, a German face. Germany was the topography of the most despicable violation, of everything that civilization stood for. consequently, we were desperately searching to reconnect with, the good German history, one that valued tolerance and respect for other cultures. we desired to place ourselves in a global perspective, a world view built on acceptance curiosity for otherness and fruitful exchange. my musical choices were part of this search. Jarrett's music, especially the solo concerts, connected to the European heritage, while also offering, an escape from it. Jarrett the piano recitalist continued

a revered tradition, but also appeared, as a rebel who revolutionized it. the next steps in discovering Jarrett's music were his recordings, with the so-called European quartet. Jarrett's compositions for this ensemble, were of a decidedly lyrical expression, with singable melodies and almost folk-like har- harmonic turns. the instrumentation, piano saxophones bass and drums, and the element of improvisation belong to the American tradition of jazz. Jarrett's play with crossing stylistic delineations, addressed my own desire, for a multicultural, globally conscious identity. Jarrett's work with the American quartet, showed him playing multiple instruments and emphasizing free improvisation. using many instruments, Jarrett later produced, uh folk-like recordings. folk and free jazz were the poles of Jarrett's aesthetic horizon. the same horizon within which i tended to define myself. finally Jarrett's classical recordings and compositions added another layer, in a multistylistic collage, again connecting to my own training in western music. Jarrett's jazz standards, recordings, also frequently display a classicizing aesthetic, that is for instance the use of baroque-like quotations over bebop quotations. Jarrett's jazz is performed as a chamber musical product, for the concert stage. this predilection appeals to European audiences who generally come to jazz from a classical western background. in short, i began as a listener, a fan if you will. Jarrett's music fit my own predilections and, so to speak my identity needs. the multiple layers however also set up a game of hide and seek with conflicting images. musical hybridity and paradox are cornerstones of Jarrett's artistic persona. Jarrett the world musician, the explorer of ethnic sound sources other than the piano, still plays informed by western by notions of form, sound quality and harmony. Jarrett the improvising solo pianist on the other hand applies principle, principles of formal construction, remarkably similar to North Indian raga performances, which became popular in the West at the time of Jarrett's formative years, the late sixties. Jarrett the jazz improviser alludes to Bach and Mozart rather than Charlie Parker. researching articles on Jarrett's work as well as interviews revealed an often defensive individualist, who made at times outrageous and pejorative statements about other artists, very self-confident statements about himself, mysterious and ambiguous comments about the nature of art, and the realm of metaphysics, and critical statements about the world of music, apart from himself. i discovered that Jarrett tends to be received at extreme poles of evaluation. there is little middle ground people adore him, or abhor him. he is often taken to be provocative. my musical hero, was caught in a web, of controversies. having been cautioned, not to glorify him in my own project, i took my distance and became frustrated myself at times disillusioned with many of Jarrett's statements and the images they transported. i realized that analyzing and seeking to understand, that which looked puzzling upon confronting Jarrett's music, would be my angle of engagement. as i emerge at this end of the process i find that much of the controversies around Jarrett, had at least as much to do with media and market forces, as with himself. in our interviews, he has addressed many of the issues that have sparked controversy, in a very thoughtful manner. he has been seen for instance as someone, who self-servingly refuses to acknowledge his musical lineage, instead emphasizing his own musical genius. with me, he was humble and eager to talk about his many influences. under public scrutiny for more than thirty years, he has nonetheless managed to do, quote, exactly what i want to do. the contrasting images of Jarrett have allowed him, to engage with a vi- wide variety of aesthetic approaches, to traverse a wide musical terrain, without giving up the idea of unifying this diversity, by forging it, into his own recognizable style. in the dissertation, i observed Jarrett's chosen musical areas, attempting to explain their cross-stylistic elements, and how Jarrett assembles his musical collage. these areas are, and so dealt with in the different chapters, his use of multiple instruments between folk and free jazz, his solo improvisations, his jazz performances, classical performances, and compositions. as the writing itself is closing a circle, i find myself reconciled with my protagonist, enriched by a deeper understanding of how various elements are brought together, in an intricate and

colorful soundscape, an artist's musical journey, that remains, an inspiration for me. </READING>

S3: gee, i feel like clapping

<SS LAUGH>

S3: that was really, great.

S1: okay, alright well now we'll get down to the hard part.

<SS LAUGH>

S1: okay we'll go around the table and we'll uh uh, ask questions make comments, whatever, so Bob, you wanna start, with you?

S3: sure alright. well Christoph, um, just a couple of of details here uh... uh i wonder if you'd comment, uh uh d- page one-sixty-five i uh, please, i- i- it was one of those uh, sort of moments, where, you know i was reading, reading through your stuff and you were <S2 LAUGH> you were talking

S2: one sixty-five looks like this

S3: oh <SS LAUGH>

S4: you've got a different

S3: oh one-forty-five i'm sorry

S2: okay. [S3: yeah] i was thinking you know

S3: yeah well i

<UNINTELLIGIBLE SPEECH>

S4: you have the only different

<SS LAUGH>

S3: um, i i you know when we first started to, discuss this uh project in_ or at least when you gave your uh, your your colloquium, i know one of the the issues that was uh, uh sort of floating around in my mind at the time was was the question of, sort of historical context chronology, and and so forth and, of course you've chosen to do a, uh, a a nonchronological approach although we do get, a a nice biographical sketch of Jarrett at the very beginning, but um, you know there there seem to be so many changes in his career, uh, of position and interest and so forth, so that when, for instance i came to this uh this portion, i believe you were talking about a concert that took place in_ this is the Kyoto concert of nineteen, seventy-six or [S2: yeah] whenever, uh and and you say um, you quote him about making the piano sing you're talking about his vocalizations and and so forth <READING> i want the notes to flo- fly naturally float in the air </READING> and so forth, <READING> that's the only

thing that interests me. </READING> the the thing that brought me up short a little bit and, i'm not trying to catch you on anything but i wonder if you'd just comment on it was th- th- the date of the quote was sixty-nine, which is quite a bit before, that particular concert and, i just wonder the extent to which, with somebody who's been so, uh, publicly available and who has made so many pronouncements some of them contradicting each other, how do you know, when, something that he says at a particular time, it can be applied to, things uh, later in his career? [S2: mhm] i uh, in this case i was looking for something, closer in proximity to the Kyoto concert, (i mean) seven years may not be a big deal but then i thought of it as a more global issue so i wonder if you'd just talk about that.

S2: mhm. actually the this particular uh, element of of Jarrett wanting to make, the piano sing, like a voice, uh is one that he has, uh expressed and keeps expressing today, um uh throughout his career. i guess i chose that uh particular quote, um bec- because i found it the most eloquent of those [S3: mhm] that address that issue, uh, but maybe it would uh make the point uh better to, to include that there are, very unrelated interview situations where he keeps making the same point so that it's obviously important to him. but i think on a deeper level your question brings up that uh, the whole relationship between those, uh changing images between the different aspects of his work or the different eras of his work, and the underlying um uh, con- consistency um, uh not to catch Jarrett as a, as somebody who intentionally plays with those images but, in the process of researching it uh what what became more and more dominant to me is, how little changes [S3: hm] uh in the overall scheme of things how many of the attitudes carry through, seemingly very uh diverse, areas and uh for me that's not that's not a criticism that's, in some ways maybe what he expresses when he says i do exactly what i want to do, and um, uh... for instance the idea um, this idea of classicizing that i talk about uh, in the dissertation classicizing jazz improvisation or, or building up an uh, uh, an aura of a, uh, a notion of artistry that we more commonly associate with western classical music um, uh that carries through, many different uh, musical arenas that he e- engages with for instance, i at one point i quote him saying even about this uh, folk project uh the Spirits project where he overdubs himself on recorders and, and all kinds of instruments, um, uh that he saw himself very much as as a as a composer, uh, rather than a folk musician. [S3: mhm] um, and all the the attributes that he brings to that notion of, being a composer are very much, part of um, of uh western classical, history, and and i, i try to be careful not to s- to use that as a value, judgment i and i try to not say, oh he tries to um, to edify the jazz image uh by [S3: mhm] becoming this classical uh, genius um, uh although those, perspectives have been mapped onto, uh what he has done in that area. so, even though it looks very different, on the one side to uh, to do free completely free improvisations than to record, these multitrack uh folk-like uh vignettes and then to go out, and play jazz standards uh even though that looks very different, [S3: mhm] uh, and is very different in terms of the the, the musical arena he engages in but, it seems to be very consistent with uh, with a few attitudes that actually, he has held constant over the course of his, career and and one of those is that he hates the piano even though as a_ that he is a pianist and this <SS LAUGH> idea, this idea of, making the piano sing making it be like a saxophone or like a voice, uh is is almost a a, metaphoric um, uh, manifestation of this idea of wanting to overcome the piano [S3: mhm] wanting to overcome the, the uh, the mechanical uh, aspect of it the distance from the sound, production, uh that that this mechanism of the piano in- in- involves

S3: well i'd be u- i mean it's a good, good response i i guess i'm looking for something even littl- just a little more, on the technical side [S2: mhm] i think it would be a good idea to, [S2: mhm] to, let your readers know, since, there's a somewhat kaleidoscopic, uh, impression created by reading the dissertation [S2: yeah] from front to back [S2: right] and it's almost as

if, you know you get the feeling well, you know a a writer could uh, uh decide that uh, he or she [S2: ah] well in your case he, uh wanted to reinforce something so, well, here this [S2: right, from there] quote bang you know it's just, sort of uh th- that kind of stuff. okay well that's uh, th- i think you could strengthen your case [S2: mhm] a little if if if, you were to do that. now, another one uh, and this your, your opening statement, uh addressed quite, quite nicely i thought but since you and i talked about this, this morning, among other things i uh i wonder if you could just say a bit, in this form about the subject of_ uh which i addressed in my uh evaluation for Rackham, uh, coming away with a bit of a feeling, that uh, after you had, done all this work on your, your boyhood idol and, torn away all his masks and everything that that somehow, uh you you didn't quite, have the, respect for him that you had when you started off and, i i, i didn't really have that feeling earlier on but i it- when you got into the, the later part and the self-construction and all of that in the marketing of Jarrett and so forth somehow, i came away feeling that, either you, you had felt your, felt him a somewhat diminished figure, or, you weren't, sort of, beefing up, <LAUGH> or you weren't explaining to your readers, that, in fact, you you were e- equally committed to uh his work, after the illusions had been uh, shattered or the masks trampled upon or you know whatever, metaphor you want to use there so, i mean obviously you you said today and you told me this morning that, you kind of, put the whole thing back whole but, could you, say a little bit about that i mean i i i just think that we, i don't think it's a case of uh having to do a whole lot on this but if you do, feel as if you, you came out of this with a renewed, understanding for for Jarrett uh, uh and a great appreciation for his artistry that you could say a little more on that and i_ let let me add just one more thing which i didn't think of this morning when i was saying but i but i went back and looked at this, i'm not sure, that in any of your, comments on specific pieces, that i take away an impression, of your, saying, this is fantastic this is really, <S2 LAUGH> this is great <LAUGH> i mean you know i, i mean you you, you sa- you say this is the process that's going on and so forth but i'm i'm not looking for, (xx) anything smarmy or sentimental or whatever, but, it's like you're really on guard, to show that, i don't know what exactly it's a it's a vexed, it's a slightly vexed position, i think.

S2: it is. <LAUGH> it is a slightly vexed uh position, uh, my choosing to, to do the opening statement this way, uh was trying to trace the the circle that that story made uh i think a- i think that at first i, ran into problems and and um, and these things were articulated uh uh, by the committee and also, from um, uh, from not having enough distance, you know uh to to the to the topic or to to him [S3: mhm] but by really, uh, by coming to it as uh as a musician who, liked his work you know i mean a few years back i, i uh, would have said i i listen to, to a lot of it and it moves me and so forth but, that was the extent of my, [S3: mhm] you know, yeah he's a really influential musician for me but it had to do with, musicianship and uh, and uh likes and dislikes which are, uh very, admittedly, subjective so, um so that's were i was coming from

S3: he had fundamental

S2: yeah

S3: okay

S2: yeah um, i i think you're right i think you're reading it right y- y- ya- that there was trying to avoid that kind of uh, uh exclamation mark uh at the end of my phrases. and uh and the the process of coming full circle with which i concluded the opening remark, is still a very young, uh, uh, process, it's it's still very recent um, and part of it has to do with the fact that uh, that

the interviews that we had, uh were so different from, from how interviews, are radiated in in magazines uh, and, uh i asked him about this in fact it all started by me_ my asking him why he wanted_ why the heck he wanted to talk to me, i mean because he really doesn't need to and so forth and, and he said that he likes it when uh when interviewers, aren't out uh, to get him, or or to get something you know to get something that then, uh uh four weeks later comes up in the magazine as him having said some outrageous thing and, and uh, you know and uh he- he- very candidly would address uh things, of that nature that he has said outrageous things and he has contradicted himself and, so what? you know, we do it, people do it it happens. and um, uh in conversation uh with me, uh because i i i wasn't coming from, i wasn't hired to do this i wasn't doing it for a deadline project next week to have it, published, i wasn't out to catch some uh, provocative remark, uh he seemed to uh feel, less defensive so m- my perspective, uh, uh on a lot of those comments that have stirred controversy around him uh have to do with also looking at, the process of how those comments were made and uh and and um, in which situation they were maked and how_ were made and how they were sparked. so um uh, having had the interviews ar- uh is certainly an experience that is, that, is part of uh, rec- rectifying some of that [S3: mhm] uh, for me of of putting things in perspective. i mean th- there are issues that s- that uh he was said to simply avoid publicly, uh, that that he was very at ease talking about, such as this whole deal about, um, you know him only hi- him always saying, uh i'm not influenced by anyone um i'm my own influence and this kind of thing, which of course itself is a, is a tradition and and and has a history uh among musicians so, what i'm trying to do um i- in the dissertation is, uh expl- uh or show what it, what it does that's right i'm i'm trying to show the process of uh what effects that has, or for instance of of showing that tradition and Bill Evans used to say the same thing, uh i don't comment about the contemporary scene, i don't really listen to other jazz musicians i listen to old music and, and he and what it does to to construct that as an, um, as a as an artistic persona and i i do accept that even using those terms construction and artistic persona, uh, makes it sound very uh sort of intentional, uh like he's trying to, manipulate some image that he has on his drawing board at home and now he, goes about it in the public arena in order to construct that image and that of course isn't the case most of the time that's just a, a bypo-product of what what happens, with this, uh with this product. and i think uh you're also right in, detecting that that process of wanting to, um, wanting to describe the effects and wanting to describe the process, uh of these phenomenons*(sic)* uh, takes away from, the impulse uh of the, the aesthetic commitment or, or enthusiasm that i that i bring to it. um, uh most of all because uh, i was trying to reach a point where that wouldn't matter, w- whether i, like him or, don't like, u- even though of course, i- it'll impact how i write but um, i was trying to uh to get away from that, and i think i'm only now at the point where i can, let myself like him, <S3 LAUGH> as much as i do, again...

S3: thanks

S1: okay, alright, John (xx)

S5: yeah, um, let me ask you some some technical things that's on the, on the, the note guide here, um... there're a bunch, there- there're many little things in here i'd like you to just take a look at [S2: mhm] but um would you look at sixty-three for a minute? <P :05> [S3: (xx) had them by side by side] um, (xx) in the in the middle of the, in the middle of the uh page where you talk about All Right? [S2: mhm...] and you give this harmonic analysis, um, i, i'm really puzzled by what you said here because you've written the music, you've notated the music in E-flat, but you analyze a chord progression which in E-flat i would've called, five-one-four. that's two-five-one in A-flat. um, and at that point you don't really feel A-flat has been, has

has taken over as the tonic do you? i mean this piece is still really really clearly in E-flat major right?

S2: ah. um, uh i- di- y- did you listen to it on the tape?

S5: yeah

S2: i i i i really did i do hear it as A-flat major and in fact one of the reasons why uh why i chose the key signature of three flats instead of four flats, is uh the predominance of the the Lydian scale in A-flat, with the rai- raised fourth [S5: mm] so i i i mean i might as well have written it, with four flats and then added the natural signs to where the Ds are. [S5: really? hm] i mean to me the the the cycling point the point at which the point of return is is A-flat.

S5: hm. well, this this to me just sounds like a million, tunes through jazz history that start on four chords

S2: okay

S5: um, you know there're tons of blues tunes for instance, chop off the first four bars of a blues, and use the last eight bars twice [S2: okay] so they start on a four, and they go, four five one, four five one, and then something like a bridge, [S2: uhuh] and then, something else, so this didn't this to me, [S2: didn't didn't make sense in A-flat] didn't ever, never it never threatened E-flat as the key

S2: alright

S5: but maybe i i i don't know maybe maybe i'm, i'm wrong. in any case you said shortly after this, the ruling key signature A, [S2: A-flat major yeah] flat major of course it isn't.

S2: okay [S5: uh] yeah, uh i mean that's um, uh, uh i i, that's an easily, fixable, uh [S5: i think] accentuation because i'm the the point that i'm actually trying to make, is uh, that one dominant key, signature isn't, aban- is never abandoned. [S5: mhm] right it's never threatened and uh uh, if it makes more sense harmonically to uh, since it ends on E-flat, um a- and to think of the A-flat chord as a four chord to start with, um, the argument is the same [S5: mhm] the the, the numerals are different

S5: yeah. well, uh, uh, right, but i mean it's like a world of difference [S2: mhm] to me right? when somebody says two-five-one and i'm hearing, five-one-four [S2: okay, right] it's really different so i think if you really do hear it that way i mean i i i'd be willing to let you hear it that way, that's fine, <SS LAUGH> but i think, the invocation of something, i mean even to say in here something about the you know the the [S2: yeah] sort of Lydian A-flat [S2: okay] character of this, [S2: mhm] would be okay [S2: mhm] although you know, the D-flats do appear so, [S2: yes] okay, um, am i going on here?

S1: go ahead, yeah

S5: okay, here's another thing about keys. page seventy-two... uh, this piece... uh, seems to have practically no B naturals in it... [S2: mhm] right? [S2: right] now why is_ why didn't you just notate this with one flat then? is this is this, do you_ is this somehow a, a, a Lydian F or a Dorian D or something it doesn't sound anything like it to me, [S2: mhm] but here again

[S2: mhm] i mean, you're you're hearing this with different, and better informed ears than i am, but i i just don't see why this isn't in on E-flat? and why these all these accidental B-flats [S2: yeah] have disappeared?

S2: i i i think what's what's happening is that um, uh, you know that i- it's, it's the same uh, principle that we talked about with the the, A-flat i mean i accept your argument that the A-flat wasn't uh, uh the best solution to to uh, take as a a as a start- harmonic starting point [S5: mhm] but, uh the A-flat a- A-flat with the sharp four, would eliminate the D-flat [S4: mhm] and it's, it's a similar situation here, with a B uh flat. i, i think of D minor, now so predominantly as not the Aeolian but the, uh the Dorian mode [S5: mhm] that's and and and when i, uh when i compose, uh th- this is how it started, i i would save myself the hassle of putting, the B-flat in. and maybe that's a little too shorthand

S5: (well we've been using) this hassle for six or eight hundred years

<SS LAUGH>

S2: okay, uh, you- you're right i sh- i'll i will, introduce the (xx) <LAUGH>

S5: if we just went through this from a purely statistical point of view, i mean, i mean you think of think of you know Bartok pieces where he'll use a key signature, uh on E-flat and one sharp simply because, he even though it's not conventional, it does describe the picture right? [S2: right] in some economical way. so i_ to me, not, not doing that seems, seems odd

S2: okay, okay

S5: okay? can i ask you just a couple more things?

S1: yeah. go.

S5: um

S2: a- y- you're right especially in a context uh where it is so diaton- where it is so so diatonical, [S5: yeah] through the piece throughout i mean um

S5: well, you know, there are there is the like the, the A minor ninth chord with a B in it and you know it's just in there for color it's not [S2: mhm...] that's and there're all there're all those B-flats that are the roots of four chords too so [S2: mhm] uh, can you, uh let's let's go to My Funny Valentine [S2: mhm] to to one-sixty-one where that where after the introduction. [S2: mhm] why don't you zip through this introduction? it's funny how- however, ruminative it may be, [S2: mhm] it just really whips through it fast. it's interesting. anyway, tell me what what it is you're trying to tell the reader with these chord symbols.

S2: um, uh at some point in the analysis later on i'm uh uh, i'm talking about how uh how Jarrett uh contrasts the, the um, the standard chord changes of of the head with um, [S5: with what he actually played] with with what he actually plays over it, and to to see that contrast i thought it was beneficial a- add the symbols to um, [S5: okay] a- but what i'm realizing as you speak, uh what is really an omission is that i didn't give a, a a, a legend that would ex- explain my, is that the word? legend? [S5: sure] uh, a map that would explain um, my symbols. so i need to i need, to add

S5: well, i'm not sure that that's necessary but i think it really is necessary, like look at the third measure of the head here you've got what you call a C minor seventh chord there's no B-flat in it but there is an A.

S2: right, but but tha- uh [S5: ah bu but how] what i'm trying to say

S5: but how do i know that reading this? if you're if you're saying, look at the way, Jarrett's actual realization of the piece contrasts with the way the piece was composed, [S2: okay] that's fine. [S2: yeah] but, that needs to be said [S2: yeah] really overtly because there's so many places where these chords symbols [S2: don't jive] disagree with the music

S2: right absolutely, yeah

S5: uh, and i i mean they're just they're just, it's j- absolutely full of them [S2: yeah] and there're places like um,

S2: so so you would say that i- before the transcription

S5: before the transcription?

S3: you say it after don't you [S2: yeah yeah]

S5: yeah it's there, i mean i

S3: it's in the text

S2: oh really?

S3: it's in the text here

S2: it is in the text?

S5: no i, i i (skimmed) (xx) it slipped by me.

S2: no, no i think you're right it's not before the transcription (ends.)

S5: um <P :05> okay well tha- that's gonna resolve a lot of this because i'm i was just looking at this and i'm thinking well you know th- there's an E-flat major seven yeah but the bass is sitting down on D-flat <LAUGH> [S2: right] for two bars. [S2: right] but but since you're referring back to the original of this, then that brings up one other thing

S2: c- may i may i, uh [S5: sure] interject one thing, th- the- one of my, bigger arguments about, Jarrett the jazz improviser is, that he uses um, he uses the uh, the format of these jazz standards, [S5: mhm] as a basis uh for, some minimally restricted free improvisation. [S5: mhm] and a- this is this harkens back to what you were saying, uh uh about how different certain aspects of his career look, and my arguing that there is a very strong underlying continuity, and one of the continuities is fascination with, free improvising with not preparing anything. [S5: mhm] so, all you need to do, from his perspective, um to play this music is, uh these three guys know, the changes for My la- Funny Valentine, he starts playing his intro, he plays eight measures of the head, that's all we need to know [S5: mhm] to know that we are

dealing with My Funny Valentine, and off he goes, an- uh, and and the the, the way he, stays within the chord changes and then, m- moves, outside of them, and then on top of it adding this these extensions these freely improvised, extros to [S5: mhm] to to the music, um uh really point towards the fact that it's not about playing successive strands of thirty-two bar choruses, that it's really about just using this as a minimal launching point, for free improvisation and to point that out i intended to, to show how strongly they disagree, how strongly what he does with it, uh disagrees with the standard changes that, [S5: mhm] that outline the piece.

S5: well that that, that's perfectly fine i think that's, that's a good thing to do. one last thing i wanted to ask you about this is, why you quote, the Real Book version of this piece rather than the original music. [S2: okay.] the Real Book version, uh i mean, this may be the way a whole lot of people these days learn this piece, [S2: mhm] but um... [S3: it's not the original] well, it's not the original and for instance the Real Book version doesn't doesn't have the chromatically descending bass line, which y- i mean [S2: right. which everybody does anyway] clearly it's it's implied and it doesn't have like the, you know the G here and the, the E-flat here and all this stuff th- th- [S2: right] that we all go out and do on Saturday night. [S2: right] um, i'm wondering if it would make more sense just to quote the original, of, the original of the piece or conceivably even this and the original.

S2: okay. i think that's a very good suggestion. at this point in my argument uh, i- uh, the the reason for the Real Book version, uh, was um my talking about rhythmic displacements, [S5: mhm] of of notes uh so i wasn't for instance concerned about the harmonies [S2: mhm] in fact i could have wiped out the chord changes for this, that that wasn't, what i was going after at this point. it was about rhythmic dip- displacement of the melody [S5: mhm] uh, uh is that different, in the original, [S5: no] music as well?

S5: well it may be, different in some [S2: mhm mhm] very minute ways but it's it's not very different. in any case if you need the original music [S2: great] i think i have it, so

S2: yeah. i i'd like to

S5: um my other stuff is just little, little nitpicky fussy stuff that you can deal with, at your leisure

S2: okay, great.

S1: okay

S5: oh, one one thing about, about the abstract, [S1: yeah] there's this mysterious sentence in here. um <READING> his work within the jazz idiom can be interpreted as specifically addressing </READING> <P :05> [S2: oh my, i think you didn't get] and that's all there is

S2: you didn't get the um,

S4: we all have that

S2: we all have that? oh my gosh

S5: well

S4: computer ate it up

S2: yes. computer uh, slaughter

<SS LAUGH>

S2: uh, [S5: well that's] i am sorry

S5: well, i'm sure that's very fixable

S2: okay yeah

S3: let me just [S2: i'm talk- talking about] tell you one other one other thing about the um, abstract which i somehow i i did a little writing on and then i forgot to bring it i_ must have fallen out, or something but, i think it would be good, uh to say something about the sources of your, [S2: mhm] i i mean in an abstract for a dissertation i think it's always a good thing to include, what is this based on? is it based on listening, periodical literature, interviews? you know whatever, so, just, stick that in somewhere.

S2: okay

S4: this is what you get for vocalizing while you type. <LAUGH> get to jump out

S2: yeah

S1: Nicolas?

S4: i i i'm_ you're lucky i can't nitpick because i picked up the wrong version, you should have color-coded them. they were [S1: oh] next to each other at home and i picked up the wrong one. [S1: oh] [S2: oh, oh] so, so i can't quote your chapter in verse and i will have to rely on my memory. um, uh, i i i'll give you some, some minor comments, on the margins but, here this, uh, let me just ask you a couple of k- questions uh, actually you know, it just occur- occurred to me i was going to ask you the same thing about My Funny, Valentine, since this is illegal it's doubly illegal, <LAUGH> probably, if you were worried about copyright right? this book is illegal to begin with.

S5: uh the Real Book?

S4: yeah.

S5: it's illegal to produce it's not illegal to own it

S4: but it's illegal to, reproduce something that's illegal isn't it?

S5: uh not unless you're gonna sell it to somebody

S4: but i mean, in, in in in [S2: yeah i uh] if you wanted to publish it you couldn't reproduce from the Real Book

S2: the whole, the whole dissertation

S5: no, when this when this becomes published, Christoph will have to [S4: yeah yeah (permission for)] seek the publishers permission even, even for this, uh

S3: especially for this

S2: well the dissertation is full of copyrighted material and i mean the the (record's covers all of)

S4: no that's fine

S3: you're not gonna be able to to give this in to the University Microfilms are you?

S2: uh i i will be able to do that um, if i mark off the, box that it's not for sale yet

S3: oh. yeah.

S2: that it's just for the record

S3: mhm

S4: mhm

S2: and that's legal

S3: and people have to come to you for the [S2: right] copy. they can't sell it

S2: yeah. uh it's just uh i haven't had the time to go through that whole process.

S4: you just asked_ i'm still a little unclear about, the role of free jazz and all of in in in in in in um, whatever, you know what i mean, by that. um in in in uh, in in the way in which you've, described this because, um, you allude to, to Ornette Coleman at, a number of places, and then you discuss rather interestingly Paul Bley. and i just wonder, how how they, uh, they really function in this because, part of the problem, was brought up by Jarrett's own statements, as you've j- already mentioned a couple of times, that it's his denial, quote unquote of his, of his roots and then, your, uh uh searching for, the historical background of his work, and, i suppose that part of this would_ one would've never attempted part of this is if he hadn't said these things. um, but, w- w- w- w- w- what is interesting here is for instance, you talk about if i remember correctly about, the two saxophone work as being, going back to Ornette Coleman, and that puzzled me, that is i don't still don't understand, you mentioned Coleman's influence a number of times but you never specify what it is if i remember correctly except for that one statement. and that puzzled me because, you referred to f- to, the double quartet, but this isn't really a two saxophone front line that's it's a, four instrument fr- front line and the two saxophones don't have any particular, [S2: mhm] uh a role in that, and it seems to me that at least in the fifties and sixties, two saxophone, front lines were, rather common and the kind of interplay you're talking about was much more, uh, uh prominent in in, actually in more traditional forms of beeb- sort of neobop or hard bop and so forth or, uh there were so many uh double saxophone groups especially tenor groups at the time and so forth. i wondered why you chose Ornette Col- that that that is the only influence i remember of Ornette Coleman that you actually mention specifically (in it.) why that?

S3: mhm

S2: um, uh uh your your comment brings out_ your question brings out that i need to be more precise uh uh on on why i'm uh, uh drawing that comparison. it's actually not about having two two saxophones specifically it's about having two lead wind instruments, um uh, uh that, uh, are uh set in an instrumentation that avoids piano. so um uh Coleman's ensembles with uh Don Cherry on trumpet, uh are are just as much a resource for me, than the double quartets, be- because the issue is, uh free improvisation in a setting, uh in which two melodic uh uh improvisers, play simultaneously, uh, with uh, without the, the chordal, underpinnings of of, of the piano.

S4: if i remember correctly you you you you specifically referred to, to free jazz with the two saxophone, for for his work with Charles Lloyd. and, [S2: mhm] that is not, a very good example because uh, that's a four instrument front line, actually and, uh the the two trumpets, it's a double quartet.

S2: mhm, yeah, (xx)

S3: where is that, Nicolas?

S4: uh i don't have the page number yeah uh uh um

S3: yeah i know you don't have the page number i mean is it

S4: it's early on in the dissertation

S3: which, it's in chapter one, isn't it?

S3: i'm sorry yes i think so but, it it seems to me if you start you you le- didn't articulate it that way and so perhaps you might, want to make it clearer because then of course you get into the whole Gerry Mulligan, Chet Baker quartet and also, in the more free jazz vein with two, uh, wind instrum- uh uh uh, two uh, mm uh woodwind instruments you've got, there was a group, um that Prince Lasha you know a post C- Ornette kind of thing Prince Lasha and Sonny Simmons had which had two saxophones or even, one played English horn and the other one played, alto clarinet they were multi-instrumentalists all of them in fact, but unusual ones because they played double reeds and, and alto clarinet which hardly anyone plays, that um, made quite a num- uh qu- some interesting recordings at the time and so forth, so there was much more of that going on and and that would (probably not) but, the other thing is, is it brings me to another question which, in a way elliptically leads back to Saint Vitus Paul Bley's influence because, you know, one thing that i found missing here is, Paul Bley had a quarte- ha- two groups one of which you mention, only in passing, which is relevant here which is that, the origin of the um, Ornette Coleman quartet is actually, the Paul Bley quintet. [S2: right] um, and, the other one is, hi- his next group which which was a quartet with John Gilmore, Gary Peacock and Paul Motian. um, and that is essentially, very much uh uh the not only the instrumentation of his American and, other quartet but if you listen to it, the singsong melodies the combination of kind of free jazz and standards and so forth, but it it's a fascinating_ this is from nineteen sixty-eight sixty-nine, um, this group, because we now think of uh of Paul Bley, cuz of his E-C-M recordings and so forth but, his early work is quite different, [S2: mhm] and is part of the neglected roots of quote unquote free jazz actually. and um

S2: we- uh, the album Footloose that i talk about is, uh, i don't know the date offhand but it is one of the early ones

S4: it's a trio recording, though [S2: right] the thing wa- that he he uh, Bley had his own, record company for a while Improvising Artists in which he released, uh these live recordings of, with Ornette Coleman, s- from, from before, Ornette made any recordings with Atlantic but also he re- he released um, some some uh concert recordings wi- of this quartet with John Gilmore w- then with Sun R- became essentially, Sun Ra's tenor saxophone player for for the rest his life. and, it's surprisingly, uh, uh, it's surprising how in- how how how how how uh similar in concept this quartet is to at least, the s- s- some of uh, Jarrett's quartet recordings. [S2: mhm] so uh when you say that, Paul Bley's influence uh on on Jarrett has been underestimated, uh i think you might want to probe a little deeper into this, [S2: mhm] because Bley is also a kind of chameleon-like figure. [S2: mhm] he has this, uh this uh, uh romantic uh tr- standard side, and as well as, uh, as as this free jazz im- free improvisation side. and, an- an- and also a cantankerous uh <LAUGH> [S2: yeah] self uh um, sort of uh presentation side to him which, in many ways parallels Jarrett of course, [S2: right which i address actually] yes. well in his case it's sort of slightly uh colored by a kind of bitterness of lack of recognition [S2: mhm] rather than overexposure but [S2: yeah] um, but y- y- you might want to, expand that a little bit because i think you you lean towards it but you don't, re-de- dig, deep into it. the other thing i, would suggest um, remember i mentioned to you that uh, when you talk about, Braxton solo work, i- i i'm, a- a- as the background for for for for for for Jarrett i i wonder if you wouldn't want to um, s- locate it historically just a little, more precisely that is, the influence that Braxton seems to have had, not just on Jarrett but on others, instrumentalists of the time that is, when this whole, s- this whole uh, fashion for solo recordings started, uh, practically everyone acknowledges Braxton when you uh jus- uh Evan Parker uh Steve Lacy all these people say that they, started doing this because, they heard Braxton doing this. and it's not only in recordings it was Braxton's solo concerts.

S3: you're talking about wind players

S4: wind players yes, b- but uh but uh but there're also pianists of course who were doing this, since time immemorial uh, but but but this idea of recording these solo, album lengths, so i mean in Braxton's case they were all double albums, uh, of of solo work and also Braxton talks about this, extensively in the liner notes to, to uh his uh s- s- second or third long one the um, what is it, nineteen seventy-nine, [S2: mhm] so, he he actually, expresses very cogently his reasons for doing this which you might, [S2: uhuh] wan- wan- want to, uh look into [S2: yes] but, but it actually became as you point out kind of a rite of passage among the A-A-C-M that people had to give these solo concerts. and Muhal Richard Abrams also did them, [S2: mhm] on piano, uh and recorded, a number of them but in Japan, cuz nobody would record him, [S2: mhm] in the States so, uh, but i i i would like to see you, if you're if y- if you want to pursue this to to to really contextualize this just a little bit more, [S2: mhm] that is wha-wha- what was going on because, uh th- th- this was a determined effort it wasn't just a a chance thing that some people were making solo [S2: right] recordings a- and (doing this) and and and especially among the A-A-C-M people there were ideological reas- or he stated ideologic reasons for this. um, but but but Braxton's about uh- bu-bu- bu- but uh to me Jarrett's about the only one who doesn't say specific quite the opposite s- i just, got this from the spheres rather than, saying that, [S2: actually you know tha- i-] (there was this very) specific

S2: yeah this was one of the, the things i i haven't completely transcribed the uh, the, the interviews with him yet but this was very specifically something that he did ad- did address uh um, uh saying that, the A-A-C-M and uh, that he was looking at the A-A-C-M at the time as as something, interesting musically that he that he drew from. i mean he uh i was surprised by how little, shy he was to acknowledge that connection when so many public statements, uh, veer away from that, so

S4: well this is what surprised me i mean, i- i- it's interesting that he's, more than anyone else he has, uh i mean of course the media has used him but he has used the media. and, why is it that he has now switched, talking to you he speaks in a completely different tongue?

S2: no there are lots of uh i- interviews where he uh, uh talks like that before as well it's just the uh the ones where, uh he pronounces his refusal of artistic lineage uh are more eye-catching or ear-catching. the- they're simply, they, they're more heard. i mean there're plenty plenty of interviews that that express that. i think um, they're usually interviews in which he was uh, felt, cornered, uh uh about that issue, and i think what's also coming through is that as much as he comes out of the free, uh jazz e- uh era and i- is invested in in, in uh, the processes of freely improvising, uh he also um, he he dislikes, the interpretation of free jazz as being, taken uh to be an avoidance of a, a a categorical avoidance of harmonic, structures and tonal language. um, uh in other words, and and the the, when i saw him last week he was, dancing around this very carefully to uh to make sure he he didn't, come out saying, that he thinks Roscoe Mitchell is recording what he is recording because he, can't, play uh uh within tonal structures or over chord changes or so forth, but he was, he he was, avoiding saying that and reverting it back to himself saying, um, uh, well uh not to pass pa- pass judgment on on anybody else uh i i i guess i was very greedy i guess i wanted, more i wanted free improvising but I also wanted tonality i also wanted uh, uh harmony i also wanted, transitory moments of chord changes that then would dissolve again and so forth. so that there was uh clearly this intent to to say, uh yes this was the the spark that, that launched my entire, uh uh idea of how to improvise how to go about playing, uh but it was also something uh, that he, felt was dissatisfactory to his own, tastes, that it was that that much of A-A-C-Ms music uh, was so clearly defined within uh, within the parameters of uh, atonal, uh, nontonal, improvisation, uh sort of with this cliche of being very dissonant, that kind of thing. so he sought uh to to, to revert to tonal structures, within freely improvised settings, rather than um, seeing those, uh, as exclusives of each other.

S4: we- i i i think that he just doesn't listen very, much to, the Art Ensemble of Chicago or to Lester Bowie's recordings because they, especially in their let see after the early sixties their work, their whole concerts consist of passages where they do whole [S2: right i] tunes and rhythm and blues

S2: i i analyzed one of those pieces [S4: yeah] actually b- w- w- the reggae piece that th- that they do on on one of the the uh E-C-M recordings, um, uh... w- whether he uh, uh sees that as a judgment of of the Art Ensemble of Chicago or the A-A-C-M in general whether that's a broad uh, uh perspective uh i don't uh i don't know i i can't judge that from what he's told me but uh, b- but the impression that i get is that he, got very tired of a certain sound of free jazz, and uh was very vocal about it and in his case it led, to him, avoiding, uh uh naming the A-A-C-M as some revolutionary impulse on him, um because he didn't care for much of the music that came out of that, uh but yet was very impressed with the impulses that led to that music, and tried to uh and saw himself very much in the same context, as that.

<P :04>

S4: do you think he's manipulating you? <P :04> [S2: n- n-] no it's not it's not i'm i'm not, yeah i ask you this quite honestly that is that he, talks differently to different, uh

S2: no i think we all talk differently to different people but, um my impr- my impression was simply that he, he was, uh uh, he was trying to say that yes he has a lot to do with that, w- but but he doesn't like much of what came out of it, so he uh, he didn't make it a big deal in his public statements to say yes I owe a lot to A-A-C-M [S4: mm] or i owe a lot to this uh impulse of, of free jazz because stylistically he went into such a different direction. maybe that some of these uh, statements were uh uh, poorly chosen on his part but i'm trying to, not evaluate that i i was i was trying to look at the fact that, uh he he does acknowledge uh an affinity, and even an involvement uh uh, with practices, that came to the fore through the A-A-C-M, he talked in one interview he talked about uh, having done a tour with the Art Ensemble of Chicago, uh in the late sixties which i wasn't aware of, where they were, traveling from city to city, doing the same gigs, so and and and he wasn't uh in any way defensive about acknowledging that i think that uh, some of these statements um, of denial have come about as ways of saying uh, uh uh uh, uh ha- have come about as him really feeling that he doesn't like much of that music. and and the way it comes out is, by not saying, these are my musical heroes or something like that

S4: well i- may i say this that that that as a result that you might want to reintegrate because of the obviously the the interview you did with him or interviews were done at the very end, [S2: right] it's not fully integrated into, the the work [SU-M: (xx)] because, i i only know of i mean yes i've in passing read his uh, interviews with him but i really haven't memorized them, and i knew them on- primarily through reading, your, your work and um uh the the the notion that_ of his denials etcetera of his lineage, they came out very forcefully in the way you presented [S2: right] his, and i had no idea that that that, all along he had been saying other things as well um and so, i i think you have to make because you've made an issue of that, and then played against [S2: right] that so you now have to, temper that it seems to me, [S2: yeah] um

S2: good point yeah i i th- i mean first of all you're right to that i need to integrate my interviews uh but also, uh it's true that i f- played off of that denial notion because it is it is that, most visible pole o- uh with, from which that controversy uh

S4: right and then it [S2: pans out] struck me that now he's saying completely the opposite but now you're only now telling us, that he's actually been, uh saying these [S2: right right] contradictory things all along

S2: what i do in the text is, show, that there are, uh that there is another side to that, rather than, uh putting it into his words that's very true, i think what i can add is that uh, that is not only something that he has done, uh uh throughout his career that it's also something that he, has addressed at various points. and it's uh it's interesting i'm not uh, sure whether you're familiar with the Edward Strickland interviews uh that were done for the Fanfare Magazine, um uh Strickland was very much, somebody that uh, he f- uh, whatever were the circumstances of the interview but it was a very uh easygoing interview and he liked Strickland and he liked how they were um, uh relating to each other and uh it's it tends to be those interviews that he, says, those kinds of things. uh and it tends to be interviews such as with Jim Aikin in in in the Keyboard Magazine, uh uh where he gets more defensive because

S4: or the New York Times Magazine (or the)

S2: right right the

S4: so no- no- no- now Wynton is going to, Wynton Marsalis is going to send Stanley Crouch to, knock him out

<SS LAUGH>

S2: uh i wanted to say uh uh one more thing about the uh Ornette Coleman reference uh, you you went on to the, the Bley um, aspect and i didn't have a chance to comment on that um, uh y- uh when you talked about Paul Bley you were talking about how, the musicians Bley was with, then uh, uh later played with with Jarrett and that, you know in order to point out how important that that influence is, and i agree, uh, but that was also one of the reasons why i did choose, uh uh Coleman as a as an example because both uh Charlie Haden and, and Dewey Redman, which then were part of, uh um Jarrett's American quartet which really was the first, the first ens- ensemble that he, uh, came to a reputation with as a leader, um, were musicians that had uh that had played with, with Coleman. so my my reference to Coleman is not only that there's some instrumentational, similarity going on here, uh but it's it's in the same manner as the Paul Bley uh quintet, it's uh it's a trading of musicians that that went on, which uh, which of course doesn't only mean that these people bring their their styles uh, uh to to the band but it also means that they bring, the sh- conceptually sh- shared background with them, um, which was forged or imp- influenced, by um, their work with with Ornette Coleman.

S4: but but but i- i- would pr- like to see if these are suggest that you- that you dig a little deeper that is wh- when you say, you talk about someone's influence such as Coleman i would like to know what that influence is in purely musical terms and not simply, shared musicians the same thing for instance you mentioned Brubeck a number of times that he has acknowledged, Brubeck's [S2: right] influence but nowhere, did i, re- remember reading in any specific way, how Brubeck's, musicianship, what what he found interesting in Brubeck's playing i mean when you do an analysis of

S2: yes i'm talking about uh, about uh voicings and chordal structures and

S4: but but in My Funny Valentine for instance when you talk about the whole baroque issues i mean it, all of those things could be found in early Brubeck recordings where he does these things, [S2: mhm] uh, uh you know, quite, [S2: right] blatantly and so forth, so i i would like to see there's more, just more s- s- es- s- s- more specifics in this kind of, uh analysis but that's you know that's up to you [S2: mhm] but but um, same thing for example with Bill Evans when you have these long rubato introductions well late Bill Evans you know you sort of wait there, for hours until he gets to the tune, and you know and the drummer and bassist is half asleep i mean fall asleep but, but i mean you know he had these long [S2: right] rubato introductions and so forth, um, uh so i- you know i- these specifics might be, helpful in [S2: mhm] but in any case i- i'll give you some, [S2: mhm] minor little things...

S1: okay?

S6: Christoph um, now that you have, uh these extensive you know this volume of, liturgies that you've done recently, um, i'm just curious has, has he talked about his say his jazz training? and i mean we know he went to Berklee, [S2: mhm] um uh the influences on th-

along those lines i mean like did he transcribe, did he ever go through like, did he ever talk about going through a period of, you know, copying, like [S2: mhm] most everyone has done, is that something you got into at all? [S2: mhm] (xx)

S2: um, as for uh i'm, before i answer uh uh i'm just remembering um... um, Gary Bergman saying, y- you know Gary Bergman is wh- wh- whatever he is now Associate Dean or Dean of Curriculum i believe at the Berklee School of Music, and um, uh, you know i associate Berklee with uh with um, a heavy dose of transcriptions and, formulaic approaches uh to to scalar material and, you know uh uh, at CAL Arts we used to call it, uh the jazz factory you know and and and of setting CAL Arts from that, a little bit. but um, uh, however that is it's interesting that uh, that um, Gary Bergman said that he never transcribed a single solo and he never, uh uh, encourages anyone to, transcribe a solo. uh

S3: yeah but what do Deans have to say about the curriculum?

<SS LAUGH>

S2: well anyway, the the point that i'm, um making uh there is that um, uh, that th- th- this issue of uh how, how do you learn jazz um, is- is obviously, controversial even among those that, teach it, as as you, know, best of all. but um, uh, uh he always talked about his jazz learning uh with me as a as simply having been um playing, playing with uh with performers playing i mean obviously the the experiences with, uh Charles Lloyd and and uh Miles David*(sic)* but uh but before also, the Blakey experience uh, uh, uh were crucial for for him uh the Blakey band mm, is often addressed in connection with Jarrett as as having been a band that didn't work out and or Blakey said that himself and that Jarrett somehow didn't fit in it and uh, and that Jarrett was bored with the rest of the group um so it's generally being portrayed as some, as a bit of a frustrating or a negative experience, and um, uh he has acknowledged that also as, as a kind of a school, nonetheless, for him, uh uh not only the experience of actually touring with_ that was his first touring ensemble, but also uh stylistically of fitting in with these uh musicians that for him that was a kind of a training. [S6: mhm] so i don't think that uh in that in his case was ac- was ever a matter of um, um uh, really following through with uh transcription and analysis in a very, uh systematic, uh- m- uh manner apart from, performing with people. [S6: hm] i mean there's a h- a heavy emphasis on uh, on you know it's done in the doing, [S6: yeah] it's not done in the classroom.

S6: except yeah yeah, i- it's just interesting because, y- uh we know he studied classical music [S2: right] from when he was very young, and so we have kind of a clear sense of okay you know you have this and there's this body of literature and you, learn it and that but, but i mean by time_ the thing is when he played with Art Blakey i mean by that time, i mean sure i i you know he learned, with Blakey and Lloyd and all those people but [S2: so what happened before? what what happened, right, right] [S3: with 'em in the first place?] i mean he had_ yeah because he had to yeah i think you know <LAUGH> uh, i'm just i'm just sorta curious about it i'm not you know uh

S4: how old was he?

S2: uh, um wait Blakey was um, sixty, five so he was twenty. i think he may have started sixty-four so, that would've been nineteen.

S6: he was nineteen when he played with Blakey

S2: nineteen

S6: so just out of, just when he just quit with Berklee or did he?

S2: yeah uh Berklee was uh sixty-two sixty-three.

S6: so he was like seventeen or eighteen when that (xx)

S2: um right yeah, yeah. and i uh uh really don't quite know how that worked because it occurred to me afterwards that um, um, that that doesn't quite work out with high school, does it? but um th- th- for instance th- the [S4: (that record he had)] first that record that says um, his first record uh where he plays in a in a, uh big band setting, organized, um uh wrote up on the liner notes that he was at Berklee and he in fact wasn't at Berklee yet, when that recording was made. so and and and uh i found uh conflicting timelines about, what year he actually was at Berklee. some say it was sixty-two sixty-three some say it was sixty-three sixty-four, and uh whenever that first album was made uh, uh some people take, take their timeline from that but the problem is, [S4: cuz he wasn't] that he wasn't at Berklee at that time

S4: i bet you that the problem is academic year versus calendar year we think of, calendar years and liner note writers think of aca- uh we think of academic years, liner note writers think of

S2: yeah, that may be part of the, yeah, yeah. well but to address that that question how do you get to play with um, with Art Blakey um... um, one thing that he addresses is uh, listening i ge- uh you know a lot of listening uh for instance the uh his whole uh, affirmation of the connection to Paul Bley is uh is through this, especially this one recording, [S6: mhm, yeah] through through Footloose. i mean i i can relate to to the idea of uh, uh, uh, of having a very few select albums that you really, go crazy over, uh rather than sort of uh covering a certain, canon you know of of something i mean we may look at it as as researchers you know we have, you know here's the discography so and so but um, uh, what it seems to boil down to in the learning process is is a few very, select records that he, just, practically memorized and and played with, as as he listened and, and one of those was Footloose by Paul Bley and one of them was Abbey Road by the Beatles. <LAUGH>

S6: because you know he s- he so comfortable, playing, you know i- in pl- it sounds like he didn't play standards for a while and then, just moving into that i mean it's really, i mean kind of going back to Bob's point like the i mean- if i were to say this is just mind-blowing you know like the the the the [S2: right the standards] (My Funny Valentine) uh, it's inter- i mean cuz there's a Miles Davis version of that which also just incredibly, unique [S2: yeah] in its own way and um and i would put this, in that same, somewhere in that same [S2: yeah] ballpark it's really, i mean and and this- it just just hearing that again when you ga- gave us that tape it just struck me how, uh, i mean he n- he not only played the tune well but it was just just this sense of freedom, on the, just, you know very interesting rhythmic concept but it was some you know just a, just a layer of, improvising [S2: mhm] on that [S2: mhm] level that he had attained that just you know comes from playing for a long time. but what

S2: c- c- can i say can i interject one thing there? um i uh, uh brings that out uh i believe very much that the standards couldn't have happened any earlier. and i i think that the the the standards are, for lack of a better word sort of the mature, stage of_ i mean when he came to that, i- it was using resources not only of having, played standards when he was um, sixteen,

but but of everything else he went through, and in in that's uh in other words playing, folk rock playing Dylan songs playing, uh Beatles songs or uh uh, going through the free um, uh f- through free improvisatory processes doing the solo recitals and so forth. and it all came together uh in the standards, and i- in that lies, a certain personal truth of this um, uh denying the answers <LAUGH> (xx) uh issue because i believe that uh his having played all these other musics is a has, influenced how he plays standards in other words he's learned to play standards not just by practicing, standards, but by practicing all the other things, that came then came out in the in the standards. so that that that is very much uh, it's just a a formula but i don't mean that, with a negative connotation it's a it's a, it's a way, of putting all the ingredients in the pot. and and and and that took, twenty years, to get

S3: well it's finding another pot to put the ingredients in

S2: yeah but maybe the the pot he feels more strongly, about, [S3: yeah] you know. so so uh i it may be some of this, provocative controversial stuff about i've not being influenced by anything and anybody, also was a way of saying look, i play standards having played, Dylan, you know or or i mean i- and that's that it shows in how i phrase and so forth so you could just as well say, i um my jazz playing has been influenced by Dylan as much as it's been influenced by Brubeck. and in one uh in uh one interview he told me you know that this whole influence thing it's so absurd i i could start naming, um you know pianists i really don't like that indirectly though also have influenced me uh in in how i make choices. and then he g- went off on this and now i forgot the name of this uh piano comedian wh- what is this popular

S3: Victor Borge?

S4: Victor Borge?

S2: yes, he said you know i've i've b- i would have to name him too, <SS LAUGH> you know, so so uh

S4: Borge's funnier

S2: so <SS LAUGH> so the idea was [S3: i'm surprised he laughed] to to uh, summarize you know to use jazz standards playing as a as a sort of a summary, of musical experiences that were very varied and m- many of which were outside jazz

S3: i think there should be at least a chapter on Victor Borge

S1: on Victor Borge

<SS LAUGH>

S4: back to the drawing board

S6: so, um can i, one more

S2: yeah i'm sorry i interrupted you

S6: no that's alright um, so i wonder if maybe we could s- shift a little bit to something a little bit more open uh, could you talk a little bit about, how this dissertation might be a spring board for, some other areas that, you're gonna pursue, either related to J- Jarrett or not possibly [S2: mhm] that um, i'm a little bit curious about what you're going to do with all this um you've got probably hours and hours of, of interviews so, [S2: mhm] in fact you, you happen to mention, n- d- i- in the passing i think once that, that you know you may do something further with Jarrett, but um, either talk about that or if there're some some windows that have been opened in this, that um you might, explore.

S2: mhm... wow, that's an interesting question um, y- you know i me- i mean of- th- the first thing that comes to my mind is this may be, a little off the wall but the first thing that comes to mind is um, this has done a lot for me as a musician and and but i haven't had the time, to actually be a musician uh uh so so i'm looking forward to how this will transpire in my, practice and in my, my playing. this, really doesn't have much to do with, the academic part but the musician was sort of on hold for a year and, and uh i- uh bu- in a good way i think that it it can do a lot of, of that um, uh w- w- what i what i've, learned is uh in in closer detail or one of the things i've learned, in closer detail to understand how this uh collage is woven together, you know um, what are the mechanics of uh, say moving from that My Funny Valentine introduction to um, to the soloing that then ensues over the over the chord changes. and one of the things that really were surprising to me is after i had made the transcription is, the predominance of that uh, diatonic uh uh of the diatonic uh material in other words staying within the C minor scale for, you know, almost half the performance uh uh, and yet it soun- it doesn't sound like that the melody notes are s- are are like that but what's going on is is highly chromatic underneath it. and um, that was something that i didn't understand just, by putting on a record and listening to it it's i i needed to see this and i needed to go wow there are, what, three hundred measures were all he's doing in his right hand is a C minor scale, and when i first came t- to jazz i, you know one of the things that attracted me is the, the the possibility of being more chromatic and, and less, tonal. so um understanding the mechanics of of that kind of improvisation and how he creates um, a longer arch of suspension or l- longer energy curve, that isn't really contained in clearly separable, um, uh, sixteen or thirty-two bar, choruses, um, was really interesting for me to find that out through research and i think it's, it's gonna end up, sounding, as well. in terms of uh a research project, i think um what i'd like to do is uh, possibly go to some other musicians and see um, see how, similar issues are handled, not in order to see whether they're doing the same thing and if they're not doing the same thing then it's not as good but, but i think that these issues uh impact any improviser, uh uh, an- and that was the launching point for my comparison with um of the solo concerts with Indian music is that there is a need, in in vernaculars uh predominantly improvised, uh to deal with form in a in a, in a creative manner and um, and one obvious solution uh for form in in uh, improvised music um, is cycles such as in Indian music, uh, and uh, in in his since he doesn't deal with that theory uh ye- you know on a on a conscious and in a strict stylistic manner, uh one of his solutions is uh uh s- s- this internalized sense of, of timing <AUDIO DISTURBANCE> and it's something that i, from my studying Indian music was very aware of, in Indian music but to find it reappear in these in this uh in these solo concerts was, uh, not something that i s- i mean i really had to see whether this was going to hold water and i i was a little surprised that it did uh uh i kind of didn't expect that research to come to that point. so i'd like to um uh f- find out more about how uh improvising musicians, um, uh deal with that other ins- improvising, uh, musicians deal with that. and i i think you know in the long run this uh, research could be, uh could be strengthened by going through the same, process with re- the respect to different concerts uh i just thought that that would, that i mean that, that's uh that's a lot to go through um and and i i i've pointed out that you know some of it happens in

the Koln concert some of it happens in the La Scala concert and some of it happens in the, in the Kyoto concert but the detailed analysis was primarily about one of 'em, um but uh it's very systematic and that's one of those interesting uh paradoxes for me with Jarrett is that, it all seems so divergent you know playing jazz standards and playing Bach uh Bach's We- Well-Tempered uh, Clavier and, and um, and then playing Arvo Part and uh Lou Harrison and then doing fr- free improvisations with uh, uh his American quartet and then playing these folk-like melodies with the European quartet. but, these impulses uh uh really carry through all those divergent areas, eras and um, uh he tends to not do any of 'em anymore, uh simultaneously, and uh i mean for all we know he may stick with this, jazz standards trio. it's really amazing with, uh you know how with how few musicians he, performs he performs either alone or with Gary Peacock and and Jack DeJohnnette, or with orchestras and that's pretty much it at the at the moment. um, so there is a strong underlying continuity and to uh to find out how that, uh carries through um maybe different uh, phases of his work um, for instance to in-depth in-depth compare you know the La Scala process of temporal development with the K- Koln concert, uh would be interesting, [SU-M: mhm mhm] and then to see how that uh figures out in, in other uh in other musicians, improvising i mean, i mentioned that Chick Corea's, uh, were the first solo piano recordings on E-C-M, and that there must have been some kind of, uh, well if not rivalry but at least, you know there was something going on between these two pianists, um, doing s- very similar thing around the same time.

S1: i, um, i'll be brief cuz uh, we're really kind of out of out of time so <LAUGH> um, w- one uh just a couple of things, h- uh having read earlier versions and then reading this version some things uh struck me that didn't strike me before, and uh one was this whole issue about the comparison between the alap the Indian the uh Shankar alap and, and the timing in terms of the solo concerts, and on page one forty-eight, and it seems to me this brings up a lot of, issues and y- s- you don't seem to, be quite sure how to, talk about this. [S2: mhm] uh, on one forty-eight, you say uh <READING> the description of Jarrett's relationship with North Indian music, suggests that his format of freely improvised solo concerts was developed in part, through a conceptual borrowing from classical Indian traditions. </READING> well i mean that's one way of, that's one, possible interpretation but then in other places you say, well uh, this has to do with the nature of improvisation itself and you have to have these struct- you sort of imply that there's something innate, in in, these these, timing systems that are going through an impro- uh i can't remember exactly where [S2: mhm] you say that but you do, in in other words you don't seem quite how, know, quite how to handle, this similarity. [S2: mm] uh, i- i- i- there's a certain ambi- i felt a certain ambiguity in, in, um, in what the meaning of this parallel is. and i wondered if, you wanted to, [S2: mhm] or if there's no ambiguity in your mind and i was just perceiving that there's a- ambivalence here about, what does it mean?

S2: mhm. well, i uh i think what it means, in particular uh, with respect to Jarrett is that uh, he loves Indian music he listened to it, he started the solo concerts at a time that was, very much under the, the star [S1: oh] of uh

S1: well then you're sticking to this tradition that it's a borrowing.

S2: uh yes

S1: you're sticking to this interpretation

S2: yes but uh uh but i'm also saying that he's not uh he never consciously tried to do that. i uh he he never came out and said i'm using alap structures uh to apply uh, uh in in my solo concerts in fact i i i i doubt that he would have, ever conceptualized it on that level so therefore what i'm saying [S1: uhuh] is there is a similar need, in uh, in improvised languages, that so heavily re- rely

S1: for a structure, yes

S2: right, for a structure. and it

S1: but, uh uh

S2: so that's the only innate thing is that need to somehow come out of structure

S1: yes there is a need yeah uh, but i- i- in order to establish that this is borrowing, you would have to establish that other improvisers, do this temporal, structuring in different ways. [S2: mhm] i in other words you have to, because, uh, uh, you don't make you don't, make the case, [S2: mhm] that it's, a borrowing, [S2: okay] you you say you've gotta have a structure you can't improvise without a structure yes of course, uh and he- here's a structure he uses and it looks like this Indian alap structure it has similarities with this Indian alap. well that doesn't, doesn't make the case, for borrowing. i mean maybe, maybe it is unconscious borrowing, but it seems to me you'd have to, do an analysis of other improvisers which have entirely different, [S2: right] temporal structures in order to make the case for borrowing here.

S2: well, that's that's [S1: yeah] that's the uh particularity of this situation [S1: uhuh] is that um, as much as Jarrett's tech- techniques or, stylistic uh, persuasions maybe related to other musicians, [S1: uhuh] there are few others that, i i i don't know any other that go through this ritual of these forty-five minute long, uh, free improvisations. i mean i just mentioned Chick Corea's recordings, they're all in shorter segments they're shorter improvisations, that don't allow for this uh kind of, de- development. so i'm not trying to say that what Jarrett does is is totally unique there but i i i would be hard pressed to to compare

S1: you mean there's no there would be no other

S2: yeah because that that is wh- what uh, both what some people so like and what's aggravates some people so much is this endlessness of these <S1 LAUGH> of these improvisations [S1: yeah] but th- a- and that's when i in in the subchapter about uh conceptual parallels with Indian musics, i told my own story and i said that, that's very much a reaction that many people have to Indian music of saying it begins [S1: yeah yeah yeah] nowhere it ends nowhere, and that that kind of thing and that's that's a criticism brought to Jarrett as well, and uh it it needs those kinds of [S1: oh okay] temporal dimensions [S1: so you're] for that to unfold

S1: uh uh, well, you're saying there aren't_ there wouldn't be anybody else to look at. to make your case stronger.

S2: f- f- uh, for that particular argument? (yeah)

S1: no i'm not i'm not talking about [S2: mhm] t- doing this for the dissertation

S2: right right mhm

<SS LAUGH>

S1: i, i don't i don't care if (xx) analysis, it just struck me that, that uh [S2: mhm] it

S2: yeah th- uh i guess that is what i

S3: you know what's great about this Janice is it's almost like gee it would've been better if he hadn't found the parallel

S1: yeah

<SS LAUGH>

S3: cuz he's gotta, now he's gotta explain the darn thing.

S4: now you've gotta take Cecil Taylor and start timing him

S1: right, right, yeah, yeah. well okay alright we'll leave that one. and a- another av- one uh brief issue and that's the uh ag- as i was going through it, it struck me how important, the um, uh, German perspective on, Jarrett is, throughout the whole the dissertation and not just because you're German, it's because you use German sources in a in a great deal and and German quotes all the way through, i- and yet in neither in the abstract, nor in the introduction, do you say, this is in some ways a d- is a dual perspective. and it seems to me that's a very important part of the dissertation [S2: mhm mhm] so i- it just, if that, [S3: i think that's true] if you, i think that needs to be in the abstract [S2: uhuh] and as well as in the introduction that, that uh, this is, is a dual perspective on Jarrett because the German perspective is very very important throughout, [S2: mhm mhm] throughout yeah, and it's not, exactly the same as the, American perspective

S2: right right, so to to acknowledge that more [S2: yeah, yeah] be more forthright

S1: bring it out [S2: mhm] uh yeah okay. alright is there anything anybody else, really, wants to say? okay uh we'll ask all of you to leave

<P 0:08> <COMMITTEE RECESS AND DELIBERATION; BREAK IN RECORDING> <MULTIPLE CONVERSATIONS UNTIL END>

S4: (xx) Stanley Crouch

<SS LAUGH>

S2: that, was that, or

S1: that's it.

S3: that was it. yeah.

<SS LAUGH>

S1: that's it.

S2: i see. i see. thank you.

S4: you want ice cream?

S3: yeah, you want something more ritualistic?

<SS LAUGH>

S2: no i just, i haven't been through this before so

S1: you didn't know. no that's all. tha- and uh so (xx)

S2: great. oh okay, and these are

S3: those are the, (xx)

S4: i brought the wrong version with me so i have to get you my uh (cover)

S2: okay so, okay

S1: (xx) brought the wrong one, so he's gonna get, he's gotta (give you his right one)

S3: yeah this is, this mine

S2: does this stay with, okay

SU-F: oh okay <LAUGH>

S2: i just wanna know whose is whose

S1: well here

S5: oh i put my name on mine.

S2: okay

S1: uh well i didn't put mine, but i_ you can tell

S3: can't tell our handwriting?

S1: he can tell my handwriting (xx)

S2: yes

S1: okay so that's mine.

S3: (gotcha.) there's one other thing here, just a (xx)

S5: wait a minute. if we have four

S2: yes i do [S4: okay] thank

S5: i'll i'll leave you a copy of the music

S2: great. please do.

S5: (up) here?

S2: yeah. that's fine. thank you. thank you. alright

S1: (you have a good move)

<SS LAUGH>

S2: thank you. i know, that's coming up soon.

SU-F: thanks for coming (xx)

S3: see you (Nils,) yeah

SU-F: sure, (xx)

SU-F: (xx) thank you for coming

SU-F: sure, it was fun <LAUGH>

S4: i have to get you my copy because i ha- i have the uh the previous v- i picked up the [S2: right] wrong version_ my cat's fault

S2: ah it's the cat's fault. great.

S3: when you indent and single space you do not need to use quotation marks.

S2: i see.

S3: so all those are (xx)

S2: great. okay.

S3: and make sure you, make sure you use double quotation marks (when you_) cuz in in in the first draft [S2: i yeah i've] i saw there were some times when you were using [S2: right] just single [S2: right] quotation marks

S2: i've tried to a-

{END OF TRANSCRIPT}

Title: Social Psychology Dissertation Defense
Academic Division: Social Sciences and Education
File ID: DEF500SF016
Publisher: Michigan Corpus of Academic Spoken English, English Language Institute, University of Michigan

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RESTRICTIONS ON CITATION OF EXAMPLES: NONE

Recording Duration: 76 min.
Recording Date: May 20, 1998
Recording Equipment: TASCAM Digital Audio Tape Recorder with two external microphones
Language: Primary Discourse Mode: INT Native Speaker Non-native Speaker Near-native Speaker
Participants: Number of Speakers: 5 Number of Participants: 5

S1: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Male; Age: 51 & over; Restriction: None
S2: Native-Speaker Status: Non-native speaker; Academic Role: Senior Graduate Student; Gender: Male; Age: 24-30; Restriction: None; First Language: Korean
S3: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Male; Age: 51 & over; Restriction: None
S4: Native-Speaker Status: Near-native speaker; Academic Role: Senior Faculty; Gender: Male; Age: 31-50; Restriction: None; First Language: German
S5: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Male; Age: 51 & over; Restriction: None
SU-1: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Male; Age: 51 & over; Restriction: None
SU-3: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Male; Age: 51 & over; Restriction: None
SU-4: Native-Speaker Status: Near-native speaker; Academic Role: Senior Faculty; Gender: Male; Age: 31-50; Restriction: None

SU-5: Native-Speaker Status: Native speaker, American English; Academic Role: Senior Faculty; Gender: Male; Age: 51 & over; Restriction: None
SU-M: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Male; Age: Unknown; Restriction: None
SS: Native-Speaker Status: Native speaker, American English; Academic Role: Unknown; Gender: Male; Age: Unknown; Restriction: None

Setting: Small Conference Room, East Hall

S1: okey-doke, uh well Kim Sook was gonna do another, very brief summary of what he's up to. uh to bring it all up on our screens...

S2: alright, um... first of all i'd like to thank all of you, for agreeing to be on the committee, reading the draft, and coming to the defense, being, with me at, my last moment of, graduate school

S3: <LAUGH> such optimism <SS LAUGH>

S2: um

SU-M: he he's gonna drop out, if he does- if he doesn't pass he told me he's gonna drop out

SU-4: (no mischievous I-G-S-I today) (xx)

SU-M: wait for the others

S2: um, my presentation will be extremely short. mainly because i presented most of the data in a proposal meeting, and also the four studies, reported in my dissertation are, very simple experiment so, i think that by now you may have clear idea about what this dissertation is about.

S3: could you maybe push that up uh the uh, the the light part does it work?

S2: which one where?

S3: so it'll be a little bit higher on the wall

S1: tilt the mirror. tilt tilt the top mirror

S4: the the top thing uh yep um

<P :05>

S3: well don't worry about it

S4: <LAUGH> it's done

S1: if you just take the top mirror and grab it won't it tilt a little bit?

S4: yes yes yes.

S2: oh yeah. is this a test? [S3: thanks] [SU-M: hm] okay, um <P :05> uh this dissertation is based on, um, this theoretical, claim, um, all people have their own theories about the world as, scientists do, and depending on what kind of theories they have, their judgment and behavior will be different. particularly in this dissertation, i'm arguing that people who have, unspecified interactionist theory, are rarely, surprised by contradicting event, and surprising event, and instead they will dispr- display greater hindsight bias, and i'm arguing that these will block their epistemic curiosity um

S3: c c-c- could i ask a procedure question? um, should we interrupt throughout, this or how do you how do you wanna proceed?

S1: uh, well normally it's just a quick, run-through but i don't if people wanna do it on a on a you know just... in this, fashion common on the fourth floor <SS LAUGH> that's fine too. i don't know, what do people wanna do? i mean there's nothing (xx)

SU-5: (whatever)

S3: i mean cuz there're various points of which, i think i might wanna want clarification and or comment on certain things

S1: okay well [S2: okay, yeah] why don't you why don't you do that?

S3: uh, including the, first five words. um, an unspecified interactionist theory naive theory. one possible interpretation of that, which in fact was the interpretation i made when i first read the um, the abstract was that there's a class of things called interactionist naive theories, and you're not gonna tell us which one it is. but now, as_ after having read it that's not what you meant. is that the case? in other words, there could be tons of interactionist naive theories. and but it's sort of a mystery, and you're not gonna tell us, you're not gonna specify, which of those theories you're talking about. but that's not what you mea- you're meaning by this term, is that [S2: no] correct? okay so, maybe it's a good idea, to tell, us and, actually the reader, right off the bat what you mean by an unspecified interactionist, naive theory because i i'm not sure that that's general kno- [S2: alright] general knowledge. is that the case?

S2: um, no i i don't think it's general knowledge. so i, have three examples of unspecified in- interaction theory. so, first of all uh people can have, what i call interaction the- theory about their self. for example they can believe, at times, you are extroverted, affable sociable, while at o- at other times you are introverted, wary and reserved. now this is interactional, uh to me because, um, it has, two, opposite, states, at the same time so being introverted and being extroverted, but it does not specify under which con- exactly under which condition, you are introverted and under which condition you are extroverted. you just have two, contradicting state in your theory, without any s- further specification. now people can have also, theory, interactionist theory about behavior, so, saying that even an honest person will behave dishonestly depending on situation, so... you you behave_ you can behave honestly or dishonestly depending on situation so it is interactional, but there is no specification, under which condition you will behave honestly, or dishonestly. in the more general level... um... you can believe, the world is both the yin and yang, so without any specification, the Taoism, says that the world is, uh, world consists of the yin and yang principle. it can be yin and yang or both. so, in that sentence, uh, i defined, interactionism. unspecified interactionism... s- so?

<P :04>

S3: yeah i i i guess it's just a matter of of presentation i mean, i- it would seem to me that in situations, where you are in effect, inventing a term, it might, make more sense, to start out right at the very beginning, th- saying what it is you mean, [S2: right] and then get into the content [S2: right] whereas is- it's actually, done almost in reverse

S2: okay um, the, Hou Fun Ma another, student here, now in Stanford, used dialectical reasoning. meaning the same thing, as i do. [S3: mhm] so he call it dialectical reasoning coined the term, but i use interactionism so, for your understanding you can equate interactionism, with dialectical reasoning. okay? now to test this claim i i compared Koreans, who are known to be more interactionist, with Americans whose theory is less interactional. um <P :05> so the dissertation, is organized in the following way. in chapter one, i provided a literature review indicating that Koreans and other A- East Asians as well indeed, more interactionist so they have more interactionist beliefs of self, and behavior. so typically their, uh self-descriptions were contextualized. implying that, their self, can be different, depending on the situation. and their causal theory emphasized an interaction between the person and the situation. and given this literature review, chapter two reported, report two studies, um, bad Samaritan study and busy Levite study. as you recall, in both studies, uh Korean subjects, were less surprised by a contradicting event, so in, study one, uh this is just one, figure, from the four figures for study one, this is probability judgment, so when the target person, who was a very religious person, did not help the, victim, Koreans showed, greater hindsight bias as indicated, the decrease, uh in probability estimate. in study two, when, less helpful person, did help another person, which should be contradicting to their, initial expectation, Koreans again expressed_ displayed greater hindsight bias, as indicated, um, in the increase of their probability estimate. and interestingly when the target person did not help, they also displayed hindsight bias so, regardless of whether the target person helped, or did not help, they displayed hindsight bias. and this pattern, uh, is quite consistent with the claim that, uh, Koreans', interactionist epistemology is blind to contradiction. so in chapter three, i reported two, other studies, study three N-S-F decision study, study four liar liar study. so in both studies, i tried to create condition, where, people should feel a sense of contradiction... however as, expected, Koreans were not surprised by this condition, where they should feel a sense of contradiction, so here, only Americans were more surprised, in th- by the presence of strong alternative hypothesis, but not Koreans. and also in study four, Americans were more surprised, and they found, a particular finding more interesting, but not Koreans... okay? in the final chapter, i discussed some implications of these findings on, development of science, and conviction and debate. my general point was that, to do science successfully, in a culture, requires a particular way of thinking style, where, uh, possessing and expressing one's conviction, through debate i- should be personally, freely allowed. and at the very end, i tried to make sure that my dissertation is not making one culture look better than the other, so i tried to, um say that, uh sometimes this argument culture of America, may have some cost. and this, the lack of argument in Asian culture may have some benefit... okay? thas- that's the dissertation.

S5: to_ on the last point i would've, um said that allowing, science, um allowing conviction and debate isn't enough you need to encourage it if you want, things to happen allowing is a fairly, it's almost a negative word you allow something. (uh) mo- many people will not, do something if it's merely allowed.

S4: but, i was under the im- oh i was also a bit surprised about the wording. because it seems that, i mean even encouraging debate, um, would not necessarily get you, to scientific, enterprises i mean you have to develop some consensus on how you're going about, accepting things as evidence and so on, which... [S3: right] seems to go far beyond, i mean it's a a taste of you know, i mean as long as people debate and are surprised and curious everything's fine and you make great discoveries.

S3: right

S5: c- certainly only necessary conditions, far from sufficient

S4: absolutely yes

S5: i i'm still curious why, um, you wanted to do the, thing you brought up just at the end about uh making, different cultures look, equally good since it didn't have anything to do with your thesis. i mean as far as i can tell. i i don't understand the connection, uh there and i wondered why <S3 LAUGH> you wanted to, um do that.

S1: a little cultural difference here between our field and your field <LAUGH> in terms [S5: well] of politics

S5: okay if that's the answer

SU-1: right

S3: actually i thought you did an outs- an outstanding job with that

S4: every cultural psychologist has to throw in a few disclaimers for all i can tell (by now)

SU-M: right

S3: yeah i mean it's, i mean the first two chapters i thought were masterful in that respect, um... i mean it is a fact of life. you know in a in a situation where you compare cultures and people are very sensitive about, this type of issue

S5: well until the last paragraph of the thesis it never occurred to me that one was better than another, then suddenly he, pointed out to me that, the whole thesis had implied one was better than another, and um and i thought that was interesting. [SS: hm] so it seemed to me, two things that are different, i don't see why one ha- pointing out things are different is interesting intellectually and um can be documented but better is a funny... concept if you don't want

S1: what what what were the sentences i'd be interested to_ it would be nice if you could avoid that i mean just

S5: well if if you want smooth relations among people, then a culture, um that, does that better may not do science well but, but that's a separate value judgment which you prefer and if you wanna do science well, you probably just can't have smooth relations among, people to the extent you can in uh, in an interactionist culture.

S1: but he does start with a very strong normative, claim you know and that is the set of descriptive, results of a very strong normative claim and then there's this thing called the fundamental attribution error, and Asians are not as susceptible to it, so there is a strong_ (that is claimed very early on)

S5: it's different

S1: well, no he makes an evalu- he makes a very s- he makes a normative claim he's actually, further out than anybody on this although i'm pretty close to it, in mak- in making a normative claim about_ there is an error that's made and that, the, epistemology of of East Asians uh is such that they are less likely to have...

S2: yeah...

S5: okay so they're better?

S1: in that respect.

S2: i was concerned, with other's reaction and i, could feel... i mean i didn't, mean that, Western thinking is better, in all sense it's better for s- doing modern science... but some of my, you know

S5: well i i th- no i think it's fairly clear Western thinking is better if you're gonna do science but that doesn't mean, that it's better, in general. there_ it's it's not as good for other things.

S2: right i mean if [S5: so] all readers are wise like you, (i need a new) (xx)

S4: mm. hm'

S5: okay well i just thought

S4: i i must say

S5: i just wanted to ask

S2: alright

S4: i i i must say that uh, uh... the Baltes link at the last paragraph did not save it for me. and that, i mean if all there is to be said, for the advantage uh, of dialectic reasoning or interactionist theories is, that you may i mean kind of approach the, indecisive state that Baltes kind_ that <LAUGH> Baltes calls wisdom <LAUGH> which you may often attribute to a, lack of mental resources to to work through the issue so we say oh, well

SU-M: right

S4: right? and i mean it's a classic aging effect i mean that's what he's saying and i mean in [SU-M: uhuh] many cases if the issue is complex then you say oh you know, i i guess both are right (and he sees this he sees that) and gee- i m- i mean why would that be a great advantage?

S2: right i mean he could

S4: i- it reminds me i mean i mean, my prediction_ i may be completely wrong. but i mean uh, Roger Dixon for our you know recent aging and (xx) book has done a review of what are the gains in aging are there any gains? and i mean the only gain you can identify is is Baltes is a increase in wisdom of the the Baltes measure, and other than that, uh what has typically been labeled gains is really just, the slowing down of loss i mean there are some domains in which the age-related loss is less pronounced than others, and for some reason people have preferred to call this gain which is a politically correct move because, you can't be accused of ageism either as little as you should be not accused of culturism or whatever the other isms may be, and uh, a- and that's getting, i i mean well suspicuously *(sic)* obvious here when you say oh yeah, [S2: i i i was,] more wisdom

<SS LAUGH>

S2: more thinking of um coping strategy, so for example in marriage, the divorce rate is, quite lower, [S4: hm] and that could change

S4: overdetermined

S2: in some sense but they have this, this belief you know there is ups and downs, so you can not make [S4: yeah] quick decision, [S4: yeah] so, um, i think that's, wisdom because <SS LAUGH> (are you aware) [S4: yeah yeah] (of these findings?)

S1: d- d- did you also feel like, political questions were being raised in the last page that weren't, otherwise, so much to the forefront?

S3: i thought the very_ the whole, first two chapters were about that. i mean just not necessarily put in those terms, um, i mean that was my interpretation of it that's why i said i thought it was really masterful, the way he did_ the way he dealt with that, but they certainly are issues that uh come up in virtually any conversation you're gonna have, about stuff like this. they i- they will come up, in almost every talk. i mean in one case i, i think i told you about it was i gave a talk one time, and there was uh, uh a Chinese operation researcher in the audience who became very indignant, about the whole proposition of the data, and attempted to come up with all kinds of explanations that the Chinese subjects they w- just happened to use were, dumb psychology, subjects. you wouldn't get the same thing if you'd used smarter students. um <SS LAUGH> you know and so, you know people, will react and i think it makes sense to anticipate those kinds of things the way that you have

S5: uh and in the first two chapters i thought he handled it beautifully, and, i agree it's just the last page i thought wasn't, um, up to the first two but that's okay i'm not objecting

S1: but you you you were bothered by that you (know) somehow (it) raised_ made things more political or pointed than you thought it had to be

S4: well i i i um i was amused i mean i i was amused because, i thought gee it's the same figure of argumentation that you find in the aging literature, where i mean basically you document you know, memory loss lang- i mean i mean document loss loss loss loss loss. so at the end of that, somehow you feel even though the data say you know, it goes downhill pretty early and it s- accelerates later on, uh you can't really say that so then you have to throw in

something where it says, gain related with aging... and, and then Baltes is is uh the thing that saves you because he claims that wisdom increases, but i'm relatively sure that if i had to construct a situation, in which i make an undergraduate wise, if i give this kid, a a conflict situation, you know where you have two reasonably plausible solutions, and i put him under heavy load, heavy cognitive load, and some time pressure then i would get a wise response, because your best response when you don't care enough to work it through or you can't work it through you say it- it's kind of both plausible kind of depends you know it could be this could be that kind of depends, now then that's a low effort, no cognitive, input, [S2: uhuh] answer, and Baltes has chosen to call that kind of thing wisdom, and and you're doing the same thing. <LAUGH>

S3: well uh well i i don't actually remember the last thing i'd have to look at that but my interpretation of the first, two chapters was i think the way to go that you got two different ways of approaching certain kinds of things and, the real issue is under what conditions, are they likely to be more functional. and uh, i see absolutely nothing wrong with that in fact i think that is the best way to think about, stuff like that you know where specifying the conditions, under which they- they're functional or not so functional and then let the reader, do with it what he will, [S5: that i agree with] um... (you know)

S1: well, w- we've seen that there are these, reactions and we should [SU-3: yeah] make_ take it under (advisement) (xx)

S2: i mean, i was in part interactionist so, i [SU-M: yes] need something say <LAUGH> (gracious) to make balance, at the end

S1: (and to) put in a slightly different context i don't know how much time you wanna spend on this but i_ i i've in the past had_ occasionally had to do, research which got me rubbing shoulders with physicians and, ph- physicians are to, psychologists as Asians are to Westerners that is, you'll say something like, uh, you know i think you know, the basic process is this and they (throw) ach it's much more complicated than that. <LAUGH> and, they're not wrong, i mean you know i want my physician to think things are very complicated and ig- you know assume this is interactional i'll be looking everywhere you know i mean uh simple-minded scientists that come in there you know (xx) but

S3: so what's your interpretation of um when you're in, the culture, conflict of psychologists and anthropologists? it's uh

S1: oh that's (the) well actually [S4: it's it's it's] it's it very it's very much the same thing it's very much the same thing i just wish to hell they'd give us credit for having something so <SS LAUGH> being so simple. i fully understand their complexity i don't understand why they can't understand my simplicity. <SS LAUGH>

<P :05>

S5: okay

<P :07>

S3: um... w- what do you think about this...? s- i- i'm not sure this is the right term but it's almost like, gets to be something like a moral issue. within, this culture, it's sometimes

considered morally, unacceptable, to do, to be as you would term it interactionist. it bothers Americans for instance that, people are inconsistent [S2: uhuh] across situations and it almost seems like the person is dishonest, when the person doesn't behave consistently. uh, have you ever come across that reaction i mean has, has anybody ever talked to you about it from that point of view and, and, have you ever i- considered the issue?

S2: yeah i mean um, um, if you um... if you don't consider, two opposite side at the same time, and stick to one side only, then you will be considered immature, in, my culture. so, maturity goes, along with, being interactionist. is more desirable, in my culture. so, uh i think that is that is cultural difference. in terms of socially des- what is socially desirable, being straightforward or being more complex and indeterminate...? you know so i r- i um, gave some review about, the cognitive dissonance effect

S3: mhm

S2: so, although i mean the cognitive dissonance effect is hard to replicate even this country, in this culture, but there is no, es- to my knowledge there is no success of replicating, dissonance effect in in Asia. meaning that we are less concerned with internal_ being internal, consistent.

S3: i'm not quite sure that that actually addresses the question i mean, let me see if i can come up with an example a better, description of... it often bothers at least in my experience a f- Americans when they see, one person, behaving in very different ways, in different situations. there's almost a moral charge, to be consistent, so like to use your vignettes, if you are a good person, you will do good things, regardless, of the circumstances, the demands. uh, am i am i out to lunch on this? i mean have you guys ever heard anything like this, i mean, or have i have i just come from a, strange subculture?

S5: no no i mean certainly what you just said is true, of people of the Americans i know

S3: yeah

S4: i mean and and it follows from disposition of (xx) and so on. i mean if your acts disclose your disposition then i mean [S5: well] different acts cannot disclose the same i mean contradictory acts cannot_ i mean one of these acts has to be wrong. right?

S5: the the local way [S4: is that] of saying it is that that uh Clinton can't possibly, be making good decisions for the country if he's making poor personal decisions.

S3: well

S5: that's exactly what you just said i think

S1: well if he lied in this he lied in all

S5: yeah

S1: A- Asians would never come up would never, would never, think (like that)

S5: nor French nor German nor (xx)

S1: right that's right that's right that's right right

S4: that's not an East West that's not an East West thing

S5: it's an America- but you said American. um

S3: yeah i mean maybe my perception is i mean, is not quite right but i mean my_ i've certainly been in s- in a lot of situations in which, uh, people observe, somebody and say gosh, he's really behaving differently here, than he did last week under other circumstances what that says is that the guy has no moral center if you will, uh, and so, but you don't see like, an issue of morality at all in this this is not the way these things are at all, seen within these kinds of cultures you're talking about?

S2: i'm not saying there is none of this but, but we are concerned with being, consistent but it's less, and, i c- i cited one study, which is not published yet, um, the study shows that, Americans are more concerned with internal consistenty *(sic)* consistency than Koreans and, that predicts their um, subjective well-being for Americans more than for Koreans subjective well-being so being consistent or not_ is really important for Americans but less important for Koreans.

S4: l- let me try an let me try an example and see what you, what your prediction would be. i i mean suppose in the U-S i say you know at the seminar that i think that theory X is, let's say Fishba- the Fishbaden-Aizen model is a stupid idea, [S2: uhuh] and then Icek Aizen gives a talk and you overhear me saying afterwards, very interesting Icek what? which would be the American response. [SU-M: hm] um, <SU-M LAUGH> uh th- th- the German response is actually like ach you know i mean just tell him it's a stupid idea i mean what the heck's going on i mean why are you playing nice? uh if i did the German thing you would consider me completely immature. i mean Korean K- Korean audience, would consider me immature. i- but if i if i s- told the speaker how wonderful his talk was, the Korean audience would probably think that that's appropriate and... i mean there's an inconsistency there i think Americans are somewhere in between at least from the German perspective on on on those issues. the Clinton thing is a bit

S5: (well then it's field-dependent) scientists are a little less American in that sense

S4: yeah the the Clinton issue is a is is is is [S5: they don't take so much crap] is yet a bit different. well i mean psychologists go out of their way to say these nice things to [S5: we don't] to speakers who say stupid stuff so, uh <LAUGH>

S5: no the furthest we'll go is not to say anything [S4: yeah] if you have to say something (xx)

S4: yeah... yeah... so then you ask did you have a good trip?

S2: (that could be) might be true but...<SU-M LAUGH> (that's_ now you're also,) concerned with being polite. [SU-3: yeah] so, [SU-3: yeah] German way... looks quite impolite <LAUGH>

S4: <LAUGH> yes, i learned that i i'm trying to improve <SS LAUGH>

S1: but so but how so for Koreans are they in fact um- i mean Germans here Americans here, Koreans there, is that, that's his prediction [S2: um] right? (cuz that's what)

S2: it depe- well i i don't want to say depending on but, depending on the status, whether y- whether the speaker is your senior, junior, when your speaker is student for example then (the) teacher can say something really nasty. but if the speaker's your advisor you cannot say that. so sometimes it's okay sometimes it's not.

S1: mhm. Galtung in the course of his essay, there's this wonderful essay, i don't know if i told you about it by Galtung, about uh Saxonic Nipponic uh uh Gallic and Teuton- and Teutonic uh, styles of intellectual argument. it's it's just it's wonderful it's just, [S3: oh that would be (fun)] it's delicious uh, now what was i going to say about before oh <LAUGH> there's, i was gonna say before the Galtung um, the point that was just, on the table which is what...? <SU-M LAUGH> apropos of aging

S4: <LAUGH> but you're getting worse don't worry

S5: if you can't remember we'll go on to the next (other) example <S4 LAUGH>

S1: uh uh about uh thing but oh yes right no that that the uh that he starts his example, with the example of um of the, American professor

S2: right

S1: that that the stupidest thing that an undergraduate can say to a professor is oh that's very interesting this opens up a whole <LAUGH>

S4: if you just (trim it a little bit fix this)

S1: that's right so i mean the Americans all just as complimentary you know, seniors and juniors...

S3: well, maybe more like the Americans with, with anybody at least in a public situation i mean that, you sort of go out of your way to be polite and to not offend, um, and, and i suppose another way you can get at the same phenomenon is the ques- is in the notion of being honest, and i think that things like this, have been discussed on occasions in, in the context of negotiations. so, in negotiations between say American and Asian companies. Americans have often been taken aback and have felt that they've been lied to, because certain things were said, in that particular context and they come back and, and people are behaving completely differently, from what they thought, [S2: mhm] was in agreement. um, do you see no connection at all between [S2: well] those kinds of things and this?

S2: actually Jeffrey, Burks and i'm, doing a study about, indirectness in in communication what we did, was to give subject, a vague, verbal evaluation, and we asked subject to, translate that verbal evaluation into scales. and we found that Americans student tend to take that verbal evaluation directly at face value, so they made more errors. because they couldn't see he didn't

S3: the verbal eval- uh the verbal statement was made by an Asian? or [S2: no] do you mean just by anybody?

S2: by um, uh, their their own cultured person... but Koreans were more accurate, in the sense that they could pinpoint the hidden meaning, so they couldn't take, the communication at face value... so they are they are more concerned with, understanding the hidden value of the communicator.

S3: well, that seems odd in that (this all)

S4: just what you would expect, that you'd have to do right i mean if [S2: yeah] [S3: right] the standard of expression is more indirect then, as a recipient you have to do more work

S2: right

S3: well either you, you regress uh, but what's odd about that is that, the Americans, would not behave in accord with their experience, so is it, i mean so, why shouldn't the Americans expect when if they're dealing with Americans, people'd say what they mean?

S2: oh so you think that when Americans say something good about you, Americans don't take it at face value, is that your assumption?

S3: yeah i mean why shouldn't that be the case?

S2: well i i don't know i mean, my colleague my, fellow student, seems to take, praisals *(sic)* from the advisor at face value, and i don't

S3: oh you don't? [S2: (well) sometimes i do] oh so you don't believe the stuff i say?

S2: sometimes i do <SS LAUGH> to me

S1: we're on record here man. we're subject to <LAUGH>

S4: if you tell him if you tell him that's it's all wrong he may believe you

S2: then i take it. <S4 LAUGH> but if you say it's alright then, (i) may be suspicious.

S1: actually Jeffrey Burks has a piece, a lovely study he's just done where he has, the actual things that are said by, uh American, evaluators, to their employees, when they don't (we) know from their ratings, that they think the employee is pretty crummy. and, you now give that transcript, to Americans, and to Koreans and ask them to say what does this guy really think, of the employee? Koreans get it right, and Americans get it wrong. [S3: hm] so the- because the i- the indirectness the the the Koreans are able to, say you know the guy's really pulling his punches [S3: and so it's] (and) Americans just take it at face value

S3: there's something wrong in this. i guess but (it's an answer)

S4: but but but i mean just wouldn't you expect that that's, [S1: that's another committee that i'm on] just the standard, that's it su- just the standard effect? i mean if you assume that the standard of politeness is such that you don't (stiff) direct criticisms or i mean anything less than uh, enthusiasm is uh critical, or

S5: well you have to learn in this culture, where we see this most dramatically is that people who do a lot of hiring, uh learn that no letter is ever bad and they have to read it much more carefully, and people who only hire occasionally get it wrong and hire the wrong people. um we see this quite a lot and...

S1: yeah well there's just this enormous main effect in this society i mean more than any other industrial society of of, being nice. [SU-M: mhm] have a nice day.

S5: well if we write a bad letter we might get sued so we never write a bad letter

S1: well that's literally that's literally the truth do you know this that in the state of Michigan you can sue if they fire you [S4: yeah] without telling somebody what you did?

S4: oh i mean i'm i'm keenly aware of that because i write letters for German students and for American students, and i could never write an American letter, for one of my German students for a job in Germany. and that's the other thing i'm a complete idiot, you can't say (of me) you don't say he [SU-5: yeah he couldn't possibly be that good right] walks on water that's just silly you know but i mean here i mean you always have to, exaggerate in this bizarre way as if the world is populated by geniuses, and you know damn well it's just a guy who got his PhD a minute ago. i i mean it's a i mean what's <LAUGH>

S1: there's a very substant- a very marked

S5: exactly

S1: temple, there's a very marked temple effect here, i mean there's been a huge shift in the la- in recent (fac-) every decade's worse and worse [S5: yes] and worse [S5: very good] it used to be you could more or less tell the truth and you could even

S4: at at this point we only have genius graduate (students) <SS LAUGH>

S1: right, and it goes up from there

S5: plus the ones who are even better

SU-M: right

SU-M: good

S4: uh, Kim Sook, i have i have a very different question there's another theme in this which is not a cultural theme, i mean which you turned into a cultural theme but, i mean there's a more, straight psychology theme in there which is the role of surprise in, judgment and reasoning. you wanna say a bit more about that or, are there angles that, you would wanna add to the discussions that you had...? i i have not i have not been aware of a of a real (a novice) of a, of a systematic treatment of the psychology of surprise and its role in, in judgment and so on

S2: i don't think there is any

S4: there really isn't much there

S2: right i mean, this is, this is um, based on nobody's research. but um, i i read, much of Berlyne's epistemic curiosity book, so, he made implicit assumption that surprise is a necessary condition for epistemic curiosity, but nobody actually look at the direct relationship, between being surprised and, other consequent behaviors. so, um, well you are right i mean i just took that, assumption, in my dissertation

S4: uh i... uh um i can't really articulate, quite well what i'm, you know what i'm after but there seems something, when i ask myself, well i mean, what do we know about surprise and when would you be surprised and i mean the way, it sounds, in your piece is, that i need an explicit theory, uh that has spelled out, predictions and links between variables to be surprised. uh, i'm not sure i really believe that it seems to me, that, i often find things surprising even though i couldn't_ surprising or not surprising, even though i couldn't have, you know probably, got the predictions right or, wrong. and it reminded me of the discussion in, let's say Karneman and Miller's norm theory where the assumption is, very much like i mean, for for comparison judgments, that you often compute the standard, [S2: after, right] ex post- not before. and and wouldn't that often be the case for surprise i mean, that somehow, it's only once a (counterfactual) comes to mind that you're surprised about the current outcome and that may not necessarily, be a function of how well-articulated your theory is but of how, accessible the (counterfactual) would be. i think i can be surprised about things for which i, i i may be wrong i mean i haven't_ but i it seems that i i can be surprised about things for which i do not have a well-articulated theory, but only a highly accessible, uh, (counterfactual) outcome, or normative outcome that i would normally have, and here's something different and i'm utterly surprised but that doesn't mean that i've, you know understood that the current thing should not have happened it's just different, that in itself is, you know?

S2: i think um, uh what i said, is not different from what you said. i, i look at the uh after-the-fact effect, that is, for example East Asians [S4: mm] since they have interactionist theory they cannot predict. because so many things they have to consider, but after the fact they can construct, reasonably convincing story about why it happened. so, possibly i mean they cannot come up with, alternative. right, because they c- they can explain, that's why they are not surprised. [S4: mhm] but for Americans, since they have relatively simple theory, they can't come up with alternative, which is contradicting to their original theory. then they can be surprised, so, i was not

S4: but surprised i mean y- you're still i mean saying it in a way, that surprise necessarily requires falsification of a, of a theory, rather than noticing that something is unusual i mean couldn't that be surprise just by exposure, to a low-probability, event, you have no theory why the probable or the improbable would happen i mean i just notice that this is different, [S2: well actually i] (do i need a) theory for that? (i mean)

S2: i mean i had a conversation with a, Korean developmental psychologist, a couple days ago who was visiting Carnegie Mellon, and i talked about this research, and i said, okay suppose one scientist, made a claim that a dog can fly... and he said well, i can, construct a theory, story why, dog can fly. and i said it's wrong i mean if if you can, construct a theory, or story, then you are wrong i mean, you should not do that. so, even if, there is no no there's no theory required, just if they can construct a story... so, then they, would not be surprised so it does not maybe require, just a theory, whether they can make a story or not. is that?

S5: and um... assuming he's said enough um let me make my comment which is that in in natural science what he says is absolutely true. that if you don't have, th- there's just tons of historical examples where, you sort of know something and until you have, u- until theory gets up to the stage where you can find it surprising, it's just there and you don't do anything with it or respond to it and then finally you have a quantitative theory, and then it doesn't fit and then, you go (hm') tha- that's um, partly why, you hear stories that at the end of the last century people said that, all of science has been done and there's nothing left to do and so forth, uh it's because there were tons of facts around, but they didn't even have the framework for them, and then slowly the framework came and they realized that, they didn't fit at all with the previous ideas, that they didn't incorporate them (enough.) so, i- it's a strong point in, but in everyday life i, i find it less strong as as you're saying

S3: so is the idea that, there were these facts and things out there but nobody had bothered to, even ask whether they reconciled with

S5: you don't know [S3: the] how to deal with them, yeah, you know it's just it's not surprising cuz you don't have a theory yet in which you're supposed to be able, to include it, and and then eventually you get to that stage and then, you realize that it doesn't fit, as the theory developed and then it can lead to a whole new, set of things

S3: okay but what about this i mean, how do folks, deal with this question of what the whole point is of having a theory? i mean, why not j- simply exist i mean why do you need a theory?

S5: for us that's easy. i mean the whole point is to understand nature.

S3: right

S5: and that's all we're about

S3: you mean when you say us who are you referring to physicists?

S5: physicists uh well natural scientists i guess, um, i think it's equally true of biologists um, or, or molecular biologists (i guess,) evolutionary biologists yeah i mean it's, natural science i think, what you wanna do is understand stuff and you just work your way, along and that's the whole point of doing it. so, there is no other reason, uh

S3: alright th- that might actually get to an even more fundamental issue which i'd be interested in hearing your your thoughts about, which is, in day-to-day life what actually is the point, of even considering questions like this i mean so, [S5: right] why would you even need to worry about stuff like that? uh, i mean to get back to Gordon's thing. you know i just go to work every day work in a factory and go back home. why the hell do i need a theory? i mean in order to do that. so, these issues would never arise. i mean so what kind of a society, would even think that you'd need to have stuff like, physical theories, about which you could become surprised?

S2: w- well i don't think, everyday-life theory is articulated as, theory in physics i mean the simplistic people have, their, theories but they_ sometimes they don't, realize they do have theory. so, i don't think many people are bothered to have their own theory explicitly...

S3: okay well, let me ask a related question. could the real core here the core at issue here, have to do with expectations, i mean so, intuitively it seems to me that, you are surprised, when something, turns out to be inconsistent, with your expectations. uh, how does that idea, reconcile, with the work you're talking about here?

S2: um, that's, for example in study, one then two, both cultures expected that in study one the target person would help the victim. when the target person did not help, which should be surprising right? [S3: okay] the Koreans were not surprised. so i think expectation_ sometimes expectation, can be a priori, but sometime it can be constructed after the fact... [S3: okay] that- that's the uh... [S3: alright] that's the_ i think that's the hindsight bias right? they [S3: right] they they act, as if they have expected, things turn out to be this way not that way, so they change their, expectation, after the fact

S3: is there any possibility that, one part of the difference might be, how firmly held the expectation is? say in the ambiguity sense?

S2: well, i mean that's why i'm interested in conviction. [S3: mhm] if you have this complex, theory and you cannot make a commitment, you are not, determined to do anything, so it takes longer time to make commitment, it takes more information to make a judgment. i think i think that might be the case.

S3: i mean do you remember how ambiguity is construed, in decision, making i_ it's been a long time since you've, read that stuff

S2: is this a test? no i don't

SU-M: mhm (xx) remember

S3: it actually

S3: yeah remember it actually is a technical term, i mean, to be distinguished from probability. so one loose way that is sometimes interpreted, is that it's almost like probabilities about probabilities, so that normal probabilities that you would talk about as discussed in this thesis, would be sometimes referred to as first order, probabilities, and then you can talk about, things like the distributions, over those probabilities, [S2: mhm] uh is it conceivable that in this context what you're really dealing with, is that those second order distributions, are different [S2: right] in the two different, [S2: right] groups

S2: yeah, i'm also, um thinking about the distinction between confidence and uncertainty, [S3: mhm] confidence is just a, your, confidence, expressed in terms of probability [S3: mhm] but uncertainty, is expressed as a range, of probability

S3: well that that that [S2: right that's_ right so, i th-] really does that does get, get at the idea so uncertainty's sometimes seen, as the extreme case [S2: right] of a diffuse second order probability

S2: so, right so i- in terms of confidence, there might be no cultural difference [S3: mhm] we know that [S3: yeah] but in terms uncertainty i think, [S3: yeah] yeah so

S3: that might be worth pursuing [S2: yeah, right] and that's sort of tried and true, sort of paradigms [S2: right] for pursuing those kinds of issues, you know, that might be worth looking at.

S1: suppose someone were to ask and i i'm, it occurs to me a reviewer might, do this say well gee the it's a lovely, treatment of all this that you have but why don't, why don't you do the, simplest thing which is to make people make a prediction, and then say guess what, you're wrong. and what would what happen then s- if you were to do that. well how would, Americans respond how would, Koreans respond.

S2: um, well if i'm_ this is right then um, Korean would still be less surprised...

S1: why?

S2: because they can, um, explain why, it didn't work out that way.

<P :06>

S3: suppose that in the Bayesian sense, <S2 LAUGH> you didn't just ask people, what they think is gonna happen, but instead you said put your money where your mouth is. would you expect, that people's expectations, would turn out to be the same? so in other words if you were to infer, what they really anticipated, on the basis of their actions, would you, for instance in your experiments, would you expect, that you would in fact get identical expectations as you did? as you did here?

S2: uhuh. i'm i'm lost.

S3: okay. there, are in general two different ways, that you can, go about assessing what people expect to happen. [S2: mhm] one is the way you did it just flat out ask 'em. [S2: right] the_ another way that you can do it, which is closer to the spirit of Bayesianism, you don't ask people anything. you, have them decide, on the basis of their beliefs and you infer what their beliefs were, from their actions. so is it conceivable, that from that point of view, the Asians were in fact more wishy-washy, in their expectations in the sense that they would not have been, as willing, to bet [S2: uhuh] uh as extremely as the Americans do? would you expect that to be the case...? sort of consistent with the spirit of your interpretations of Jeffrey's experiments, you know sorta like people regress, they you know, they don't really expect much of anything. you know they they you know it's almost like free-lancing they're, gonna, just react to things as they occur

S2: well i hope that's that's the case. i expect that would be the case

S3: mhm <P :05> well i got a whole string of other questions so le- let's let some other folks, jump in this...

S1: o- on the f- face of it, it seems to me that um, if you have, Americans with, simple-minded models of the world, uh and Asians with complicated models of the world, and then you ask, people for predictions, Americans oughta be more confident. because, not as many, alternatives are being considered. uh, and yet, we know, that, it seems to be at least with respect to some things that Chinese are more, overconfident, than Americans. so how would you put those?

S2: i think that's why, Joe and i think that we needed to distinguish, confidence from, uncertainty... so in, uh, overconfidence, is a measure of confidence. (just) i think it's a statistical term (it's) a technical term not an everyday life term. right is overconfidence

S3: yeah well yeah there is a specific way you measure it i mean [S2: right so] we hope that it's not independent of the everyday (thinking)

S2: i think the um, conviction is everyday life term and i think that conviction is, is maybe more, reliable indicator of behavior than, overconfidence... so, i mean that's why, i put discussion about, Joe's work abo- about overconfidence and, um, my thinking about conviction. that's a_ uh it seems like Asians are less convinced, have, less conviction, yet they have e- at least equal level of confidence in terms of a probability. so unless i think a w- unless we solve that, problem, um, i mean they will just, continuing, confusion, confusion about, that word and this (word)

S3: okay but, suppose i'm a reviewer, and you make this proposal about this conviction thing, suppose i say well jeez, it's just a word, conviction, i mean, can you, in effect operationally define conviction? i mean, so i would like to see like if i'm a really serious Bayesian type of guy, i really want you to put your money where your mouth is, i mean how can i know that somebody's really, convinced? rather than just says that he's convinced?

S2: um

S3: and this seems to be especially problematic since you're cutting across languages

S2: right, Bob Abelson, um, wrote something about conviction so he developed some, criteria to measure conviction [S3: okay] so and, among those criteria there is behavior component [S3: okay] like how much you discuss, with your friends about that issue, how much are you trying to convince, others? i mean there there is i mean there is behavioral component and, you know emotional component so, i think we can measure conviction, in in that way

S3: why would you not take the Bayesian tack? which is, put your money where your mouth is. so, <SU-1 LAUGH> give you some options if you really think this is gonna happen, then you choose A, if you don't you choose B why not take that that approach?

S2: um, i can do that <LAUGH>

S3: and you would expect that there would be differences?

S2: i mean i'm not familiar with the Bayesian, approach so, i mean i feel, comfortable with, the conviction (rather than Bayesian) but...

S4: what's your what what would be your assumption i'm still, not so clear about the basic process what would be your assumption, when you um, put your subjects under load...? so that they um, have limited cognitive resources and they can't run through the various complexities. what what what would you expect?

S2: so you think that under heavy cognitive load, subject will behave just like Asians? so they cannot

S4: yeah i i i don't know, i mean on the one hand you could say on the one hand you could argue, that Americans become like Asians by s- you know saying ach i'm not gonna work through this thing i mean, you know, a- and you give the it depends answer, on the other hand you could say, that Asians become like Americans because they can't work through the complexity of these interactionist theories, and they'd go with one rather than the other. uh i'm i'm i'm not really sure what i would [S2: well (i mean) my my] expect but i mean there seems to be, there seems to be uh, i mean there seemed to be additional assumptions needed about processing requirements when you think of these things as, differentially complex theories which would, be another way of of addressing some of that

S2: yeah i think, to me um Asian way of thinking it needs, you know, resources, cognitive resources these are active processing of information so, if they are under heavy cognitive load, they will be like Americans. they, just choose one over the other. but for Americans i don't know what, outcome would be

SU-4: what that would be, yeah

S2: yeah. i mean they they don't_ be like, Asians... that_ i think that's for sure

S4: they would not be no

S2: they would not be

S4: no not in that sense

S2: yeah

SU-1: i suppose you

S4: un- unless un- unless you un- unless you do, the listing tasks, where i'm sure because i mean there you present [S2: right] i mean there you do this lengthy thing where you present one side and then the other side and, will you now put me under load i'll probably say it depends [S2: right] uh but but i mean spontaneously i would not construe one side and the other side under load so that that should...

S2: right

S1: uh this may be related to a conversation that, uh Kim Sook and i have had, um, periodically. i mean he he writes as if, he thinks, uh, Asians have... almost elaborated or articulated [S4: right] and, somehow i think no it's Americans who've got, the arl- the articulated, theories they're not very elaborate, but they're uh, they're relatively explicit they're relatively articulate and that's why they can be contradicted and it's, and there aren't there just, there aren't, there aren't it's just a mood that Asians have that, things happen, you know, nothing's totally surprising nothing's you know lots of the world is complicated so, why would i be surprised when anything happens rather than any other thing. (they're) very very different way of accounting for these phenomena and i i don't i don't know [S4: well wouldn't] where you stand on that

S4: wouldn't, yeah but i mean it seem- it seems to me, i mean i i i see that ambiguity i mean is there is is there i mean are there complex theories that somehow (are this) kind of thing, and

hence i mean no matter what outcome, there is i mean you always find some (sequent) of the theory that fits.

S1: right.

S4: or is there no theory at all? and all i do is is basically [S1: right] reasoning in hindsight when i see that and i say oh you know i mean that could be because of X and i see another thing and say oh that could be because of Y, and but i mean if if that was the case shouldn't then something like, a manipulation of of mental resources in this in the judgment situation, if you (xx)

S1: that that's one i think it's a v- an elegant way of getting at this question [S2: right] uh

S4: i mean that's that's how we would, normally [S1: right] approach these (concepts)

S1: right Americans i- if it's, Americans oughta become, more like, well either of you guys could probably articulate better which way, what kind of result speaks to which

S4: well i i mean i mean if you had if you had a complicated theory, i mean if Asians have a complicated uh uh multifaceted theory, that they can always [SU-3: right right right] map onto some aspect, then i mean putting them under load should no longer, allow that and they should become more like Americans. if they if they just make up a theory on the spot no ma- depending on the outcome then that shouldn't do much of a difference. i mean it seems like a similar kind of thing that you are addressing with the culture and aging research. i mean it seems to be one of these things that should, i i mean [S5: well he's avoiding...] (th- there's a- there's a) cultural differences are attenuated or accentuated

S5: he's avoiding this, this controversy by, taking the results and trying to extrapolate them in doing science which is a much simpler issue, [S4: right] and then he doesn't have to work that out

S4: and i'm and i'm pushing and i'm pushing daily life

S5: yeah and [S4: i'm i'm i'm saying] and then, but he's a he's, he sidestepped you by

S4: yes i know <LAUGH> (i knew it would upset you, so) i noticed that

S2: but yeah that would be a [S4: yes] wonderful study i mean [S4: yes] manipulating, the load

S1: i i think i've got the way of characterizing these two possibilities for Asians. are Asians like clinical psychologists who've got a million theories and you can't surprise 'em or are they like your mother, who knew it all along? <SS LAUGH>

S2: well... in f- in fact the- there is few clinical psychologist in Korea <SS LAUGH>

S4: but there are as many mothers, as here

S1: but many mothers

S2: right so...

S5: let me ask one um, question about the thesis, itself um, while i pretty much agree with your conclusions about, how these cultural differences affect cognition and affect the development of science, i think in the thesis itself there's a pretty big extrapolation, from your results to the conclusions you wanna draw about science. um so i guess, he- i'm just, curious if you thought a little bit about, a few future experiments to fill in that extrapolation and make it more, um, concrete to draw the kinds of conclusions you (made) about, you know, those effects.

S2: so between, (for example sup-) this thesis and science right?

S5: well your [S2: (bring)] yeah i (mean) your your four experiments um, certainly, say what, um, i mean you drew direct conclusions from them, but then to extrapolate them to the general conclusions about culture and cognition and science, is, somewhat conjectural and, um you can, they certainly, lean in the direction you're saying but there's not a, strong chain of arguments step by step, that you know takes you to those so you could probably develop some other experiments that would, fill that in have you_ has your thinking gone in that, direction a bit?

S2: um, the closest thing i have thought about is to get actual debate over a scientific issue. so i gave one example i_ whether, uh nature is more important than nurture, right so, if you're interactionist, and you are put in a debate situation with other, people, then you may feel that those, those in- discussion will be silly, and there is clear answer, both are important. and still, i need some assumption so, but that's the closest thing

S5: well you're making theoretical arguments [S2: right] there rather than, um strengthening them with, with data that could fill in um, w- which would seem to me not (a bad thing) to do

S2: i'd love to hear from you

S5: well i haven't thought about, what experiments would do it but it seems to me that there's a gap, that would be fun to develop some [S2: right] experiments for if you pursue these again. sure i'd be pleased to discuss that with you

<P :06>

S3: Kim Sook, um, on various, occasions in the thesis, you say things like the following. you say <READING> such contrasting reactions are consistent with a claim that interactionist, Koreans do not see contradictions as readily as dispositionist Americans. </READING> do you literally mean that?

S2: yeah, i did.

S3: okay

S4: you_ and and you're reading it differently i i suppose

S3: oh no i'm reading exactly what he wrote, uh

S4: no i mean what if, um...?

S3: okay le- let me let me tell you what i'm driving at

S4: what's what's the meaning of contradiction here i mean that's, i mean i stumbled over similar statements, where i i mean i was i was tempted to say like oh really? i mean, but i think what he means and this this could be interesting i think what he means is, that there is no contradiction for Koreans, but there is a contradiction for Americans, (which which)

S3: that that that's precisely it be- because is it that they don't see it as being contradictory or they react to the contradiction differently, [S2: (oh)] can d- do your experiments allow you to make a difference

S2: i mean the first the first case

S3: so they [S2: they don't] literally don't see them as contradictory

S2: right because they can explain, with their theory...

S3: do your data really, allow you to say that...?

S2: well i mean it's a it's a, it's a whole issue, in, emotional research for example, when, unless you measure like ph- psych- physiological, reaction, so when i say oh i'm surprised, then you don't, you cannot determine whether i really mean i'm not surprised or i just report i'm not surprised. so

S3: tha- that's a separate issue, i mean, i- it's like, wait le- let me give you an example si- it's not a really good analogy but it's sort of close, like i was really shocked, years ago when i was on a review committee and i started reading stuff in, well i had to review a proposal that had to do with, cultural differences in language, language perception, and uh this particular study had to do with peculiarity from an American's point of view, o- of Japanese (uh) confusing Rs and Ls, and it was a psychophysical experiment and they conc- well the experiments and they concluded that, it wasn't simply a matter of, not_ people not being able to say things in terms of and things like that they literally could not distinguish, the physical sounds. the difference between Rs and Ls. that's different, from reacting to them and saying well, uh, and it's, and it's sort of like here is it that people don't really see, these two facts as being inconsistent or they simply, treat, the inconsistency differently? and i'm not entirely convinced and i'm i'm hoping you can, [S2: i mean if] explain it to me [S2: if the the s- the s-] how your experiments allow you to tell the difference

S2: i mean if the second one, is the case, they just treat contradiction differently, then why, do they do that?

S5: politically correct

<P :06>

S2: possibly

S4: how do you know they're just treating it (differently?)

S2: no that's what i'm, asking i mean i don't i don't know

S3: but no you ma- you made a- the opposite claim, that they see them differently

S5: b- you should able to distinguish with an experiment that's Joe's point

S3: but i'm not sure these experiments do you think these experiments are capable of doing that? if not then what kinds of experiments could you do, to distinguish them?

S2: hm, so they see contradiction but they just, react [S3: yeah, right] differently, express [S1: right] differently

S1: right

S3: right

S1: it's a good (Joe's point too)

S2: yeah, i got, the exact same question at Illinois when i gave a job talk, and, the questioner, wanted me to develop experiment in this part so my answer was that okay um

S3: if if they gave you the job you would do that? <SS LAUGH>

S4: if they if they give you that job right, you do the experiment as many (xx) and you do and you go for P three hundreds

S2: so i gave two, possible exp- experiment one, you can create a public setting, and private setting, because their their assumption was that, Am- Amer- Koreans, wanted to be polite to be respectful to experimenter, so, uh they want_ they don't want to their expression, so you can create, private setting versus public setting. or, you can have a panel study, so you can look you you can measure their reaction, time one, and then, sometime later, because, initially you may have reacted differently, but the more you can think of in private setting, you may want to express, that reaction more frankly, so

S3: what would you think of a Hou Fun, approach to this? suppose, say in these kinds of scenarios you have, you have the Americans, to, in essence explain, why they consider, these situations to be contradictory. and then you see what the Korean subjects think of that reasoning and vice versa.

S2: say again? is that?

S3: alright, one of the things that Hou Fun did in his thesis, was to have subjects, to look at arguments [S2: right] and appraise those arguments. and what i'm suggesting here is something analogous. so you have these situations in which, you have Americans and you have Koreans seeing situations that Americans traditionally would see as, contradictory. presumably they have reasons for doing that, so suppose they were to articulate those. would K- would you expect Koreans to say boy that's hogwash, that's really dumb, i think that's a horrible, reaction to the situation, would you expect that to be the case? and also how do you think Americans, might react to the kinds of arguments that Koreans would give? and also would you expect their arguments to be different? i would think that you would. or you might

expect that, they aren't gonna even_ their_ Koreans won't even see, anything to explain, i mean that would be my interpretation of what you're saying here, that they would see it as a silly question

S2: well it's, what's to do, i mean, that's the best answer i can give, so i mean you can, i mean we, have, various argument, write about the scenario and ask them which one they prefer, or which one sounds reasonable i mean i can yeah

S3: well, just something to think about

S2: yeah... i mean, your last point is, quite good i mean cuz, if they are really truly interactionist there is nothing to explain, seriously.

S1: these are all, questions that are easily translated into studies [S2: right] that sound, eminently worthwhile to make, probably it is time to just, talk to people and listen to what they're saying

S3: when all else fails

S1: when all else fails, let your subjects talk to you... <LAUGH> um, i have, uh, this is a question i've asked periodically, um, uh Kim Sook and maybe we can get, additional, reactions to these questions and and every time i see a draft it's, indeed he has a a a clearer and clearer, job of it but, what, um... uh there's some, i i sort of want to see the paragraph or the page, that makes it very clear why all three of these experiments, come from the same proposition. i mean maybe they don't

S3: there're four

S1: hm?

S3: there're four experiments

S1: oh well but, but, one and two are really the same experiment [S3: oh okay] so i mean he's got three qualitatively different kinds of experiments here and, um, it would just be nice if he could, you know give the three sentences to why, (i don't know) six sentences to why these three experiments all fall out of the same basic proposition. the experiments, are as far as i can tell number one, that, behavior that wouldn't have been predicted, is not as surprising to Asians, as it is to Americans. secondly that, hypothesis, confirmation is not more surprising, when an alternative was possible or at least salable, uh than when the alternative wasn't possible or salable in other words there's something there about contradiction or potential contradiction. that's, doesn't seem to impress Asians as much, and, third that, uh, contradiction of a belief just doesn't seem to produce surprise so you make people believe something and you, ask 'em what they think of that and they tell you and then, you say oh guess what, um, the opposite of that is correct and, and uh, and they_ it just doesn't seem to intr- in- induce surprise, in Asians so, how can, how can you put, those, drive all three of those things from the same, core notion?

S2: i mean, i was surprised that um, you, do not see the connection. <SS LAUGH> that was, that was funny

S1: yes, we've been talking about the aging problem <SS LAUGH>

S2: (actually) to me, to me

S3: it's obvious <SS LAUGH>

S5: so he, so he's obvious- he's obviously not Korean

S4: doesn't have a good interactionist theory

S2: um, um, my_ okay here is my, answer um, if you have a interaction theory, then, you don't see a contradiction as contradiction. so you would not be surprised by surprising and contradicting event

S1: wait wait one second (hm) and you don't see contradiction as a contradiction? well that doesn't, i don't see that that follows (what)

S4: everything depends

S1: okay everything depends right. i thou- if you've got an interactionist theory then everything depends but, if everything depends, then it's harder to see a contradiction [S2: right] yeah okay okay then and these are all about contradiction, all of these studies, are contradiction studies right?

S2: yeah i think so yeah

S1: clearly the third one is. flat contradiction doesn't make something more surprising than if it hadn't been contradictory... um, people don't seem to see that, the hypothesis that was confirmed and the hypothesis, that was not confirmed are suf- sufficiently different then you should be more surprised, than if we didn't know about that competing hypothesis which also seems (a failure to,) recognition, contradiction, and, how is the first then how is that an instance of, failure to recognize contradiction?

S2: because, for example in study one they expected, that the target person would help, and in fact, he did not help. so that should be taken as a contradiction

S1: okay so it's an implicit

S2: implicit contra- yes right, so study

S1: implicit contradiction okay you may wanna use that term of im- implicit contradiction and say okay now i'm gonna get really explicit, in fact as you go from one to two to three, you are making the explicitness of the contradiction [S2: right] e- ever greater [S2: right so] and that would be a nice organizing theme is just you know a sentence or two per, in length. that's an implicit contradiction that this, apparently warm guy you know, kind person did this unkind thing, still more explicit is, you have two alternative possibilities versus only the one [S2: right] and literally completely explicit [S2: right] is, A is the case and then you say actually, not A is the case... <P :05> alrighty

S5: okay

S1: other questions...? um, okay, you wanna give us a couple minutes then

S2: thank you

{END OF TRANSCRIPT}

Title: Social justice and non-violence social change in the Environmental Justice Movement
Academic Division: School of Natural Resources

RESTRICTIONS ON CITATION OF EXAMPLES: NONE

Recording Duration: 112 min.
Recording Date: September 22, 2003
Recording Equipment: TASCAM Digital Audio Tape Recorder with two external microphones
Language: Primary Discourse Mode: MIX Native Speaker Near-native Speaker

S1: Candidate
S2: Committee Member
S3: Committee Member
S4: Chair (advisor)
S5: Committee Member
S6: Graduate Student
S7: Graduate Student
S8: Graduate Student
S9: Graduate Student
S10: Graduate Student
R1: ELI Researcher
R2: ELI Researcher (myself)
R3: ELI Researcher

Setting: Small Conference Room, Moore Building

S1: ... we're having a bit of trouble hearing you, can people understand?

S2: yeah, right now we're having a fine conversation

S3: yeah, w- we solved the problems which (xxx – 00:11)

S4: okay

S1: okay, oh that's good, so i think we're ready to go and [S4: okay] uh, before we start, before Bunyan starts, um we just have to ask um the two of you a question um Steve and Path um we have some people here who wanna record uh the dissertation and they'll explain why in a second, so they are gonna explain why and then you can tell if you give your informed consents, so here they are

R1: thank you, uh my name is Rita Simpson and i´m here on behalf of the English Language Institute, uh we have gotten preliminary consent from Scott and his adviser to do the recording of this dissertation defense for the purposes of uh a large project that is going on at the ELI to collect uh over two hundred hours of acad- samples of academic speech, and dissertation defenses are just one those kinds of examples, uh i don't wanna take up too much time, but i wanna make sure that if anybody has any objections to the recording, that you, know that you are free to say so now and we would then not do it if you didn´t feel

confortable, uh or if you have any questions about it and if uh you decide at the end of the defense that there´s any part, all or any part of your speech that you don´t feel confortable having be a part of this project then you can also state that at the end, uh are there any questions why we are here, i know that was, pretty quick, uh

S4: people feel ok with that?

S3: well i i i don't know about Pat, but i didn't i i heard the request but i didn't hear the the person's affiliation or the reason <LAUGH>

R1: okay, my- my name is

S2: yeah, i don't have a problem

S3: i don't have a problem i'm just curious who who this is

R1: okay, i´m sorry, my name is Rita Simpson i´m here from the English Language Institute at the U of M, and we, the underlying rationale for the project has to do primarily with the teaching of English as a second language, uh [S3: okay, fine, yeah] that´s the simplest answer and so anybody wh- besides the candidate and the and the adviser who speaks at the end, i think for the purposes of the conference call, we can accept you-, yeah hearing you having said that you consent verbally uh is fine uh but the rest of you afterwards if you have spoken uh we´d like you to sign a v- a consent form so that we have the written consent on file and thank you again very much for allowing us to record this

S4: okay, uh this is Bunyan speaking and what i'm gonna do is go through an agenda and have consensus on the agenda and then we will take the ball rolling okay. First of all i'd like to- there are several people here and uh i'd like to go through, have some introductions, we've done the recording consensual s- and stuff, uh consent stuff, uh Scott's gonna give us a little background in terms of how you get interested in non-violence uh as a strategy for intentional social change followed by probably a twenty to thirty-minute presentation on the part of Scott, uh then there will be questions by the committee, by the committee, okay, followed by questions by the guest guests, and then that's followed by a a private meeting by the committee because we have to go through deliberations and then after deliberations we will invite Scott back into the room, uh and we will give him the results, uh and that's the agenda. any questions or any additions or any <P: 04> was the agenda okay?

S3: yes fine with me [S4: all right]

S2: th- th- th- there´s an audience there is that right?

S4: yes and i will go around the room uh, and have people, uh, say their names and and and what they are about, [S3: (xxx – 4:04)] so that you have a feeling of who's here, okay. okay i'll tell you what uh, why don't i start out by saying that my name is Bunyan Briant uh, i'm uh a teacher in the School of Natural Resources and head of the Environment Justice, uh, initiative, uh and uh, uh chairman of the dissertation proposal or dissertation as she said <SS LAUGH> we will now pass the boats (slide??) <SS: LAUGH>

S5: i'm Rachel, hi Pat, hi Steve.

S3: (xxx – 4:35) Rachel

S5: i'm on the committee <S1 LAUGH>

S6: um Beth, SNRE, PhD candidate

S7: Michael, SNRE, PhD candidate

S8: um Crystal PhD candidate in Anthropology and Natural Resources

S9: Maria PhD candidate, SNRE

S10: Ashine, friend of the candidate

S1: and Scott Sherman the candidate

S4: what about the two in the back?

S1: oh yes, uh Leonardo

R2: i´m just part of the ELI project

S4: yeah uh gives your name and

R2: my name is Leonardo and i am a PhD candidate in- at the English Language Department

R3: hi, my name is Carson and i´m also doing work with MICASE in the ELI

S4: okay, all right, what we gonna do is turn over to Scott and he´ll give us a little information about how you became interested or involved in in transformative action and non-violence, is that right, can you go from there?

S1: okay, uh well i got started on in my interest in social justice and non-violence social change uh actually in a sort tragic manner. when i was seventeen i was involved in brutal gang violence and was nearly killed, and uh, at that time in my life i really didn't know how to respond to this terrible act of violence, uh and the reactions of people around me just seemed crazy, to a lot of people i was sort of notorious at the time and made the newspaper, i was walking around with the bandages all over my- me, so everybody knew who i was and uh people would come up to me, total strangers, and suggest that we, you know, go retaliate against the gang that had gotten me, uh that we respond to violence with violence, and other people suggested that i just run away, you know, if i can avoid the situation, if i can avoid the areas of town, these gang members, just basically live my life in fear, and i felt like there had to be another option besides violence or cowardess, but i really didn't know about it, and of course i knew about uh Martin Luther King Junior, Mahatma Gandhi, Cesar Chaves, but i didn't really know anything about their philosophy yet, and when i was at college in Berkley, uh there was a course in non-violence that was offered and i it changed my views, i realized that non-violence was much more than just the absence of violence, uh, which i'll talk about in this dissestatio- dissertation research, and i became very interested in the social aspects of

non-violence. uh so a few years later when i started to get involved in the environmental justice movement while in Law School studying environmental law at Berkley, uh, i was very interested in how communities responded uh to conditions of perceived conditions of environmental injustice or environmental racism, and whether they were using everybody would say that they were using a non-violent approach, and yet many of the approaches were not in the spirit of Martin Luther King Junior or Mahatma Gandhi, and so after law school uh when i actually became a community organizer and i was working in inter cities neighborhoods, working in unsustainable communities, working with people fighting for environmental justice, uh i was interested in the tactics that we were using, because they were based on Sololinsky's methods on the famous community organizer who was very adversarial and antagonistic in his approach, and to me this seemed very much counter to what I'd learned about non-violence, um in the readings of Gandhi and King and many academic scholars as well, uh so that's how i got interested in this, uh i was just i was very interested in general looking at environmental justice movement as you will see in my presentation or you'll hear on the phone, uh many environmental justice groups are very successful and yet others are not, and so i was just quite fascinated in what are the conditions and circumstances in which uh environmental justice groups and community activists will be successful in trying to create social change, so that's how i got interested in this. so i guess that leads into my presentation. now i should preface this by saying that i was all prepared to give this spectacular multimedia presentation, but in deference to the committee members on the phone who can't see it this is going to be a very dry presentation, just- essentially the words i'm saying will be repeated on the screen, there are a few photos in here but not much, you're not missing much Pat and Steve. okay, so um the dissertation is called strategies for success in the environmental justice movement, and it starts out with the basic problem of environmental injustice. um environmental problems as most people in this room already know do not affect people equally, uh poor people and colored people tend to be disproportionately to ecological hazards. there have been numb- numerous studies, uh they have documented this problem and some have even called it environmental racism, uh Goldman did a study a meta-analysis of sixty-four other studies that had been done on environmental injustice and found that race uh was actually more significant factor than socio-economic status in being able to explain where hazardous waste are located, where people are exposed to lead poisoning, where people are exposed to all different sorts of environmental hazards. and so this is basically the problem of environmental injustice, that environmental hazards such as toxic waste incinerators, landfills, nuclear waste facilities are not put in Beverly Hills, uh they're not put in Malibu, they are put in areas like south central Los Angeles and east Los Angeles which tend to be uh have more people of color and more poor people. so my question was how do people respond to questions of environmental injustice, there is so much excellent literature in the fields, including uh some performed by some people in this room about that there really is a problem or suggesting that there is a problem of environmental injustice in this country, uh but there really was a gap in the literature, there were very few people who looked at how the communities were responding to this, uh the few th- th- there were many researchers who studied a single case in depth, and might write an entire book about one community that fought against conditions of environmental hazards in their community, um, and there were few researchers (xxx – 11:44) who compared many cases to find meaningful similarities, uh there was some research though, uh on grassroots responses to environmental injustice comparing various cases. uh the first and most prominent was Robert Bollard in 1990, his seminal book Dumping in Dixie, where he looked at five African-American communities in the southern United States, uh and to see how they responded, what kinds of strategies they used in response to environmental injustice. he wasn't really interested or he didn't look very deeply in in trying to analyze which ones were most successful and his study was really

limited to these five black communities in the south. um, Walsh, Worland and Smith in 1997 again limited their cases to just one region of the country, they- and only one issue, they were looking at toxic waste incinerators and they were only looking at three states in northeastern United States, um Erinson for doctoral dis- dissertation in sociology at University of California in Santa Cruz, looked at five Latino communities in California, um the limits of this were not only that it was again one geographical region, one ethnic group, but also all the outcomes were successful, so there wasn't really a meaningful comparison between one's that had succeeded and one's that had failed. um mo- most recently Robertson, Thompson and Wise have written an excellent book comparing four case studies on environmental injustice in Louisiana, um the most extensive research on grassroots responses to environmental injustice was Cynthia Warrick for h- her doctoral dissertation uh for George Mason University in 1999. and essentially she too- looked at thirty-six cases across the country trying to find out, uh what is associated with success. uh Warrick's study was very important but it did have a few flaws. first of all thirty-three of her thirty-six cases were still in the southern United States, um and were black communities. the other three were Latinos communities, she didn't study any native American communities, white communities, Asian communities, multi-racial and multi-ethnic communities. um also she only had fifty sources for her entire research, for thirty-six cases, an average of 1.4, um even she conceded in her research that didn't have that much information for example, she was looking to see whether media, modalizing the mass media would be an effective response, and she admitted that she wasn't able to find information on eleven of the thirty-six groups, and yet s- she (xxx – 14:29) proceeded to conclude that the media wasn't an important factor. um so her data- data were somewhat incomplete. so the current research, i looked at sixty communities across the United States, from Hawaii to Arizona, to West Virginia, that's the extent of the visual part and these are the environmental injustice places as you can see, uh these are just photos that i took around my journeys of the US. um, so the current research looks at sixty communities across the United States. Um, i used more than seven hundred sources, i would often have hundreds and hundreds of pages, um of data for each source, um and i ended up coding from a hundred and seventeen independent variables, most of the studies, um that I've discussed previously only looked at three or four variables, and i really wanted to investigate many different variables. um also the current research looks at a number of issues, um unlike Walsh, Warland, and Smith i didn't just focus on one issue such as incinerators, i looked at landfills, incinerators, nuclear waste facilities, chemical contaminations such as lead poisoning, resources extraction, for example mining, polluting industries, and superfund sites. so among the variables i looked at, uh, i looked at six different types of adversaries, uh environmental justice, uh, communities fighting for environmental justice, uh, can uh, face large corporations, Fortune five-hundred corporations, they can face small corporations, they can face the US government, their state government, or a local city or county government, and they can also face citizen opposition from other people, often times people are fighting against an incinerator and other people in the community are fighting for it saying this is bringing economic prosperity to our town. so i looked at six different types of adversaries, eight different types of obstacles uh, there are many obstacles that communities can face, they ar- they often face harassment, abuse, arrest, uh they face governments officials dismissing their concerns and saying there is no problem, they face scientific studies that purport to say that the, uh, eco- quote on quote ecological hazard are actually completely safe, and there are a number of other obstacles that they can talk about in questions and answers. i also looked at sixteen different types of strategies, uh everything from writing letters and making phone calls, petitions, speaking out at public hearings, filing an environmental lawsuit, filing a civil rights lawsuit, uh, direct actions, civil disobedience, boycotts, i looked at many different strategies that the communities used, six different types of alliances, because communities can

ally sometimes with their local politicians, sometimes they make alliances with other environmental justice groups from around the country, sometimes they make alliances with university professors and students, sometimes they make alliances with celebrities and try to bring the fame and fortune of the celebrities to their cause. and then i looked at many many other factors including the race and ethnicity of the community, the gender of the leadership many environmental justice, uh, actions are led primarily by women, uh social economic status, location, whether it's rural or urban as well as the EPA region of the country, uh length of time of struggle, institutional lengths, and the ways in which issues are framed, which i'll talk about more about in a little while. and the basic question that i was thinking to answer as i said before is under what circumstances and conditions are grassroots activists most likely to succeed in achieving environmental justice? and this is an important question because for the most part, uh, sort of the unsung story of the movement one of the the most inspiring stories from the environmental movement is that the (xxx – 18:40) movement has extremely successful. uh between 1985 and 1994 local communities defeated two-hundred and eighty incinerator proposals and at the same time of seventy-three incinerators were actually built in the US at this time. uh they also- local communities have (xxx – blocked ???) every proposal for commercial hazardous waste landfills since 1979, the last one they got placed was in the town of last chance called Erodo. uh, als- many other communities have defeated the plans of Fortune hun- Fortune five-hundred corporations and the federal government, to cite one prominent example, uh, in the late 1990's uh Texas was going to place a large nuclear waste facility uh near the town of Sierra Blanca, uh this was a town that was already suffering environmental injustice, this is where New York sent all its sewage, it was send it all to- on something called the poo-poo choo-choo, that's what the local people called the local poo-poo choo-choo, and they sent all this sewage out to be spread across uh the west Texas desert, and, uh, government official felt like they could get away with this because there were only twelve-hundred people in an area the size of Connecticut in the desert, and when they tried to put a nuclear waste facility uh the community rose up and fought against it, and the nuclear industry outspent the community a thousand to one, George W. Bush who was the government of Texas was actively supporting the nuclear waste facility, Bill Clinton the president of the United Sates was actively supporting the nuclear waste facility, all the major politicians in Texas were supporting the facility and yet the community was able to rise up and stop it. but ther- the environmental justice movement of course is more than just the study of success, uh problems of environmental injustice do continue to process, there are hundreds of communities where citizen movements don't even arise to challenge conditions of environmental hazards and toxins, and in some communities the protest movements emerge but they aren't successful in stopping the locally unwanted land use or lither. uh, in fact, uh some it i- some of you who've attended protest have probably heard the the slogan people united will never be defeated, and a friend of mine used to say let's be realistic, let's change the slogan it should be the people united will sometimes win and sometimes loose [SS: LAUGHS] and so my question was when are they most likely to win and when are they most likely to loose. well fortunately there's a whole body of academic literature and scholarship on this very question of how social movements emerge to con- contest conditions of injustice. so social movement theory is uh there are five major strands, i'll go through them very quickly and probably oversimplify them. uh collective behavior theory was one of the first ones, uh, essentially saying that people rise up when there is a major grievance but collective behavior theory, specially, uh, Neil Smelzers, one of the leading proponents, seems to suggest that these types of movements were irrational and spontaneous almost like mobs, uh so that wasn't perhaps the adequate to suggest, it- it was important in suggesting that external conditions could cause social movements to arise but it may not have been enough, because uh other uh researchers such as McCarthy and Zald realized that there are many grievances all

over the time there, a- all over the country and all over the world, there are people who have grievances and yet you don't see mass revolutions breaking out on the streets, and they- they talked about resource mobilization being a key to successful social movement emergence, which essentially means that a social movement is not gonna arise unless people can mobilize the media, or can mobilize money, and can mobilize other forms, uh, you know, just people powered just mobilizing a lot people, uh, so that was an important contribution to the field as well. the next one was political process theory which suggests that, uh, social movement groups are political players, they participate in the system and just like other groups that are competing for scarce resources and are players in the political system so too must social movements be considered like that. new social movement theory, however, looked at the previous three, uh, strands of social movement theory and said – this really doesn't define things like the women's movement, the gay and lesbian movement, even the environmental movement. there are certain social movement that are identified by the identity, the collective identity of people, and so social movement theory was enriched by new social movement theory. the final one that i'll talk about is called social contructionism or framing, which suggest that social movements are going to be successful if the leaders, uh, can convince other people that they share a common discourse, so for example, they frame a- an issue in a way that it will appeal at the moral majority, uh, in the 1980's and even continuing till this day, basically spoke out and tried to convince a large portion of the country that they shared certain values, certain moral values that were being ignored by people in the government, and so that's an example of a conservative social movement. uh, but social movement theory, uh, one problem with that is that, uh, even uh, some of the leading researchers such as Magganan, McCathy and Zalt, admit that (xxx – 24:21) studies mostly, uh, how social movements emerge, but not after they emerge whether they are successful or how they are successful. so i also looked at non-violence social change theory. uh, non-violence social change theory examines how seemingly powerless people, have been able to, uh, overcome conditions of social injustice without resorting to violence. So anything from the civil rights movement and Gandhi's striving for independence, uh, from Britain in India, but many other cases throughout the twentieth century, and th- throughout history, uh of, this non-violent movements. uh, Jean Sharp from Harvard, int- identified a hundred and ninety-eight methods of non-violent action. uh, and all of these methods of non-violence action share the same theoretical principle, which is that a government, and i might also add a corporation, only has power to the extent that people give it to them, so that is why a boycott is so successful, for example, because, uh, if the people refut- refuse to ride the buses, then the government has no power, can't force the people to ride the buses, and so the people have more power than they think, over government. well the hypothesis of this research based mostly on non-violence social change theory is the communities will be successful in achieving environmental social justice to the degree that they use tech- strategies of non-violence social change, in other words, working outside the system, and let me explain why i thought this. um, people who are experiencing or who perceive that they are experiencing conditions of environmental injustice, uh, probably are experiencing that because they don't have a role in the system already, uh, so if they try to appeal to politicians to stop saying nuclear waste facilities, well were the politicians who in the first place said we wanna place this in this community. uh if they try to appeal to the legal system, uh, the legal system isn't, uh, going to be very responsive, it hasn't been known for being favorable to poor people, uh one judge even said, uh saying, that poor people have access to the justice system is like saying that the Christians had access to the lions in the ol- days of the Romans, you know that this essence of that the legal system devours the poor, it doesn't really give them access. uh similarly even when, even when people appeal, say they come do university and say will you do a study showing that we are suffering a disproportionate exposure to environmental toxins and that ar- and that

are harmful to our health. non-violence social change theory would suggest that even this will not be successful, because often times the commun- the corporations and the government will have their own studies which say, actually, this nuclear waste facility is completely safe. so it's going to bring a lot of money into the community and it won't harm your health at all. so that's the hypothesis of this research, but this of course we have to ask what does success mean? and there can be various meanings of success. Warrick on her research on environmental justice success basically looked at one type of success, which is success in achieving goals, obviously environmental justice groups tend to have some sort of goal that they want to achieve, usually it is to shut down or prevent a locally unwanted land use, such as a landfill, uh, it maybe to be relocated from an area, say a community that's in a superfund site that's toxic and so the people demand to be relocated, other times people just want health care, ther- there are many different types of succe- of goals, and so Cynthia Warrick just looked at success in achieving goals. i- i used the same measure that she did, except that i took it a step further, she basically said you are either successful in achieving goals or you're not. But if you look at environmental justice cases, there are many cases where they don-, the community doesn't actually achieve all their goals, but they do get concessions. so for example, in Richmond California, a community, uh, who wanted all types of con-, all types of, uh, many different goals from a, uh, refinery, from an oil refinery nearby, and they didn't get what they wanted, but they did get five million dollars, uh, in benefits, they got, uh, the local corporation to open a health care clinic to study their health. uh, so this, this is not a total victory, but i basically did zero, one, two. uh, no success, concessions, and then achieving their goals. but this isn't s- satisfactory, one of the most famous cases of environmental justice is the one of Warren county, North Carolina. uh, this is a community where-, it was the area in North Carolina with the gratest percentage of African-Americans, and the government decided to put a PCB landfill, PCBs are non-carcinogens, uh, they wanted to put a PCB landfill in this community's backyard, even though the PCBs had not been produced or used in this area. uh, people engaged in civil disobedience, uh, they got celebrities, they got a local congress person to join in, it got a lot of media attention, and in the end, under the first measure of success they lost. The PC land-, the PCB landfill was sited there. but this is often credited as launching the whole movement for environmental justice, many people, many scholars of environmental justice say that Warren county is really where it all began. so i have a second measure of success which is called broader success, which is for unexpected beneficial outcomes that just happen to occur after the campaign has ended. so people might think that they lost, but then later on there's some benefit that they weren't even expecting, so another example of this may be, uh, a- a case in Houston where people were fighting against a landfill in the community, and they weren't able to stop it, but afterwards the city the council passed a law saying it does seem like there is a pattern of environmental injustice, so we will no longer be able to put any, uh, landfills, or any, uh, waste facilities in minority communities in Houston. so that's the second measure, and then i have a third measure as well, which is long-tern success, uh, which essentially is, i like to call it empowerment, because this is- often times people will loose in the first measure of success, they won't achieve their goals, but the people have a new found sense of empowerment, because formerly apathetic people, many of these environmental justice cases amazingly are about people who were not organizers before, they were not political before, often times they had no political experience, uh, many of these cases people were not, they couldn't even speak English, were not American citizens, uh, and yet they gained a real sense of empowerment, and after this case ended, win or loose, they went on to take on other campaigns, other issues. so that's really a long-term success, whether they were in power, but also balance this against cost, because in many communities, uh, the battle was very costly, whether financially, uh, often times people put their own money into the campaign. uh, costly in terms of human lives, often times people died during these

campaigns, many people, uh, which is why people fought against this, because they said this is harming our health, and many people actually died in the time that took to resolve the case. uh, so that's how i measured success and here are the results that i found. fifty of the sixty communities did achieve a measure of success in meeting their goals. twenty-eight of them, so slightly less than a half, achieved their goals completely, and another twenty-two achieved concessions. so, out of these the sixty that i studied, only uh, only ten did not achieve their goals at least partially. the next result, for broader success, is that twenty of the sixty communities achieved unexpected benefits after the cases was finished. and then finally for long-term success, this is the most surprising, in fifty-two out of the sixty cases, the residents mobilized to further actions, so even though only twenty-eight of the communities fully achieved their goals, fifty-two of the cases, many people, obviously this doesn't mean everyone, but many members of the community mobilized to take on further campaigns. uh, this is the really remarkable thing, in ninety-seven percent of the cases, so fifty-eight of the sixty cases, local communities ach- achieved success on at least in one of the three measures. uh, and so we're gonna look at what was associated with success in achieving goals. for the first measure uh, of achieving goals, one thing that may seem obvious, if it was a short battle, the community seemed more likely to win. so, uh, battles th- that went very quickly usually in favor of the local community. uh, next, this again seems intuitive, residents faced few obstacles if, people there's a good example of, uh, in Anniston Alabama people were sewing Monsanto, uh, for, for producing deadly chemicals and trying to cover it up. now they faced very few obstacles, they didn't face negative media attention, they didn't face any scientific studies saying that these chemicals aren't dangerous, really they faced very few obstacles, so it wasn't surprising that they won. uh, political alliances are associated with success in achieving goals, uh, this is interesting, this contradicts my hypothesis, my hypothesis that you need to work outside the system. actually, uh, if you form alliances with politicians and work inside the system, and try to win politicians over to your side, you're likely to achieve your goals. uh, all of these by the way are at a p value of less than point-zero-five, a few of these (xxx – went? 34:49) marked, and when i know, are slightly higher, but they're still less than p, uh, p is less than .1. uh, media attention, this is positive and frequent media attention, i define that as, uh, at least ten, uh, sources that i could find in the media at the time, so not books that were written years after the fact, but media attention that they were getting at the time, if they had at least ten, uh, that was associated, uh, at point-zero-seven with success. what was associated with the failure to achieve goals? one thing was when residents lost legal cases. in about seventy-two per cent of these cases, people went to court, people used some sort of legal action, and when residents lost the legal case, they tended not to achieve their goals at all. why is this? sometimes people get very demoralized when they put the case in the hands of a lawyer. they think this person is an expert, we don't have to do so much community organizing anymore, because the lawyers have it in control, and then when the lawyer, uh, when the case is lost in court, often times the community is very demoralized, so a- a law can be very dangerous. Interestingly enough, media is a double edged sword, when the residents face critical media attention, uh, when the local media sources said these are a bunch of crazy hippies, or whatever else, and really criticized them, uh, that tended to be associated with a failure to achieve goals. the next one at a p value of less than point-zero-seven is when the activists themselves were subjects to lawsuits, there's something called strategic lawsuits against public participation. let's say i think Oprah win free. faced one of these when she criticized the beef industry, and she had somebody on her show who said that uh, meat is bad for the environment and bad for your health, and when Oprah heard at the detail she said i'm never gonna eat a hamburger again. and she got sued because Texas has a law that you can't defame the uh, the cattle industry. and, uh, so often times corporations or governments will file lawsuits against activists, figuring that in many of these cases, what's surprising about

these cases that i studied is a lot of them are not mass movements, often times it's only a few people. and so the corporations figure if we can target a few of these people with the strategic lawsuit, basically trying to infringe on their right to, uh, free speech, um, we can stop them because the legal cost is will be so expensive. uh, now there are about, uh, i think, uh, close to thirty states that either have enacted (xxx - anti-slap?? – 37:38) legislation, or are in the process to do this to stop the strategic lawsuits against public participation. uh, and then civil right litigation was also loosing strategy at, uh p is less than point zero seve- seven five. and this is due to something peculiar in our legal system, which is if you wanna approve racism in a court of law, you pretty much have to prove that it was intentional, you need a smoking gun, you need to show not that the effects of some government action were discriminatory, but the legal standard of discrimination is you have to show that it was intentional, so you have to have perhaps a quote from some government official who says let's put it here because it's where the African-Americans live. uh, well that's not very likely to happen, so most cases, okay, most cases that were filed, uh, on civil rights claims of racism and discrimination were lost. okay what was associated with a broader success? uh, civil disobedience was, and i'll talk about in a second, uh, residents faced harassment and arrest, this could seem surprising, and residents faced multiple adversaries. i wanna talk about these last two for a second. it would seem counterintuitive that when people faced harassment and arrest and abuse, you know, in some of these cases people got death threats, or, uh, actually had assassination attempts against them, uh, and also when residents faced multiple adversaries, which means multiple adversaries i define as, out of the six categories of possible adversaries, the local government, state government, federal government, small corporation, big corporation, or other citizens, they faced five or six of these adversaries all at the same time. and yet both of those cases is associated with the broader success and one of the reasons is there is almost like a martyrdom, uh, feeling like when e- or a bunker mentality, when everybody is against you, when they're, uh, harassing you it often brings people together, an excellent (xxx – 39:48) know this, that doesn't contribute to success in achieving their goals, but it often achieves to a broader success, because the perception later is this community, it really is sort of martyrdom type of thing. this community has suffered, and so often times the government wants to remedy that after the case. uh, residents were white. uh, this was associated with a broader success. uh, as you know, uh, th- only twenty of the sixty cases had a broader success. six of the nine white communities that i studied achieved a broader success out of the fifty-one communities with ethnic and racial minorities only fourteen achieved a broader success. so this is interesting, and you can kind of look at it from a case that i didn't study, Aaron Brokovitch. th- this this woman, uh, took a case in a town in California where people felt they were being contaminated, they had c-, uh, contamination from PG&E, a major utility, and this is can say it's an environmental justice story. the residents were poor, it was a rural area, and th- it was made into a major Hollywood movie that won an academy award, w- how many environmental justice cases, uh, tha- of-, uh ethnic, or racial communities have had major movies about them, (xxx – 41:13) a civil action, with John Travolta, it was a best selling book, uh then made a major Hollywood movie, again about a white community that faced conditions of environmental hazards. uh, when the cases were resolved between 1982 and 87 they tended to be associated with a broader success, and when citizens did research, that tended to be associated with a broader success, and since i am running out of time i can answer why in the question and answer period. uh, with failure to achieve a broader success, if the case ended more recently, it may not have achieved a broader success, and that's because broader successes may take a few years to see, so if a case ended last year, it may indeed someday be a broader success but we can't see it yet. uh, when they pursued civil rights legislation, uh, litigation, again this was achieved with failure, in this category. when the case was in the southwest, or the gulf, like Texas, Louisiana, New Mexico, uh, they

tended not to be successful, we can talk about that why- why later. uh, and when studies denied that a problem existed, this was associated. okay and finally, what was associated with long term success? uh, i'll go through all of these very quickly. because a lot of them are strategies of direct action, or political action, things like marches and protest, writing letter, uh, lobbing politicians, making political alliances, citizen research. basically, when people are active in their own cause, this tends to be associated with mobilizing them later for another cause. also you notice institutional links. this means if the environmental justice organization arose out of a previous community organizing group, or church, or institution in the community, and this does make sense that it would be associated with long term success, because these are multi-issue organizations. and then, uh, with failure to achieve long-term success, only when residents used eight or fewer strategies, this was the only thing. so again, this seems to suggest that when people use many different strategies, or when people take action into their own hands, uh, they're more likely to go on to long-term success. bu- the question you have to ask after all this research is how successful are, uh these environmental justice activists? Many of them have succeeded in stopping locally unwanted land uses, but at the end of the day they've been reacting to problems and they still live in toxic unsustainable impoverished neighborhoods. uh, in twenty-seven of the sixty cases residents suffered significant costs. and in only six of the sixty cases, did, uh, communities achieve the highest level suc- of success in all three measures. and this gets, uh, to an issue of environmental justice should be more than the absence of injustice, it's not just about being able to defeat an incinerator, being able to defeat a landfill, uh, Bunyan here, uh, suggested a positive definition of environmental justice, uh, which is about sustainable community- communities where people can realize their highest potentials with decent paying and safe jobs, good schools and recreation, good housing and healthcare, etc, etc. uh, much more of a sustainability type of thing. but social movement theory and non-violence social change theory don't really address sustainability, they're mostly about how people react to grievances. when people think about non-violence, even people who understand it and who've studied King and Gandhi, they think it's all about protests and boycotts and, uh, civil disobedience (xxx – sittings???- 45:06) responding to injustice, and yet Gandhi and King, uh, if you read them carefully and look at other, uh, scholars of non-violence social change, they suggest that non-violence is much more than the absence of violence, and much more than just responding to injustice. in fact, non-violence is a terrible name for it, most people don't understand they- they think, you know, anything that is not violent is non-violent. and Gandhi, King, so many leading non-violence activists often said it's a shame we don't have a better word for non-violence, cuz non-violence doesn't really describe it. and they came up with some terms, uh, Gandhi came up with terms like Satiaraha, an Indian term that he coined, which basically means holding on to the truth, it also means soul force, but these don't really translate very well. he also came up with Ahimsa, which just means not having the desire to do harm, which again is like non-violence in sort of a negative definition. uh, King didn't even bother trying to come out with a new term, but my, uh, committee members suggested that i should try. uh, and so i came up with the term transformative action. and the reason why i like transformative action is because what Gandhi and King talked about and what non-violence scholars have talked about is so much more than not being violent, uh so here are the principles of transformative action. the first one is about responding to injustice okay. it will be, a community will be successful if it can expose injustice. so the notion is that often times people cover things up and they don't want anyone to hear about it, and so the first principle of transformative action is you have to speak the truth to power, you have to let everybody see that some injustice has occurred, and when people see this, their moral indignation will be such that, uh, they will rise up and force the government to stop and force the corporation. and often times this is successful because the corporation is so embarrassed, when, you know it's terrible PR for it, they may not have

any moral qualms about doing it, but when something that they've done that they try to hush up comes to light, it tends to uh be bad PR and they often backed down. the next principle of transformative action is a term that i coined called social chrysalis. and just like chrysalis is the process that the butterfly goes through when transforming from a caterpillar into a butterfly, uh social chrysalis is sort of an internal transformation that people undergo when they undertake the uh the strategies that King and Gandhi advocated. so one of these is good will against opponents. now if you look at most grassroots activists, most of them have a lot of anger and hatred and bitterness towards their opponents and they're trying to defeat them and humiliate them, and Gandhi and King emphasized no this is contrary to the spirit of non-violence, we're trying to win them over to our side, we're looking for common ground with our adversaries, we don't wanna eliminate our antagonists, we just want to eliminate the antagonisms. so it reframes this win-loose paradigm into win-win. we want the corporation, we want the government, we want everybody to succeed, we want everybody to find some sort of common ground. and so how do you do this? w- the final principle of transformative action is what's known as the constructive programming. Gandhi said often, you kno-, this is the true essence of non-violence, it's not about what we're against, it's about what we're for. King late in his life said what good is it if we can sit in and eat lunch at a counter if we don't have any money to buy lunch at the counter. we need a constructive program, creating visions of a better future, finding alternatives to unsustainable development, and empowering citizens to lead the process. so it's not being co-opted (49:11) by saying we're gonna work together with the corporations and government and then the corporations and the government drive the process. these citizens lead the process and they invite the other stake holders as partners. Uh, so transformative action transforms adversaries into allies, transforms anger into good will, and transforms competition into cooperation, which produces the one-on-one effect synergy, rather than this notion of you versus me. what adds up when we have an ethnic of you versus me is both times spend a lot of time and money and resources into injuring each other and fighting each other rather than fighting the problem. but the principle of synergy says when we work together, are some, uh, is- not the whole is greater than the sum of the parts, basically that, uh, we- we have more power working together than if you added it all up. and so my final slide is that the environmental justice movement is can also be transformative because it can also transform the way we look at urban planning, uh involving this notion of, uh, environmental sustainability a positive ver-vision, public health adopting the precautionary principle, rather than always reacting to problems, and economic development overcoming the paradigm that, uh, economic development has to come at the expense of people's health, and the environmental health of the community. and that is the end, time to open the questions [S4: thank you] thank you.

S4: thanks a lot for [S1: (xxx)] that uh informative presentation Scott, and so moving on to the next phase of the agenda, uh, the-, what I'd like to have happen is- and that is each faculty member will get a chance to ask Scott questions, okay, one by one, uh and uh if at any point any faculty member has a question related to, uh, the previous questions feel free to (xxx – 51:12) in okay. but at least each faculty member gets some space, in terms of asking these questions. uh and then after we've got all gone around, have some-(xxx) questions then we'll (xxx) to the audience (xxx) as well. so, uh does that uh feel okay with people?

S2: yes

S4: okay

S4: so, uh, i think I'd like to go to uh, our distant, uh, colleagues, and uh i was wondering if uh maybe Pat would you lead us off on this kind of uh discussion or uh questioning?

S2: uh, yeah my- my first uh I've been working with a scholar with the issue of communities that uh failures or uh changes in her planning to deal with poor communities minority (xxx – 52:06) uh it- it- it- the first part of the dissertation Scott and it touched Armand Andrew uh presentation of the issue of long-term change, worrying and (xxx) communities uh and and one of which is is more important for doctorate in terms of the sixty cases you looked and i- i I could- i'm not sure we're talking about the same creature here, you're talking about long-term change referring to clear mobilization and causes and what i'm thinking about is sort of a long-term education, but people who can (xxx) probably previously in terms of how to figure out how to solve the problem, uh and then other (xxx - arenas), uh and and those communities' behaviors will go out and and prevent any sorts of problems which the true is probably (xxx) minorities have just to solve problems then, is that what you mean by long-term change, and how important is that for the cases tha- <p:04>

S1: th- that's a right question, um, long-term change, actually, all i meant by that is that after a campaign has ended th- people mobilize for anything, so maybe education as you said to prevent things like this, prevent things like this from happening again, uh it could just be that another issue arose, uh, you know, i studied many communities, for example the Mothers of East LA, where after one uh issue would be defeated, another issue would arise in their community, so if it w- wasn't an incinerator the next one might be an oil pipeline, so that was the next issue that they fought. uh but interestingly enough, uh in answer to your question, of the sixty communities it- uh it appears that only six of them really engaged in long-term change, that was more positive or more constructive, that was more preventative, that was more working towards, uh, Bunyan's vision of what environmental justice means in a positive aspect. Uh, so this is something that i think it is really untapped, and i think that really the- the direction in which environmental justice movement needs go. does that answer the question?

S2: uh yeah.

S1: okay. that's good [SS LAUGHS]. Um should we go to Steve and- [S4: no wait just a minute] or just more with Pat.

S4: let's s- stick with Pat. Pat do you any other questions you would like to put to Scott?

S2: uh, i- i guess as a follow one in terms of the transformative action idea. uh, how doe- how does that differ, well you talked about soul and [S1: yes] and certainly if you take out the confrontational aspects of the (xxx – 54:58) processes, well says he's trying to (xxx) what his followers have been trying to do, uh is teach people in communities how to solve problems themselves and (xxx) confrontational [S1:um] so how does your what you're proposing differ from that in terms of political and social message that you propose?

S1: uh in some way the political and social message is similar and that- you're right, Sololinsky is trying to empower communities, uh and has been very effective, i mean, one of the reasons why so many community organizers still base their movements on the uh principles of Sololinsky, the industrial areas foundation is still going strong after close to sixty years since Sololinsky found is because of this message, uh one of Sololinsky's principles is never do anything for someone that they could do it themselves, and and the notion is we are trying to empower people to make these changes in their own lives and community. so in that

sense, Sololinsky's vision is very similar to the vision of transformative action, and yet in terms of the methods and attitudes behind it it couldn't be more different. uh Sololinsky has a quote in one of his books that he wants to rob raw the resentment of the community, he wants them to explode in anger uh towards the people in power, and transformative action says this will actually be counterproductive. uh i remember i was speaking uh at Louis and Clark University, uh a few years ago and Justice Scolea (56:34) from the supreme court had just spoken there, and all the students from Louis and Clark, which is a very strong environmental law program, uh had gone out in protest when Scolea a notoriously conservative justice of the supreme court had spoken, and they went out and chanted one two three four, Justice Scolea is a corporate whore. and needless to say this probably (xxx) him over, he probably did afterwards say you know what, they've got a point. what've i been doing my whole life? th-th- th- this notion of using uh resentment and using anger, uh to- to get people to feel like they are in power to make changes. anger is a powerful source, anger does get people to take action, but it can also burn people out, and it can also, uh, backfire. when i was a community organizer, working with the industrial areas foundation, uh in the years- in the two years before i came to Michigan, uh we actually got our funding cut off because we were funded by the government. the government had said, uh it was a joint venture funded by the Los Angeles city government, uh, city and county, uh state of California, uh and even the United States government basically saying we don't really know what to do about the problems, uh, in Los Angeles, so we are going to give, uh seven and a half million dollars to the industrial areas foundation to see if they know a solution, and they're gonna put a hundred community organizers out in areas that, uh are impoverished, that have lots of violence, that are unsustainable, and see what happens. and we ended up targeting the very government that was giving us the money and yelling at them that they didn't do what we wanted, and they cut out for funding, and that's how the program ended. so i think uh while ou- our message of empowerment is similar to that of Olinsky's, the attitudes behind it are very different, and i think it may have a v- a very different result.

S5: didn't Olinsky also kind of favored a more daring, surprise kinda approach? how would you fit that into uh transformative.

S1: that's a good question, uh, yes, uh Olinski did- did favor cer- surprise tactics, i mean some of his famous ones whether these are apocryphal or whether he really did them is- one time i think he had a protest against uh at the opera somewhere and he felt like it was a very elite organization, and so he suggested that everybody- in town they have just a baked bean fast, and that everybody eats lots and lots and lots of beans, and then all go to the opera that night, uh you know, so this notion of, you know, we're just gonna use sort of an outlandish creative tactics, you know, none of the regular opera goers are going to want to stay in a uh smelly opera house. uh that was one of his things. uh and yes, often times there were surprises, often times they were not announced, and that can be very counterproductive as well. sometimes it's effective, uh, in the perception of the community, because the community members feel empowered. we surprise the government, we surprise the corporation, they didn't know what was coming. uh you see this in a um, in a film, if any of you have seen it, i believe it's called Bread and Roses, about justice for janitors. and essentially what happens is in this high rise apartment building in Los Angeles where the janitors are trying to strike for better uh wages, better work conditions. um the owners of the apartment building or of the high rise office building are having a big corporate like Christmas party or something, and uh the janitors all of a sudden without anyone expecting it all rush in and disrupt it and they're banging pans and doing everything and disrupt the whole thing, and the idea of transformative action, Gandhi always said, we- we're going to announce what we're doing, before hand, we gonna let you

know exactly what our actions are because we believe that we're doing the right thing, and we believe that, you know, you'll- you'll see the light of reason and fact, we're not trying to humiliate you, we're not trying to defeat you. there was one famous case of Gandhi when he was fighting the British in India, and um the- the British government was weaken because there was a railroad strike, and everybody said to Gandhi now is your chance to strike, now you should take action because the government is already weak, because all the railroads are shut down and everything else, and Gandhi said yes, but if i did it and the government, you know, made concessions only because i hit them when they were down, that's not what non-violence is about, i'm actually trying to win them over to see my point of view. and so he announced in public, we will have no civil disobedience while this other strike is going on, let that be resolved first, then we'll resolve our issues. and the British government was so impressed, um one of the leaders of the British government in India at that time later said that that was the one thing that- that ultimately won him over to Gandhi's side, that u- until that point he had seen Gandhi as a nuisances, and as somebody who was his enemy. and when he realized that Gandhi actually had the British government's best interest in mind, um that- that really changed his point of view so.

S4: Pat, you have anymore questions?

S2: no that's good.

S4: okay? alrighty, um you wanna (xxx – 1:02:27)

S5: i thought you said define folks or <S1 LAUGHS>

S1: so Steve

S3: am i next?

S4: yeah, go ahead.

S3: hi Scott [S1: hi], great presentation [S1: thanks], and um my congratulations on the evolution of your dissertation uh from its earlier stages, [S1: yes it's come a long way] into something quite um impressive. um, I- I'd like to ask you a question um it- it's sort of a macro level type of question [S1:okay]. um when you look at your dissertation, um you seem to uh make a statement that_ well let's explore one more justice movement, look at a particular community and see whether or not they've been successful [S1: uhu], uh you uh quite wisely over time, you know, sort of managed your and brought your view of what success is [S1:uhu] uh that's terrific. um but you go on then and and say and you analyzed it uh very nicely, you really have done a great job in sort of dissecting what makes for successful or unsuccessful efforts at the community level (xxx – 1:03:36) [S1: uhu], then you then you then you said by yourself it's been uh, you know, you could you could claim that the environmental justice never has been successful [S1: uhu]. they're keeping their number of cases and so on that you mentioned, that uh as far as you've been successful, only you, but you have fine-tuned more isolate successful, and it's obvious why it's not [S1: uhu]. then, then you go on and say well_ uh this this is the question i have here, are you going in saying what_ let's try to improve upon this, will we, uhu, or make it something (xxx) than it already is by being this uh transformative action. um and and and and maybe then to (xxx) much more creative, uh, force for change. is that, is that, is that th-, (xxx) that evolution of your the dissertation.

S1: I- i think that's correct, i think that's a good assessment of it. essentially i'm saying that t- um the_ i have nothing but praise for these environmental justice activists, who have done a terrific job under very trying conditions in many circumstances, and fighting against locally unwanted land uses, and fighting against incinerators, and nuclear waste facilities, and lead poisoning in their homes. um but that_ at the end of the day when they've defeated these locally unwanted land uses or these um they've been relocated out of a place that's been contaminated, often times you have to look at how much have they really succeeded. is there a um as you say a more creative next stage that the movement can go? and i I believe that there is, and and i believe there are many activists, i don't think i'm saying anything new that many activist don't already realize, um but yet in my analysis of the cases very few communities, and i I didn't mentioned them in this presentation but i do talk about them in the dissertation, there are a f- a few communities that have been leaders in going on and saying okay it's more than just what we're against, now let's start working on a constructive vision of what we want. so i think your assessment is correct.

S3: okay, that- w- that's part of my question. um you have (xxx – 1:05:45) vital information now, uh uh based on your research that can help uh organizers fine-tune their EJ efforsts [S1: uhu], but now you've asked them to go (xxx) step, i I'd say what a big step for their mind now to become something moor.

S1: yes.

S3: um how do they do that? ho- why don't we have a (xxx) this way, why don't we have more deadly uh street examples? ar- are you asking too much from them, or how do they make, how do they make the next space?

S1: uh that's a great question. in one sense i think it's a matter of um perception. One of the uh the studies that i looked at, um the Green Institute in Minneapolis, um they have fought for over a decade against the trash transfer facility in a largely made of American multi-racial community of Minneapolis, and um, when they were fighting it they didn't even think, it wasn't sort of within um the realm of things they'd considered, it_ the fight against something was so urgent and so overwhelming that they hadn't even uh thought about what would come next, and it was actually they got the idea, um, form Cynthia Hamilton, an environmental justice researcher and scholar, um who met with them towards the end of their journey, and she said okay but if you win, what happens then, what do you want, what is your positive vision? and everyone looked around the room and they said well we hadn't really thought about that. so i think that in many cases it's not so much that it's difficult, it's it's more that people are so swept up in this urgent notion of fighting something that they see as an eminent threat to their health, um that they don't really consider um that there could be a next stage of the campaign.

S3: okay, um, what would that_ could you use social movement literature to help you uh to think about how to get to their next stage?

S1: um, probably not <SS LAUGHS>. um i mean unfortunately, and that is one of the reasons why i developed, um, this transformative action theory because i felt that social movement theory and social movement literature and even non-violence social change literature as it's currently uh written really doesn't address these more positive pro-active steps at all, it's quite surprising.

S3: uh but you just gave an example of an individual, an organizer who had an idea, a great question to ask. uh [S1: yes] that shows some leadership if you will.

S1: actually she's an academic, she's not even an organizer.

S3: she's not, okay th- [S1: yeah] but she provides_ she became a resource in the sense of helping to think then, think strategically for the future.

S1: yes, definitely.

S3: why not uh uh (xxx – 1:08:40) motion of the uh resource mobilization (xxx) with resources, reaching out, and help people uh people in their communities think about the next phase.

S1: actually that that is a great idea, i mean, resource mobilization, i think you're right. um that's something i hadn't considered, but i do think that in terms of_ if there could be um an organization, i mean right now we've got a number of nationwide networks of environmental justice organizations, and i think a few of them, the southwest organizing project and a number of others are starting to think in this way, but i do think that you're right, that's a way they could uh use the social movement literature on resource mobilization [S3: (xxx)] as an idea.

S3: yeah, they need examples they need information, they need uh uh case studies [S1: yes] and and and in suggesting research one of the important things that seem to these orga- these movements to go to the next phase is that they had multiple framings, is that right, they get their practice from the [S1: yes, yes I] they had multiple frames or or um things to be able to have a greater um sort of connections with other issues and so on that allowed them to sustain a double (xxx – 1:09:51) one issue_ event that (xxx) on the the uh dependent result.

S1: th- that's a great point i forgot to mention in the actual presentation although it is a part of the dissertation itself, which is that when groups frame things in more than one way, so if a group frames something as only an environmental issue, or only as health issue, if it's a one issue type of uh campaign, those tend to dissolve, but um there's a greater chance of long term success when they do have a multi-issue campaign, when they, when they frame in many uh different ways. you're right.

S3: but it- it seems like you have the workings of not only a vision but also the means to help these various groups come to- your next stages of social you know transf- uh movement stage, and I, you know, i'm urging you actually to think seriously about how to help you to get from from simply being hideous to regime reactionaries into into working towards a a more (xxx – 1:10:56) you know, vision process.

S1: yeah tha- that's a great suggestion. I'm_ i'll be thinking about that [S3: okay] <SS LAUGHS> thanks

S4: any more questions um Steve?

S3: i'm done. that's fine.

S4: okay Rachel

S5: let me jump off from what Steve was just saying. okay you just go to a to a community and get them to do transformative things, or does it require that evolution of havin- having struggled first around something something very specific and collusive?

S1: that's a that's a really good question and it was something that intrigued me because my hypothesis going into the dissertation was this notion that if you work outside the system, um, you know, was sort of radical idea that the system doesn't work, just abandon it and work outside the system, and yet something that i realized is that if people try to work outside the system without making a good faith effort to work inside the system first, then they actually loose credibility. so yo- you're right in the sense that the struggle is necessary, um when they say well we've gone to the politicians and it didn't work, we've gone to the courts and it didn't work, we've gone to the scientists and it's been disputed. that's when um it's much more legitimate for them all of a sudden to embark on more radical tactics such as direct action working outside of the system. um so similarly I- i agree um transformative action may need sort of this reactionary thing first because as we've seen in my dissertation research, um, the_ this is what these sort of reactions to these perceived eminent threats, these are the types of things that mobilize people in the first place, many of whom were formerly apathetic. and so often times it will be difficult to go into a community which hasn't yet been mobilized around some issue that they're reacting to and saying hey let's mobilize towards something positive. in that respect, um, the notions of social movement uh theory literature are very very important in suggesting, you know, what are the types of things that get people to be mobilized. well one of s- uh social movement theory ideas is suddenly imposed grievances. if you have something that's been forced upon you, or if you perceive it's been forced upon you against your will, um you're more likely to have the community rise up. so if you go to a community that isn't already fighting against grievance, you're right, maybe it's much more difficult to all of a sudden say okay let's do a transformative action campaign.

S5: what about visioning, does that have some of the same parallel thoughts to it? can you can you vision before you have struggles as creative one?

S1: i think you can to a certain degree, um, it's a question you know that requires further research and that's beyond my expertise about uh what drives people to undertake citizen action, to become engaged citizens in the first place. um but i think about the example of Chattanooga, where in Chattanooga they have this visioning process of what they wanted their community to look like. well before that time people weren't organized very well so in some sense there have been no reactionary movement before the uh vision twenty-twenty process. but in that case they were reacting in the sense of Chattanooga being one of the most polluted cities in the nation, where in the middle of the day if people were to go outside in a white shirt and go to lunch for an hour they would come back covered with soot. um so_ and where cars always needed their headlights on during the daytime hours because it was so dark and smoked-filled in the city. so in that sense, rather than taking a campaign of_ we're gonna fight against the smog and the soot and everything else, that was included in part of the idea of let_ this city looks really unsustainable, let's try and create a vision of what we need. so again there w-_ it was a_ there was a crisis that sparked there or conditions uh problems uh that sparked it.

S5: i'm wondering, how far do think you can generalize your results? where_ how- how far can we apply them? do they, for instance, speak to any kind of advise you might give the US government with respect to Iraq?

S1: uh, it's a good question. um, well i'll start with the issue of generalizability. um, obviously this was not a random sample. uh, i took the sixty cases about which i could find the most data, about which i would be able to code for all these variables. Now looking throughout the environmental justice literature, uh there's an immense amount of it, i have boxes and boxes of it, i read stories about many many different cases, and yet these sixty were probably the only ones that at this time i could code for. and so in that sense_ and the N is very small, it's N equal 60, so even statistical analysis, the things that I found to be statistically significant, it's difficult to say if you can generalize those, even tu- the environmental justice groups, because I'm basically saying_ I'm describing what happened with these sixty communities, and, and so rather than saying this is the advise that I'd give to all other communities, I'm merely suggesting this is what took place in these sixty prominent cases.

S5: you sound like a researcher <S1 LAUGHS>

S1: um, took me a while to get there <S1 LAUGHS> and then um, but in terms of generalizing the notions of transformative action, specially to the United States government with Iraq, I do think that um transformative action can be generalizable to a larger scale, I mean, I do think, um, the notions of non-violence as has previously been conceived, um, are very powerful and have taken place on an international context, and writing my dissertation, for those of you who haven't read my dissertation I'll describe, um non-violence has been extremely successful even against very powerful regimes that were oppressive and dic- dictatorship, fascist. Non-violence, when it was used against the Nazis, in Denmark, in Norway, and in the heart of Berlin in 1944 was successful, and this is a story that very few people know about, that because non-violence was rarely tried against the Nazis most people just assumed you know, the Nazis are so evil we must um use violence, this is one of the cases where violence is warranted. But there were many cases where people were not trained in non-violence, they were not_ they- they didn't study the scholarship, and yet spontaneously they reacted in ways that show that transformative action can be a very powerful force. um I think it was Theodore Rosak who said um non-violence_ the study and practice of non- violence is at about the stage of electricity in the days of Marconni and Edison, you know that there's so much further that we can go with this. um so I think that on an international context I think it's something it's something we definitely need to explore.

S5: you wanna talk about the three principles and how they might [S1: yeah, sure] be a part

S1: um why I think exposing injustice (1:18:38) um this is one the clearest ones, and it's not happening so much in America, but I was just in Great Britain, where, you know they're having a major scandal about the quote on quote sexing up of the weapons of mass destruction claims, and that even though intelligence showed that um that Iraq was not as powerful when this threatening as Tony Blair and George W. Bush were suggesting, um that Bush and Blair used this as a justification nonetheless. and while this has not yet had repercussions on Bush here in America, I've read a poll last week that seventy percent of Americans still believe that Saddam was behind September eleven. So, clearly there's a- an issue of information and how people are gathering their information in the United States. but in Britain, this notion of exposing injustice there is a whole similar to Watergate type of

investigation looking into whether Blair lied and deceived the British public, and that, could be the downfall, of his, or people in his uh government. so that's the first principle is basically uh exposing to the light of day things that were hidden. um the second principle is the most interesting: social chrysalis. I mean how do you do this on an international context? How do you transform adversaries into allies? How do you hatred into good will, especially because, y'know, some people have suggested, some people on the left have suggested that it's actually good for Bush not to capture Osama Bin Laden or even Saddam Hussein because just like George Or- Orwell's 1984 it's important to have this enemy, this threat, this, you know, this person who's always out there looming and Bush says I will protect you, and so if there were another terrorist attack akin to nine-eleven his polls would probably sky rock it just like they did after nine-eleven if he comes out with this sort of strong, you know, non-transformative action type stance. um, so the question is how would that um take place on an international context. um, I can only speculate, of course, but I mean one thing thati would say is that um I had a- this is an interesting anecdote. After nine-eleven happened, um I went to a restaurant near UCLA with a number of my students, and th- my students knew that I was very interested in non-violence and transformative action, and this was before Iraq, this was round the time we were deciding what to do in Afghanistan, and they kept insisting that, you know, they were asking me what I thought we should do and I said you know well I know first of all what we shouldn't do which is which is bomb Afghanistan and they said but we have to do something, and I'm like we can do something, we can use non-violent principles, we can try to bring these to justice. The United sates had the sympathy of the world with it, and in fact, this is one of the interesting principles of transformative action – is that victims receive sympathy. um in the civil right movement, when um people were marching through the streets, um, of different cities, and were attacked by the dogs, and were attacked by the fire hoses, if they'd fought back, and they just erupted into violence, a lot of people might've said: see, this is why you need to use violence against these people, you this- this is intolerable. But the fact that they didn't fight back, that they actually got down, they prayed, they blessed the people who were attacking them and tried to get up and walk, that all of a sudden made this such a dramatic picture in the eyes of the world and really brought a great deal of sympathy to their side. well the United States which has never been particularly loved in the last few decades for its foreign policy, after nine-eleven had a great deal of good will. A great deal of um the- the countries of the world offering to lend support and sympathy. in fact, um a Paris newspaper, as we know now, the French aren't always in love with the American, um but a French newspaper – the headline after September eleven was: we are all American now, or we are all Americans today. Um and we could've used that good will to- to search for justice, basically to say, we want to use the intelligence and the legal, the full legal force of the entire world community to bring um Osama Bin laden and members of al Quaeda to justice, and we could've set a moral example by saying we refuse to use violence, we will not strike back. And that way every time- and people I often people ask me about, for example, um the crisis in Israel and Palestine. um the fact this cycle of violence that every time um a suicide bomber hits an Israeli community, Israel immediately retaliates, and this just adds to the bloodshed and the peace process goes out of control, and the notion is if one side, let's say it could be the Palestinians, it could be the Israelis, but let's say the Palestinians said we are going to take a principled stance for non-violence, you can bomb us but we will not do anything back, we can do this-, it would be an amazing, um I mean, I think in many cases the- much of the world's community already favors the Palestinians, and the US is, often alone in its support of Israel, but I think that in that case even the US would be hard pressed to support an Israel that continued campaigns of violence against Palestinians who said: you can kill us, we will not kill you back. We renounce violence as a tool. And I do think that if the United States, if we had any leader, who um had the moral courage to stand up and say we have been attacked but

we wanna show how much we believe that these attacks are reprehensible by resisting to resort to the same kind of behavior. I really do think that that would make a major transition in terms of the sympathy of the world, I think, as many people have suggested, our campaign of lashing back at Afghanistan and Iraq, may have only helped recruit many more terrorists in the future. So that's the second principle. And then the constructive program is- could be something like if you do see these people as your allies, if you say we're all working towards common goals, and we need a new vision while we're all working together, well that could be somewhat like the reconstruction of the Iraq if you hadn't bombed Iraq in the first place. And then it could be something where- if you can get the world community agreeing that Saddam Hussein is a danger, is a menace, etc, etc, and you can say well we need a new vision for Iraq, a new leadership involving the people and having the people leaded, as grassroots campaign rather than the United States saying we picked these people to choose a new government, I think that could make a difference, this is all speculation, of course. <p: 03> other questions?

S5: I can (xxx – 1:26:12) or your turn, which way you wanna go?

S4: alright, let me try it [S5: okay]. uh is very interesting uh Rachel because I had down here um written some of the conflict that is going on in the room today <SS LAUGHS> further action on the environment implied to these situations right <S5: LAUGHS> um, so you- you- you answered that basically. The other uh question I have here uh are there any instances where the military can be trained in non-violence and- and transformative action?

S1: uh, um not yet <S1 LAUGHS> um I think that it's- it has great potential actually, I mean after um 1989 and after- you know everything seemed to be changing in the world in South Africa, and what is now the former Soviet Union and what was then the iron curtain. um there was this process of- what we were talking about military conversion, all these money that we normally pour into the military being used on things like education you know transforming bases, military bases into more peaceful and things like this. and now with- with this sort of abstract anatomy of terrorism that seems very unlikely. but it's interesting that w- um over a hundred years ago um I believe it was William James wrote a- a very important essay called um "The Moral Equivalent of War", [S4: uhu] and in this essay he basically suggested that you know war is too destructive we can no longer go on, but why can't we have an army, an in his case ironically enough, now it would be considered completely politically in- incorrect specially in SNRE. his was sort of a war against nature, like w- we have to fight against all the forces of nature, and subdue nature, but the notion of taking the power and energy that now we- we um we use to train people in de-humanizing other, and training them to see the other people as the enemy, and training them to fight with violence. um one of the other terms that I thought about instead of social chrysalis for my second principle was social aikido. and aikido is this martial art for those of you who don't know, that essentially you convert the power of your opponent to your advantage. And, I liked this notion so, for example, if we you know if you were- if you were rushing at me, if I were to fight you head on, uh we'd both get injured most likely. And yet if I were to stand in the same direction as you're rushing towards me I just move my stance from facing you to facing the way that you're running. So, then, all have to do is just hold out a finger you know and I could flip you if I so desired um to fend off the attack. um but this notion that we can transform the energy into power, I mean the military has tremendous amount of power, um obviously, and then it has a tremendous amount of financial resources. so I do believe that, and one the thing I wanna do in the future with my own life and career is develop a transformative action training program. I want you know I talk in this dissertation about um replacing you know transforming anger in good will, for example, I say that anger is counter productive. Yet a question is you know other than a

terrible movie with Adam Sandler and Jack Nicholson, how do you really do anger management, I mean how do you transform the rage that many people harver or even repress in their lives, how can you train people in transformative action and take that energy that normally is poured into resentment and anger and bitterness, and how do you basically teach people and help them teach themselves help them find within themselves that there- that they can use that power for a greater force. and that's something that I haven't figured out and that's something that I wanna work with [S4: well] in the future.

S4: several years ago I- I talked to Jean Sharp over the phone and one of the things that I was really intrigued about was and that is that he said that he had a contract to train the I think I think it was the Swiss army [S1: wow] in non-violence okay, and and and and the way he was coming at it and that is that if that country is ever invaded, then they have an army trained in non-violence and non-corporation, and so the- the occupying forces not really sustain themselves because the army will be trained in non-violence uh uh in- in- in order to resist. Okay the the ar- army in force. so I thought that was a very interesting kind of thing and so the question is, that triggered a comment on my part and that is in what circumstances and situations can, uh say, the military be trained in non-violence, and maybe that's one kind of situation. Um and think that Jean Sharp was saying too that non-violence is very powerful because people non-cooperation and non-violence probably goes (1:31:20), people are not defending territory. w- we- talk about the military you the- they say your parameters and they are protecting a area [S1: uhu] but people you know they just you know there's no property to protect, you just stand there, you just don't cooperate. And so he was saying that the defense department is very afraid of non-violence because the military doesn't know how to deal with it [S1: yes] so I think that even in Iraq, you know if if those soldiers over there had participated in non-violence non-cooperation they'd be probably be much further ahead in terms of their own opinion [S1: that's true] uh the other question I'd like to raise is that um <p: 04> it um page sixty of yo- page two-fifty of yo- dissert- page two-fifty of your dissertation uh uh to look_ you talk about um the media, and how critical the media was, and how- how the media didn't work out in some cases in terms of (xxx) various groups [S1: uhu] now the question is, for me, and that is if these groups were_ could these groups have avoided negative media if they had understood the philosophy of non-violence [S1: hum]? (xxx) could- could that could that have happened? and, also, to what extent, was King and Gandhi public relation experts?

S1: oh that's interesting. Um the first question is hard to say, I mean on the one hand the politics of anger and the politics of things that aren't transformative action male great progress. um when somebody says this corporation is evil, and this corporation has killed my baby [S4: uhu] that draws almost immediately um extraordinary attention. Now that_ you may say this is just the first principle of transformative action it's exposing the injustice to light, but it may not be true. One of the criticisms that's often been um lodged against the environmental justice movement, for example Christopher Forman of the Brookings Institute wrote a book in which one of his major arguments is that there may be health problems in these communities not because of the incinerators not because of these things you can_ it's so hard to find cause and effect [S4: uhu] and it maybe things like diet or lifestyle that affect. So when somebody says this corporation killed my baby, it's a dramatic thing, but the press um looks at it and maybe even reports on it even if it may not be based on fact, whereas a more transformative action approach might not get any press at all. You know if- if transformative action if you're saying let's work with the corporation and here's a new vision, it's not quite as dramatic, it doesn't um it doesn't have the same panache. One of the um there's this interesting debate that I'm sure a lot of you heard recently about that much of talk radio in

America is very conservative, you have the (xxx – 1:34:38), you have Michael Sabage um you have all these people um on the right but you don't have many people on the left who are commenting on these same issues um or who have mass audiences. And um o- one of your Eric Alterman in the Nation made the point that perhaps it's because often times people like Rush Limbong make very black and white issues, he says environmental wackos, feminine nazis, he makes it very dramatic and makes the statements to capture people's attention. Whereas often times, and you can see my bias showing right through here, um but I'm just quoting Eric Alterman, of course, um Eric Alterman says um people um on the progressive side tend to see things more in shades of gray, and they tend to say well it's not a black and white issue, it's not that the other side is evil or irrational, we have to look at these factors and these contexts and that does make for us compelling talk radio. um

S4: just a minute, just a minute [S1: yes] let me ask the question this way, to what extent do you think the environmental justice groups out there understand the philosophy behind non-violence?

S1: oh very little. I think very few understand the philosophy.

S4: so if if in fact that if more groups understood the philosophy, do you feel that we'd be much further ahead along in the movement?

S1: yes I do. yes, actually I do um I think though in terms of the media attention I I may have misunderstood your question, um they might not (xxx 1:36:13) much media attention, but I actually think that they make more progress in the changes they were doing in their communities.

S4: okay but then don't you think that media is also critical I mean in terms of moving the- the- the issue forward, I mean in other words if- if you can't put a spotlight on something I mean I mean it- it- I don't think it's gonna move very far. In other words, that I think if_ like Gandhi was I think an incredible public relations person [S1: yes] he kne- knew how to use the- the media, if he didn't have that skill, I mean I don't think he would've been as powerful as he turned out to be [S1: yeah] so- so- so you know doing things in (xxx 1:36:56) you know is not gonna cut it [S1: exactly] so

S1: I- well I agree with that, I mean I do think in answer the second part of your question King and Gandhi were public relations experts, I mean they were_ they had a real sense of what was necessary in order to attract media attention and and the- often times I think, again in answer to your question, the environmental justice movement, not only are they non-violent, um in the spirit of Gandhi and King, but often times they are not very creative in their media approaches you know the- the sort of activist approaches of s- you know hey hey ho ho Chevron has got to go, um it tends to loose its power and the media doesn't wanna cover because it's- it's happened so many times so I do think that more creative media approaches in PR approaches are definitely necessary for transformative action.

S4: okay. another question um <p: 03> at the uh uh first national uh people- first national people people called it environmental (xxx – 1:38:06) summer, um there was a woman who said something like we didn't want one person to emerge as a spoken person because we have all worked too long and too hard to have the bounds between us destroyed. The media and the EPA were pushing for this spokes person, so it's been a real struggle. I'm really glad we've made that decision. In other words what she was saying is that we don't want to have, what's

important, a national leader or a national organization okay, because she felt that it'd just be too much energy up here and this is the first time, and I think in current history where people of colored groups come together to fight environmental injustice [S1: yeah] so it would just (xxx) her okay. the question for me is that there's a- there's a person by the name of Gerllac in Hine, Virginia Hine, and they came out with a study years ago that talks about social movement organizations uh in a different way then what you've been talking about, and they talk about national movement organizations okay, and they talk about decentralize you know multi-leader organizations, and what they are saying in fact is that these national organizations that were advantages that they can coordinate a national event [S1: uhu] very easily. These decentralized organization can now do that as well, but one of the disadvantages of these national centralized organizations, Gellarc said, if you cut off the head of these organizations [S1: yes] then everything comes sort of crashing down, and so in the 1960's and early 70's a lot of the- a lot of the black leaders either died or were assassinated and so forth, I feel that the so rising movement (xxx) [S1: yes] I remember in different years alright. And so it seems to me that the environmental justice movement uh because of the decentralized approach uh probably will- may have a much longer longevity because you lock off the head of one of these organizations um you have you know fifty- a hundred organizations who car- carry out the battle right. So I was wondering if uh have you thought in terms of whether um national-based organizations would be uh much more of (xxx) or- or- or- or- or would these decentralized organizations would they be much more of what you think should be happening in the environmental justice movement. Now this is here like (xxx) just wondering what you're thinking about.

S1: so it's a good question, I do think uh there's a wonderful passage from the Taliesin that says when the true leader has finished her work the people say look we did all by ourselves and and I love this concept of a leader being somebody who empowers others to feel that they have done by themselves, I mean that is in some ways the ideal as a passed question asked about. Sololinsky these notion of empowering people saying we're not gonna do for you what you can do for yourselves, um because otherwise as you say when a leader gets assassinated, when a leader goes away, and as a community organizer I saw this happen, there'd be very powerful community organizers who then after six months or a year leave the community, take a new job, whatever, and the community falls apart because they believe that they needed that that one leader cuz the- that's where their power was coming from, rather than the power coming from themselves. um but the way I've often thought about it because it's a question that gets asked a lot you know should we have strong national leadership, should we have a lot of decentralization, a lot of people credit the anti-globalization movement strengths again to not having one central spokes person um not having one person who can be attacked or arrested but that- you know who led the battle of Seattle, who led what happened in Genoa, you know who led a protest in Cancun a few weeks ago, it- it's hard to tell because there are so many decentralized organization that are working for the same cause. Yet, having said that, um it's always been a question similar to should we do things from the grassroots, from the bottom up or from the top down, and my response has always been from every which where – do it um you know it's not an either-or type of proposition, and I do think that there are certain leaders and Martin Luther King Junior was one of them who put a voice to the um to the feelings of the people, and who can be so articulate that many more people hear about it because of whatever they heard about it before, and so I think the- that leaders like that have to be careful that they don't get worshipped, that they don't- that they aren't put um on some you know as if they were in the pantheon of the gods, um bu- it would be ideal if you could have a number of leaders like this and also a number of decentralized leaders. I think that really the answer to your question is I believe in both, I believe [S4: bu-] in the decentralized

S4: but if you had to make a choice I mean in terms of emphasis I mean what would that be?

S1: I decentralize them.

S4: okay one more question just to <S1 LAUGHS>

S5: time we're kind of worried about, that's all

S4: okay. okay just you mentioned, you mentioned uh that the women played a major role in terms of [S1: yes] and uh I think that's correct because (xxx – 1:43:52) has been women, middle-aged, older women who played a major role in the environmental justice movement. The question for me is uh where the hell are the students?

S1: mm it's a good question.

S4: I mean because it seems to me we talked about the future we talked about you know transformative action and so forth and then we talked about how to engage students and to me I mean there's (xxx – 1:44:20) students, because in the civil rights movement students were definitively the vanguard, I know that (xxx) responds to that end.

S1: um I think my quick response is that a lot of this activism comes from when people feel personally threatened and one of the reasons that many of the women who were leaders in the environmental justice movement give is simply I had no choice. The health of my children was at stake here [S4: right] and I think that students um many of them don't feel necessarily that there is an eminent threat, they don't the relevance in their own life of some of these larger issues um you know they're going by their business, they're taking tests, they're studying, um they're doing whatever they're doing with their lives and you know I often heard and I've been perplex by this because I think there are so many important issues but I've often heard in the media people saying there are no big issues for the youths of today you know it isn't like the 60's with the Vietnam war, or like the civil rights movement when it was so clear, and I've heard the media suggest this and I don't necessarily believe it but it is a sentiment that is out there that perhaps students don't really see this um this relevance to their own life and why it's urgent and why they don't wanna get involved.

S4: well let's have a couple of questions from the audience and then um bring about closures um section

S1: yeah but

S6: I actually (xxx – 1:45:59) and I hope this wasn't (xxx) [S1: okay] but um you mentioned sort of the idea in your transformative action theory that um transforming towards more positive and synchronistic types of activity um but when Bunyan asked you about like sort of sort of as an analogy the (xxx) versus (xxx) you said (xxx) and so my question is in terms of using the different approaches um to achieve environmental justice um do you think there aren't cases in which an adversarial would be um effective litigation you know painting dynamic pictures through the media and stuff like that um and are you saying that only the more synergistic approach is what you think would be the most effective.

S1: it- it's a good question an- and here I'd like to differentiate between um adversarial antagonistic and confrontational, because I think that confrontational approaches are required in many circumstances I mean there's that wonderful co- quote by Frederick Douglas, the one about he who expects how does it go you know social change without agitation is like somebody who expects you know the ocean without its mighty roar and etc etc. um many times when you confron- specially the first principle of transformative action this notion of speaking the truth of power you have to confront and it's going to seem adversarial, but the point is not to be antagonistic, not to be um hateful and bitter in trying to defeat the opponent, but try to confront them and expose something that maybe embarrassing to them and even so I said you know the goal of transformative action is not to embarrass them, it's a question of are you embarrassing them o- or have they embarrassed themselves and you're just allowing it to be seen. um a- an example of this is in the Dudley Street community which I talk about in my dissertation where this community um was working with the city government in Boston of an impoverished neighborhood and they got the mayor on their side and they got the city government on their side and so that actually they were the first community in the nation to ever be given the right to eminent domain which is usually a right reserved for the government which essentially allows the government to take private land for public use, and no community group has ever had this power, but in Dudley Street there were all these abandoned lots owned by absentee landlords and this non-profit this community group wanted to re-develop them and to revalorize the neighborhood and the government said yes this is a good public use so we're going to delegate this authority of eminent domain to you. but this didn't stop them from being confrontational when they needed to be, there was one time in their neighborhood when uh there were all these abandoned cars, like this was the area wh- they got dumped on by all the rest of Boston, um ther- there've been a lot of arson in the neighborhood, and there were a lot of burned out lots, so a lot of times you know vandals would just come by and throw trash there, cars that'd been stolen would be abandoned on this neighborhood, and they called the mayor and the mayor hadn't done anything, and they kept calling the mayor they said we though that you were ally you know and she just wasn't taking action and so what they ended up doing was, and this is an example of a very creative media approach, um they called up the mayor's office (xxx – 1:49:43) his name was Ray Flynn and he was running for mayor of Boston again, and they said we'd like two hundred Flynn for mayor bumper stickers and (xxx) mayor's campaign team was so enthusiastic you know this is great this community is going to support us uh previous to this the mayor had been perceived by many to be racially insensitive and this was a very diverse multi-ethnic community and so they gratefully and (xxx) sent two hundred bumper stickers and then of the community members put them on all these abandoned cars and that were littering their neighborhood and the media had a fielding came out and you know photographed this and put it on TV the next day all the cars were gone the city came and cleaned it up. so it's an example where this confrontational look creative and not bitter was basically just exposing the fact that the mayor ha- isn't doing his job and we've been calling the mayor and the mayor is not and so we're going to s- jokingly show these abandoned cars you know oh mayor Flynn is doing such a great job he's got all these abandoned cars in our neighborhood so I hope that sort of delineates the difference and antagonistic approach and confrontational.

S6: alright

S4: okay let's take one more question

S1: okay Mike

S7: I- I'm just wondering in (xxx – 1:50:58) questions it seems like maybe non-violence as an approach suffers from a scale problem, um because you seem to hint that it may not be for these (xxx) limitations and training armies and i- I'm wondering uh very seriously if there's any kind of uh conduit in thinking that you didn't look at non-violence as a theory and uh peace keeping as a theory which tends to be forgotten uh you know not with (xxx) but I mean piercing others who uh came up with the notion of peace-keeping [S1: yes} and the idea there would indeed be armies on a certain level but mobilized presumably for keeping peace uh that would seem to be a means of combining some of the scale problems and I'm wondering is there something to be learned from that body of thinking have you found or

S1: yes there's actually um there's some excellent scholarship on this. um there's a book and Gandhi had actually also proposed um the idea of what he called the shanty (xxx – 1:52:02) which was a peace army to exactly what Jean Sharp was suggesting and somebody um I can give the reference and email it to you um wrote a brilliant book and and I didn't use in my dissertation because it was somewhat tangential about comparing peace-keeping and to this ideal of what he called peace-building and and it's fascinating so I recommend that book to you.

S4: okay, I think

{END OF TRANSCRIPT}

Title: Virtual study of gastric acid in Helicobacter infection
Academic Division: Department of Microbiology and Immunology

RESTRICTIONS ON CITATION OF EXAMPLES: NONE

Recording Duration: 62 min
Recording Date: October 12, 2003
Recording Equipment: TASCAM Digital Audio Tape Recorder with two external microphones
Language: Primary Discourse Mode: MIX Native Speaker Near-native Speaker

S1: Chair (advisor)
S2: Candidate
S3: Graduate Student
S4: Graduate Student
S5: Graduate Student
S6: Graduate Student
S7: Graduate Student
S8: Graduate Student
S9: Graduate Student
R1: ELI Researcher (myself)

Setting: Large Conference Room, Hackam Building

S1: so good morning, bright n' early for- for some mathematics this morning um welcome to uh the thesis defense it's my pleasure to introduce uh Ian Joseph today he's defending his thesis in the Department of Microbiology and Immunology, um before I introduce Ian what I'll do is give a little background so you can understand what he's been doing for the past six years here in Michigan. um Ian received his bachelor's before he came here from the University of the Virgin Islands in Saint Thomas as a matter appreciated for him <SS LAUGH> and um w- actually he started research there um early on into corals and (xxx – 7:21) monkeys um but he decided to go on more microorganisms and and he came to the University of Michigan in nineteen ninety seven. um Ian decided to rotate in my lab in uhm the summer of nineteen ninety eight and after that time he decided to stay and and do his PhD thesis with me and you have to realize that when he came he had almost no mathematical background and so he never though about things in that theoretical framework before so it was quite a challenge but he- he rode the challenge quite well as you'll see today. um after joining my lab Ian uh

S2: (xxx) there you go

S1: so, I am always standing on this side, uh so when Ian first joined the lab you could say he was rather fair, he was the first private student who hated to the lab and um he was kind of lonely, a lot <SS LAUGH> in fact, in this picture you can see he thought the microwave was a- was actually the computer <SS LAUGH> so we really had a lot of training to do. um and he would sit at the computer and work quietly headphones on very um but he really was- was quite disturbed and so he turned to alcohol <SS LAUGH> and and he drank heavily, a lot <SS LAUGH> and in fact there's pictures of him all over <SS LAUGH> with alcohol. and then

one day he got a friend <SS LAUGH> so he came to the lab and and they uh <SS LAUGH> they'd be friend to him and he- he's smiling now he looks happy here right, and more friends <SS LAUGH> from the group, and then eventually a whole crowd <SS LAUGH> surrounding him. He started to do this really well and he grew and matured into the- the guy we know and love today. so uh Ian's project when he came to the lab, I actually gave him uh a project we had just published some really general work on infection with Helicobacter Pylori of the human host and host response. And um in- in fact I just said Ian see if you can do a better job, see if can uncover some mechanisms, because what we've just got is a framework here, and what we really want to do is uncover some specific mechanisms. And so he thought well to do that what I'm gonna need to do is really try to understand the framework upon which Helicobacter um resides in the human host which is the stomach. So he spent about a year reading the literature on gastric acid secretion and on uh Helicobacter's interaction with the gastric acid secretion system and he- after turning to that literature he realized that basically people don't know a lot about its regulation uh in in humans, there's a lot of animals studies but in fact not a lot of human studies as you can imagine why. And there's a lot of differences between the stomachs that they were looking at in the animal models and the stomachs in the humans so uh I think that his idea was, he's really gonna have to figure out this puzzle before he can even move on to understand helicobacter infecting the human host. And so we spent three years developing that model uh it was not easy because the literature was- was vast and scarce at the same time. um and so once he was able to do that uh we were able to collaborate from the (xxx – 10:11) University of Michigan and we published a really nice piece of work in the Journal of Applied Physiology this year uh on the gastric acid secretion model. So once Ian had that model in place then he was able to um think about imposing Helicobacter uh into that system and so that's what came next. and I won't tell you about that cuz that's what Ian is gonna talk about today is is that part of the model. but um I I I will say that I think um it ended up being quite an elegant and simple answer to a very complicated question and hopefully he'll be able to um show you how mathematical modeling helped him reveal that. um during his work he actually worked on two other projects on the lab, um both related to the gastric acid secretion system model. The first one had to do with pronpton pump inhibitors, now these are drugs that are prescribed to deal with different types of gastric um illnesses um and you can imagine right now that in ph- pharmaceutical companies the number one drug prescribed usually has something to do with the gastric system and so this is a very hot area, we had to this great model of gastric acid secretion so why not asking questions about that. so we together with (xxx – 11:10) in my in my group he published uh just submitted some really interesting work on that area. Now um another piece of work that he worked on related to gastric acid secretion system was a more mathematical treatise on um delay because a- any time you have a network you there's gonna be delays that signals get transduced from one side to the other and how important are those delays and actually can you even estimate what the time scales of those delays are and so together with s- Simeone Marino and (xxx) in the lab they published uh uh a really nice piece of work that's about to appear um on- on the roles of these delays in gastric acid secretion. so I have to say that Ian achieved all of this while juggling a personal life that included um having to take about six months off total to help deal with his father who had taken ill, but we're happy to say that his dad is here today and his doing well and his whole family is here and um to support him and um so we're excited to- to help Ian celebrate this achievement together. um Ian has decided to remain in my lab for post-doctoral work for a while so he'll be around um so we're happy not to um have to say goodbye to him to soon. so um before I introduce Ian I have um a person here who needs to make a comment so why don't you get up and do that and then um

R1: yeah (I state the purpose of my presence)

S1: okay, so without further ado I'll introduce Ian Joseph who's gonna talk to you today about a virtual study of gastric acid in Helicobacter infection <p:15> <candidate prepares Powerpoint and adjusts microphone>

S2: Can everybody hear me? <p:03> well thanks Denise for that wonderful introduction, the seminar has now ended, you may go <SS LAUGH> as Denise mentioned, the topic for my thesis defense is a virtual study of the role of gastric acid in Helicobacter Pylori infection of a human host and what I'd like to do is take you through the outline of my presentation. first I begin with an introduction to H. Pylori microbiology, then I'll show you how we built an integrated model of Helicobacter Pylori host interactions, then I'll go into the experiments we performed and the results generated, which include a comparison of model results with experimental data, as well as virtual deletions, as well as variations of infectious doses which gives us an indication as to the minimal infectious dose, then I'll end with conclusions and future directions. But first what I'd like to do is take a step back and when researching in the lab I was- I became interested in Helicobacter Pylori based on the fact that it has a global prevalence within um as shown here. In developing countries the prevalences approximately ninet- eighty to ninety percent whereas in developed countries is much lower, and this is probably due to a lack of treatment as well as poor sanitation in the developing countries. so having this you can ap- s- s- begin to appreciate that possibly H. Pylori has co-existed with men for millennia. In particular, spiral microorganisms which were like H. Pylori were first identifies in mammalian s- uh stomachs and in human stomachs, then eighteen ninety three and nineteen thirty nine respectively. However it was not until nineteen eighty two and what I consider an elegant study by Marshall and Warren, where Marshall ingested the microorganisms and observed that uh chronic gastritis uh re- uh resulted, and this was the fulfillment of Cox Postulates, in other words, (xxx) disease. <p:03> so since then, man- uh much researches are being done to characterize H. Pylori showing here. Notably H, Pylori is a ground negative microeophilic organism and as you can see from the figure it has a spiral shape and possesses between four and six flagella. Now H. Pylori colonizes the stomach and as such it experiences several barriers to colonization, this include a thick mucus lining which coats the s- inner s- inner walls of the stomach H. Pylori also faces high gastric acid, you'll note that the ph is approximately two within your stomach, but also faces high peristaltic forces specially during the consumption of food, as well as a high frequency of wash out with the stomach contents into the intestines. therefore H. Pylori has evolved adaptations which overcome these barriers. Now in interacting with uh in interacting H. Pylori with the human host there is a range of interactions which range from commensalisms to parasitism. upon in- uh infection what is uh established is a chronic infection in the majority of the individuals during which H. Pylori is a- similar or likely similar to that of normal gastric flora. cardiac gastritis is observed, however the patients remain clinically asymptomatic. In a small percentage of individuals disease occurs and these diseases include peptic ulcer disease, (xxx – 17:37) associated (xxx) tissue and (xxx) as well as gastric carcinomas. When this occurs you- uh the interaction is considered parasitic. So the question is why do some people progress to disease and the hypotheses I've been propose and these include: one, post-susceptibility which include genetic predispositions such as altered gastric acid secretion as well as differences in immune responses between individuals. there's also (xxx) factors which include virulence factors which I'll discuss in my talk, as well as environmental factors namely diet, stress, which I'm on it, smoking <SS LAUGH> and pharmaceutics namely aspirin, aspirin is a a drug which can cause disease uh win- within individuals. however, for the purpose of the talk we wi- I will focus on altered gastric acid secretion and the action of

vir- of virulence factors. so recall that I mentioned that H. Pylori faces several barriers to colonization and it has as a result evolved various adaptations, so for- in order to enter the thick mucus lining motility and the spiral shape of the bacteria is important in that it allows the bacteria to borrow into that mucus lining. once in the mucus lining bacteria migrate to the epithelial surface where they can on to go adherence. This adherence is important in that it prevents the wash out of bacteria during the frequent gastric emptying into the intestines. There's also- the bacteria also faces a high gastric acidity and for this the expressed urease activity, I'll go into this in further detail in my next uh slide. However the point I want you to take on from this slide is that deletion of these virulence- of these factors results in an in- inability to colonize and therefore they are characterized as H. Pylori virulence factors. so as for the s- uh urease activity H. Pylori exhibits strong uh urea- uh urease activity in which urea is degraded to give the ammonia and bicarbonate and this is ammonia and bicarbonate is used to buffer the acid presence within the stomach viral out colonization of the periplasmic space of the bacteria. now acid adaptive bacteria, bacteria which are able to survive uh bet- between a range three point five to eight as shown here can als- uh also uh grow uh oh sorry are restricted in their growth in that they're restricted to a region of ph between six and eight shown here. now urease mutants are unable to colonize as I mentioned earlier <p:03> subsequently two putative virulence factors have been identified and these are vicuolating cytotoxin, which I refer to as VAC-A as well as the CAG pathogenicity (xxx 20:58) - or CAG-P-A-I. now deletion of these does not result in an inability to colonize, however, it leads to a decrease risk of uh disease individual affected with H. Pylori and specifically VAC-A promotes host cells vicuolation where- and as well as it increases the urea prone ability across the gastric mucosa, that is from the gastric capillaries into the mucous lining of the stomach. it also- but the more important f- point that I want you to take away is that it enhances post-cell apoptosis. Likewise, CAG- the CAG pathogenicity (xxx) uh also in- uh causes apoptosis via the insertion of proteins expressed by the CAG pathogenicity (xxx) via this type force secretory apparatus, it also induces cytoskeletal rearrangements, which I will not discuss further because we do not include it in our model. However, going back the early, in 1994 McCall proposed this hypothesis in which differences in acid levels resulted in different types of disease, notably even individuals showed higher secretion of acid levels, they were more likely to develop gastric carcinomas. Conversely, if they ha- sorry, that's- if they secreted less acid. However, if they secreted more acid, they were more likely to develop gastritis <p: 08> so this k- brought us to all go which was to assess the influence of gastric acid and determine infection outcome. So to achieve this goal we looked at H-Pylori and we could appreciate that H-Pylori is a strict human pathogen, and this has ethical implications in that you're not able to do as many human experimentation uh as much human experimentation as you would like. Furthermore, there's a lack of ideal animal models as Denise alluded to for studying human gastric acid diseases, you'll appreciate the species' differences between animals and humans. But the more important point here is that the interactions of H-Pylori with the host is a complex and dynamic interaction, and for this, we are able to use an integrated approach – that of mathematical modeling. I won't get into too much math, but I just want you to appreciate that we used mathematical modeling as a tool for assessing the uh these interactions. So this brings us to building an integrative model of H-Pylori host interactions. So first what I did was I developed a mathematical model of gastric acid secretion and its regulation, then we introduced h-Pylori in the gastric acid secretion model, followed by the fact- we assessed the effect of gastric acid on H-Pylori colonization, this allowed us to assess our primary goal. But to do this we had to first simplify the stomach into two regions shown here. the first region comprises the corpus rigid and this is proximal to the esophagus whereas the antral region shown here is proximal to the duodena. So having defined the two regions of the stomach shown here, we then built our model diagrammatically. So, for us we defined

sub-regions, I- the current within the mucous, we defined lumina- uh a luminal uh re- uh sub-region as well as an epithelial sub-region so that we could track chemical both chemical uh as well as macroscopic events occurring within these regions. And n- note that within the regions we assigned various cells according to the uh what we observed in literature. In the corpus region, we observed ECL cells, parietal cells, and D cells, whereas in the corpus we also see u- some T cells, but more importantly we have uh G cells which secrete uh a potent stimulant of gastric acid. So this is how we went about building the interactions even further, in that we looked at the factors that these cells secreted, notably upon receipt of food within the stomach both CNS and ENS stimulate G cells to release gastrin, this gastrin diffuses into the blood capillary network and is transported to the corpus where it stimulates ECS cells to produce histamine. Both histamine and gastrin in concert up-regulate parietal cell release of acid into the mucus lining, this acid can then diffuse across to the other region of the stomach. we also include within our model uhm terms for washout due to mucus shedding as well as washout ditto cells sloughing. Now we can turn our attention to the bacteria and for this what we did was we included two types of bacteria based on phenotypes. These were motile bacteria and adherent bacteria. what are able to do is would- we're able to look at the exchange between various sub-regions as well as reg- uh between various regions of the stomach. these bacteria induced nutrient release from the host cell, we hypothesized that, due to uh an increase of host cells apoptosis which is indicative of inflammatory response. So to put the H-Pylori model together with the host gastric acid secretion model we get this complex figure, and this complex figure uh as I'll show you were able to work with it and build uh a model which we were able to uh assess our goal. But f- what I'd like to do now is to look more closely at the interactions of the bact- with the bug with the host. and what I show here is adherent H-Pylori attaching itself to the host epithelia's cell via an adhesion pedestal. And again, as you can see, upon diffusion of urea into the lumen of the stomach bacteria able to uptake this urea across a urea I-channel which is ph dependent and once inside this cytoplasm the urea's enzyme degrades this urea into ammonia and is again used to alkalize the (xxx - 28:13) space. We also included the expression of VAC-A and CAG-A and defined the functions of these proteins in uh in our system. Again an increase in nutrient levels, as seen here, suggests increase inflammation due to apoptosis. So we described our H-Pylori interactions, now we can go on to translate our interactions into mathematical equations and for this we were able to- I was able to use uh well two mathematical models done by doctors Kirchner and Blazer uh as a basis as well as my gastric acid secretion model as a foundation for building this uh H-Pylori model. Having done so we estimated rates of interactions, simulated the model and compared results with experimental data to test the validity of our model. Having tested our model we are able to perform experiments which include (xxx) deletions, variations of infectious doses, remember the MIDs, as well as treatment with pronpton pump inhibitors, however due to the time constraint I won't this latter point. So we tracked uh various host uh various host and bacterial factors within our model, and for the host factors we were able to track effecters of gastric acid secretion, namely the gastrin, and histamine which are potent stimulants of acid, and somatostatin which down-regulates gastric acid secretion. we also tracked the cell populations which secreted these effecters. Include in our model, of course, as you can appreciate, was acid and bicarbonate which was- is also produced by the host to buffer the acid protecting the epithelial lining from the (xxx) effects. We also included nutrients and urea for the bacterial pop- uh factors we included the adherent and motile bacteria and effects of urea as shown here. we also included those two putative virulence factors that I mentioned VAC-A and CAG proteins. So now what I'd like to do is to take you through a descriptive uh characterization of how we build our model differential equations. And h- here I show one particular example in that I show you the rate of change of bacteria in a single region, and it represents a balance between gain and loss terms. So to describe this uh mathematical term,

all this mathematical framework, we are able to dis- give these descriptive uh terms, namely, uh the rate of change of bacteria in a single region was dependent on the ph and nutrient-dependent growth as well as the exchange of bacteria from other regions to the region of interest and loss of bacteria occurred via uh host cell sloughing as well as mucus shedding, and bacteria also enhanced s- uh sloughing due to apoptosis of their media. There was also exchange of bacteria from the region of interest to other regions and this represented a loss term. So now having done the descriptive uh descriptive framework we can now go on to develop our mathematical uh differential equations in depth, and what I show you here is one example of the forty-four differential equations we included in our model, so you can appreciate that this model was very very complex. But for here I show you that uh the rate of change of antral adherent H-Pylori again is dependent on the ph and nutrients as well as loss occurred due to sloughing. There's also m- exchange between the motile bacterial population and an adherent bacterial population since motile bacteria can swim and be- uh adhere. Adherent bacteria can then be lost to the motile population as they divide, and then there's this enhanced loss of uh bacteria due to apoptosis mediated by CAG, VAC-A and ammonia. You'll notice that for the nutrient-dependent loss I model it using uh uh mathematical terms, uh typical of the Michelins-Manton kinetics used in enzyme uh kinetics. What I'd like for y- to do now what I'd like to do now is to show you how we included the ph dependency in our model. And to do this, again, I refer to this uh growth survival curve of H-Pylori over a dif- uh a defined ph range. and we estimated the growth dependency shown here and as you can see we have a good fit and this is included in our model. But to incorporate H-Pylori into the model what we'r- what we did was we described terms for the buffering of gastric acid by bacteria uh bacterial conduction of ammonia we also produced uh the production of bacterial bicarbonate, which contributed to the whole spool of bicarbonate due to the bacteria uh again degrade urea to produce bicarbonate in this process. So now we can go on to simulate our model pru- uh and obtain results. So the first thing that we wanted to do was to look at bacterial levels in each region of the stomach and what we observed is shown in this figure. I'd like to draw your attention to the first graph, and for this graph what- for this simulation what we did was introduce ten to the four bacteria motile bacteria into the corpus lumen, subsequently there's a decline in both adherent and motile bacterial populations and this is due to exchange to the antral region. Upon the antral bacteria uh chaining at steady state levels corpus bacteria uh replenished and achieved their steady state levels. What I want you to take on from these two figures is that the majority of the bacteria are found in the antral and this is indicative of antral predominant colonization, which is uh been observed experimentally. If we look at the ratios of motile to adherent bacteria we also see uh an agreement with our simulation data with experimental data in that we see that ninety-five percent of the bacteria are motile whereas five percent are adherent, again this is- so taken together our simulation here is in agreement with experimental data. So we now had the bacteria in the system, we can now look at the effects that the bacteria exert on the host infectious and shown here are our simulations for one gastrin and antral somatostatin but first for gastrin what we observed that's- was that when we did our simulation gastrin levels increased in the presence of the bacteria and this was significantly increased to a point- to one point seven full increase above our uninfected controls, this was in keeping with experimental results where similar full increase was observed. The converse was true uh in- for antral somatostatin in that we observed a significant decrease of antral somatostatin below that of our uninfected controls. This is qualitatively observed experimentally when looking at the total somatostatin within the stomach, however when you look at antral somatostatin experimentally, this- a similar full decrease is observed as shown by Zavros in our audience. So again, in the presence of H-Pylori, gastrin increases and somatostatin decreases. So recall that gastrin exerts a strong control on gastric acid in that stimulates the release of uh gastric

acid. So we wanted to see what effect this would have on the system so we looked at the effects of H-Pylori on acid levels and this is what is shown here. In our simulations what we observed was that in the presence of H-Pylori, gastri- the antral ph levels shown here we elevated or increased due to the production of ammonia by the bacteria and this was above uh significantly above our uninfected controls. Again this is in agreement with experimental data and as you can see we were able to track for the first day over the time course of study the change of ammonia levels produced by the bacteria and as you can see in the presence of bacteria, bacteria produced ammonia, however in the absence they do not. Experimentally what is observed is that there is a background level of ammonia and this is due to uh the de-amination of amino acids uh to produce ammonia which is subsequently converted to urea, however we do not included it in our model, but we do see similar f- uh we do see an increase in ammonia uh in H-Pylori uh positive individuals. so don- having done that now we can look at host bacterial factors and I want to first address those two putative factors uh VAC-A and CAG protein and as you can see the shape of the curves is similar and this is due to the fact that both VAC-A and CAG protein are proportional to the levels of bacteria present within the stomach. however when we looked at the post-nutrient levels what we observed as that there was a significant increase in the levels of nutrients in the presence of bacteria and at the epithelial surface there was a greater uh a greater concentration of nutrients than at the luminal surface and this we attribute to the the fusion of nutrients from the epithelial surface to the luminal surface. We were also able again to look at urea and what we observed as that in the presence of bacteria bacteria reduced the levels of urea due to the production of ammonia and you'll notice that there is a greater uh decrease in- at the luminal surface and this is due to the fact that mo- there are more motile bacteria at the luminal surface than there are adherent bacteria at the epithelial surface. So, what I've shown you is that we tested the model reversely and our model is in agreement with experimental data. So having done this we can now move on to look at our hypothesis that acid is key in determining infection outcome, but first what we wanted to do was to access whether or not there a- our model is able to red- reproduce infection outcomes on the various conditions acid conditions. So what we defined were the three uh infection outcomes wh- that we were looking for per- namely clearance which we described as bacterial population falling below our level of the infection which is ten to the zero or one bacteria, persistence which is a steady state bacterial population as well as disease in the case of (xxx – 40:31) bacterial (xxx) you know in our model. So, in order to look at whether or not our model is able to reproduce these uhm infectious outcomes, what I did was I tweak the levels of gastric acid secretion by parietal cells, I either increase it or decreased it to mimic the uh the hyperal- or the hyper or the hypo acid secretion uh respectively. So, looking at uh the stomach ph on the nominal levels of gastric acid the ph is approximately two and what we observed is that upon introducing the ten to four bacteria there is a subsequently decline and the bacteria achieved consistent levels, however when I increased the acid input from parietal cells you appreciate the ge- the stomach levels of uhm sorry the stomach ph decre- uh decreases, what we observed is that the bacteria declined below our uh level of detection and this indicates clearance. By decreasing the output of acid from parietal cells stomach ph increased and as a result bacteria overgrowth occurred. So again in high acid levels, we observed clearance, in normal acid levels ph of two we saw persistence, and at low acid levels uh uh ph of approximately seven we saw bacterial overgrowth, so the model is able to reproduce these uh infectious outcomes. so having done this now we can move on to look at our experiments and for this we wanted to determine the key host and bacterial factors affecting acid using uncertainty and sensitivity analysis, due to time constraints I won't get into the methodology here, except to say that of the host bacterial factors and h- host and bacterial factors that we uh looked at in our model, those which directly in- a or indirectly uh affected acid levels were key. So I'm gonna show two examples

of these. And here we have the first panel is the the uh a host uh sorry a bacterial factor and then the second panel is a host factor. What we did was we varied the urea uptake by bacteria and as you can see in- as we decreased the levels of this uptake, bacterial populations declined. Likewise, for the host side, when we decreased the somatostatin dissociation from ECL cells, there was a s- a decline in the bacterial populations shown here. so this suggests that this host and bacterial factors uh affect uh our antral- our bacterial populations, but more importantly what we observed was that the significance of key factors also varied over time, and that they contribu- uh for instance uh the urea uptake by contributing more during the initial stages of colonization and then declined after that. now other key factors included uh host and bacterial factors shown here, and what we observed was that the fusion of acid and bicarbonate was important and this is- uh this speaks to experimental inp- uh results which were obtained in that the (hytrophobicity – 44:08) of the mucus lining decreases in the presence of uh H-Pylori. We also observed that the transport of gastrin from the antrum to the corpus was also key, and this is- was is important in that it might explain why in the presence of H-Pylori there are changes in the capillary circulation of the stomach. as for the bacterial factors, urea is a (xxx) appreciate uh was important and through virtual deletion experiments we showed that these uh bacteria aren't able to colonize and this was in agreement with experimental data. But we wanted to see what effects the r- role of VAC-A and CAG- the CAG protein had on uh affecting our infection outcomes and in particular acid. So this figure shows the uh these results, and what I did was I deleted uh CAG ad VAC-A independently as well as together, however, both CAG and the double knockdown showed similar dynamics similar bacterial dynamics. So what I'll do here is just show you uh two examples where I look at the CAG knockout and as you can see when we look at our CAG knockout the CAG bacteria increase more rapidly towards perstistant levels when compared to our wild type and this w- this indicates that that expression of the CAG protein is a- represents a cost to the bacteria. however, in the case of VAC-A, we do not see uh any uh change in bacterial dynamics when looking at the mutant and the wild type bacteria. so what we wanted to do was to see whether or not exerted any effects elsewhere (xxx) the other host effecters and w- as you can see here I'm showing the effects that the mutants have as well as the wild type bacteria have on host nutrient levels and you'll note that the CAG knockout as well as the wild type bacteria induce nutrient release to similar levels, however the VAC-A bact- mutant bacteria are significantly reduced in comparison to our wild type. The more important point from this slide is that knocking out both CAG and VAC-A shows some synergy in that these bacteria aren't able to induce nutrient release, which is indicative of inflammation and as you can see they'v- the nutrient levels fall below our uninfected controls due to bacterial consumption <p:03> but the- another important point that I want you to take on from this slide is that although these bacteria (xxx – 47:09) the CAG and the wild type bacteria induce uh induce nutrient release the nutrient release does not affect the levels of bacterial population, the two do not go hand in hand. So this shows that the fact that bacteria expressed in both VAC-A and CAG-TAI induce apoptosis which then leads to inflammation and this inflammation can uh increase the risk of disease development. Apoptosis as you'll appreciate releases nutrient content within the stomach for bacterial uh consumption and again nutrient levels do not correlate with bacterial levels, that's an important point that I want to drive home. So the next question that we addressed was that whether or not varying uh the infectious dose of bacteria had an effect on the outcome. S- so what I show you here are our variations in infectious doses for wild type, the CAG and mutant, and VAC and mutant and a double mutant. And the important point is that for our wild type bacteria we observed a minimal infectious dose of ten to the three microorganisms, although the establishment of persistence occurs well after ninety days. However for our CAG- or for our both all our three mutants the- in minimal infectious dose for these bacteria was ten to the four uh bacteria. we

hypothesize that higher bacterial populations meant greater ammonia production which increases the chances of colonization so what we are able to do here was we used our urea's knockout uh uh bacteria and performed similar experiments and even higher levels of bacteria, ten to the six, we did not observe colonization, I- high uh greater ammonia production is important in increasing the chances of colonization by H-Pylori. So this brings me to my conclusions. I've shown you here that acid is a key determinant in infection outcome. Furthermore I've shown you that the expression of CAG proteins represents a cost to the bacteria in that it increases uh apoptosis as well as there is- this suggests an increased level of inflammation. Our dominat- our double mutants sorry were less virulent in that they showed decreased apoptosis and uh indicative of decreased inflammation. So this brings me to my future directions which I'll probably hopefully have a chance to do before I leave doctor Kirschner's lab (sorry) and this includes the incl- uh the incorporation of an adaptive immune response into the model. You'll appreciate that uh H-Pylori skews the inflammatory response to its favor, I- in the bact- in the body you have observed a TH-one versus a TH-two response, the TH-one being more dominant. You also discerned a eff- what I'll also like to do is discern the effects of extra gastric infections on h-Pylori colonization notably infections which HIV- in HIV which we do in our lab. Finally I would like to get to uh s- uh an assessment of the role of gender and age differences in H-Pylori infection and for this point uh what I'd like to say that in studies, epidemiological studies, what they observe is that in males who are elderly there was an increased chance of gastric carcinomas, so using my model I would like to see what relationship this has on the system. So, this brings me to the end and for this I'd like to thank my doctoral committee without whom I would not be standing here today <S2 LAUGH> I really appreciate the advi- the advise of doctor Kirschner who was a great mentor, uh you recently saw the defense by (xxx – 51:44) and (xxx) went to in depth into the fact that Denise's door's always opened and I really appreciated that policy, any time I wanted uh any (xxx) advise I could always go to her, call her up at home, deliver my thesis <S2 LAUGH> to her at home <SS LAUGH> and uh we had a great working partnership. The other members of the committee included doctor Victor Dirita, doctor Cary Engveberg, doctor Juanita Merchant, doctor Lin- Linda Samuelson and doctor Michael Savageau. I would like to single out again the Merchant lab who- with whom we did our gstric acid secretion model, and for being there even though I harassed her <S2 LAUGH> a lot uh especially uh during th- that development of our- the gastric acid secretion model <p:03> what can I say. I would like to thank the members both past and present of the Kirschner lab. The present members are shown here. You have become like my brothers and sisters away from home and <p:04> [candidate gets very emotional and starts crying] and for me you <p:04> it will be really hard to miss uh when I leave uh not having to see you uh further, note- uh what I want to do is highlight the fact that Brian Murphy, (xxx – 53:15) as well as Jane (xxx) who are not here they were also instrumental, not only for their friendship, but also f- in helping me with my model, as well as (xxx) who is now in uh in Baltimore <p:04> and how can I neglect my friends uh you are familiar with Tania who graduated from here in I believe it was two thousand and one or two thousand and two sorry as well as her husband Andrew they wanted to be here but they could not make it due to uh other commitments, also doctor (xxx) doctors Neil Faulkner (xxx) and Jana who uh during my stunt here were great friends to me, I can't begin to tell you how much they meant to me. I also like to single out the immunology and microbiology staff who I also harassed <S2 LAUGH> a lot whenever I needed something <S2 LAUGH> the badminton crew (xxx), doctor Quack uh (xxx) for keeping me in shape <SS LAUGH> during my stunt here, I say a big thank you and to the members of the All Nations Campus Ministry (xxx) you provided much uh support to me and for that I am very grateful, I'll miss you dearly. This is not to clear, but to my family, they're sitting in the back, uh to my dad, he recently suffered a stroke, he nearly died

[candidate starts to cry] but through the grace of God he's here with me <p:03> to my mom I say a big thank you, there were nights when I called fussing <SS LAUGH> saying I can't do this anymore <S2 LAUGH> this H-Pylori is giving me ulcers <SS LAUGH> and she was there for me and I really appreciate that, and my brother for chastising whenever I called him <S2 LAUGH> I say a big thank you and to his little son who has been an inspiration to me thank you Julian, and finally to my girlfriend, it has been a long-distance relationship but you've always been there through the time supporting me and I say a very big thank you. Thank you for last night supporting me when I was practicing as well <SS LAUGH> the end. Thanks. [applause]

S1: questions? Mike [S3: yeah]

S3: you you were modeling the effects of ph level uh on disease progression, (xxx - 56:06) to see diseases and (xxx) I mean I don't know anything about stomach physiology is that you know a single ph?

S2: yes, that's an attainable ph in the presence of uh PPIs uh which suppress uh can completely suppress uh the le- uh the secretion of acid by parietal cells as well as the production of ammonia by the bacteria uh the ph- the ph can attain levels of seven within the stomach.

S4: I have kind of a related question and that is I thought that much of the uh damage caused during these uh infections is because you slough off the mucus and the acid in the stomach of the stomach is what is doing is pull out the de-amination of the stomach itself, and so at ph seven you might get back to your overgrowth, but would you still get gastritis because now the stomach acid isn't there to do what made the damage

S2: right, you all said that gastritis and particularly uh Widen mentioned uh the fact that the PPIs treated [S4: uh] in the study is that when you use PPIs [S4: yeah] gastric acid output from the corpus region is suppressed, and bacteria then migrate from the antral region into the corpus region and you get this global colonization and you see a global uh a more- dive uh a more disperse gastritis uh and that speaks to your question

S4: uh probably due to VAC-A and other

S2: right, due to VAC-A inducing other …

S2: for inflammatory cicles

S2: yeah

S5: y- your- the issue of low acidity being important in clearance of bacteria and high acidity being important for persistence is interesting, I was wondering if you could comment, in treatment of H-Pylori infection many of the treatments of- often involve using PPIs and how does that fit into your model?

S2: right, so you- a lot of the studies is uh use PPIs in c- uhm in conjunction with antibiotics [S5: right] however, from our model what we observed was that the low PA uh by decreasing ph levels, we are ob- able to observe this clearance, however it was not entirely clear form the stomach there was still some bold levels of bacteria present in other areas of the stomach. but

this uh the reason why (xxx – 58:32) mentioned this is because this might for another method of treating uh H-Pylori infection if you could someway or another boost the level of cell acid output from the stomach you might decline the levels within the antral region and then using antibiotics or some other form of treatment super- uh completely eradicate the bacteria from the stomach <p:03> yes Kate

S6: uhm yeah I- I think you really (xxx) I think I'm starting a new (xxx) <SS LAUGH> (xxx) I have a very basic question about the modeling uh and this is sort of where I get (xxx) every time, I don't know if you can answer this uh with mathematics (xxx) when you add a factor like for example you have your- your uh your basic model of acid and uhm (xxx) stomach, and then you say okay and then you add bacteria and that came as an acid. What is it about the bacteria that you're adding to your model, in other words, there- there's lots of different features under that tree and and what, I don't know if I can ask this

S1: not it's a very good [S2: exc- excellent question Kate] very clear question Kate [S6: okay] very clear

S2: right, so there was one slide where I mentioned that the bacteria buffered acid via ammonia as well as the production of bicarbonate. So what we were able to do was look at the changes in ammonia levels as well as bicarbonate produced by bacteria as well and uh have these buffered levels of acid and that in the cells modulates gastric acid levels, s-

S1: so additional terms [S2: terms, yeah] in an existing model that captured these extra things that were coming from the bacterial equations [S2: yes] uh, exactly.

S7: (xxx) to follow up on that but there must be another term cuz the bacteria also cause more gastrin secretion and hence they must

S2: right,

S7: they simultaneously erase the [S2: so that's] ph right

S2: well [S7: xxx] yes. So what the body tries to do it it tries to maintain the ph at a constant level and as a result gastrin levels elevate however this is ineffective in uh boosting the levels due to the presence of the bacteria uh uh producing this ammonia

S7: so, the- the- another thing sort of counterintuitive to me is if the bacteria can't divide until their ph three how can at ph two they persist? So did you have a term that

S1: no they divided ph six to eight Wess not in P, they only [S7: likewise] okay

S7: and then it's even more counterintuitive [S1: okay] how can they persist if they can't divide?

S2: well they can divide because at the epithelial surface the ph is approximately seven

S7: and then tha- there is a term for that in your [S2: yes] in the a

S2: so we capture both what's occurring at the luminal surface and at the epithelial surface and we have adherent bacteria which experiences a ph of around two, and at the adherent

bacteria which experiences uh a more suitable ph, seven and the adherent population is what is able to grow and divide and that in turn can contribute to the motile population maintaining the motile bacteria within the stomach. uh Doctor Kirschner did a model the s- showed uh that the adherent population serves as a pool for replenishing motile bacteria which are lost.

S7: and and when you say when you hav- when in the uhm in the ordinate is the uh total number of bacteria in the uh antron [S2: that's] that's that's most of the bacteria gonna be adherent to the epithelial layer that's where the vast majority will come from right

S2: no it was the opposite, where most of that were motile, most of them adherent, but adherent population again still serves as a pool for the motile [S7: most of the removal] correct

S1: it's like a core population in STD only need a few to- per (xxx – 1:02:28) basically, so it's the same idea.

S7: but (xxx) to see what's, I'm hung up on this, the motile ones are experiencing a lower ph

S2: a lower ph, yes, then are divided [S7: uhum] so they are continuously being lost but adherent population is [S7: like in xxx] is the one they are fighting and it's (xxx) to that motile population.

S7: so return way back to my (xxx) question the answer in- in a sense is don't really have to obtain ph seven in the lumen of the stomach because you can have plenty of bacteria being produced in the epithelial surface that is experiencing much

S2: yeap

S7: higher ph simply uh will

S2: right, so within our model we are able to look at that as well <p:05> yes go on Harry

S8: yeah the CAG and VAC (xxx – 1:03:22) what you're suggesting is that they can beat the disease but not (xxx) the population which I wonder why the bacteria will hold on to something to create a disease (xxx) survival, and then later you're showing that lower in the infectious doses what happens (xxx) it's important for the colonization but then you know when we connect the dots of this it suggests that maybe that's what selects them that's- there isn't a hypothesis (xxx) so I think that you are suggesting that those uhm components I mean (xxx) that is the correct interpretation of this and there is a reason why you don't say that explicitly? <S2 LAUGH>

S1: well he did, he said there was a cost for VAC, remember cuz he did the VAC- the CAG knock out and it took longer to colonize [S8: right] so that's sort of subtle but you're right he doesn't

S8: is this [S2: yes] your hypothesis th- that's why those factors I mean came that's why we have diseases because they aren't able to hold the bacteria th- they just

S2: well they might not help the bacterial populations per se but

S8: just to establish

S2: right to establish but later on they might bacterial- uh the bacterial population in that through causing disease uh you get this increase release of bacteria into the intestines and that might decrease transition to other individuals, that's one hypothesis which I've seen in literature uh but you- your probably- that's a good suggestion your hypothesis is sometime a good suggestion which

S8: (xxx – 1:04:54) was your hypothesis but in <SS LAUGH>

S2: sorry, you're right sorry <S2 LAUGH>

S8: (xxx) explicitly I didn't read it explicitly

S2: right

S7: you can see my (xxx) would be a selectable (xxx) inducing infectious doses you know what happens with that [S1: right, it's a good- great point]

S2: yeah, th- that's a very good point

S1: Mary will take one more question

S9: yeah uhm so you've said that VAC-A produces (vasectosis) and that might contribute to the release of (xxx) for the bacteria, I guess that's something (valuable) (xxx) more nutrients resolve your bacterial (xxx) but that's not what your model showed [S2: right] you can speak a little bit so why you think the same (xxx)

S2: well you'll appreciate that within an environment this- the bacteria try to limit their their pre- presence, uh they try to limit the damage they caused in the host, so what's probably occurring what's occurring in my model is that the bacteria maintained this persistence levels, they did not overgrow because in overgrowing they induce this uh in- uh damage increase damage to the host whereas at the persistence levels they are able to maintain levels where the damage is limited to the host and the bacteria also (xxx). does that answer your question?

S9: (xxx)

S1: yeah, in fact there's one thing that Ian can talk about that speaks to almost everyone of your questions and that is that uhm not in all cases does disease collate with bacterial overgrowth, in fact a lot of times what you see when you get disease like an ulcer you clear the nit you clear the bacteria and that's because the niche that's created is basically destroyed right, this beautiful environment being set up, and so we can only capture that with our model cause we don't model the tissue itself so we don't really have that element in there so actually (xxx – 1:06:44) disease has (xxx) overgrowth is a hundred per cent correct uh but certainly if you had ten to the ten- the bacteria in your you know stomach that would be a bad thing you know and and you know there would be a lot of inflammation a lot of CAG and VAC and then things would happen bad but certainly you can get the disease other way, maybe you're even more likely to get the disease other way so we haven't really teased that out yet uh and also it's not really clear what nutrient is that the bug eats, nobody knows, so we hypothesized that it's getting stuff from maybe that apoptosis in the background cells but nobody knows

and so we really can't comment on why the proportion of bacterial nutrients is not uh you know it's not correlated or maybe even negatively correlated I don't know. So the paper that we published with Morny a couple of years ago said that it's really fine tuning host bacterial feedback system and I mean and you would imagine that's true with any (xxx) that you had, there's gotta be some happiness going on between bug and host to get to that commensalisms situation to occur and so probably something gets disrupted in that normal balance uh that leads to disease, so anyway, let me just tell you that at three o'clock here today there's gonna be a reception for Ian so please come and have a piece of cake wish him well okay? Now thank you for coming <APPLAUSE>

{End of transcript}

S1: okay uh welcome everybody good afternoon it's a real pleasure for me to see so many of you today for a very special honorable person Chris Depcik uh we have uh his family here David and Lona and his wife uh Jennifer, and of course all your friends and your committee, for more than six years of hard work we have accumulated at the University of Michigan uh he came to us a while ago, and to me it really seems like yesterday, I remember a guy who was in my class reading the newspaper waiting every morning for me to start the lecture, and uh boy I could not even think what will follow up uh I worked with Chris for five of those six years uh he worked with me on the his masters thesis first where he worked on developing an open-ended thermodynamic cyclic simulation tool uh and really it's pone-ended and <SS LAUGH> it really led to many interesting discoveries later uh we have worked together in class uh in teaching, he's a great teacher himself uh he has won the outstanding GSI award and uh uh actually he he holds a unique record and I don't know that anybody else uh Keith Jacobs is close he has been my GSI for three times and so (xxx – 05:06) two times I think and so you know [S2: I keep working on it] there's hope <SS LAUGH> this is a difficult record uh and so I really enjoyed this semester working with Chris on many things, after his masters he worked on his doctoral degree and basically has been investigating uh the combination of uh engine modeling and after treatment modeling uh and particularly coming up with some uh great uh uh gas dynamics techniques and reacting flow techniques to advance the state of the art and I should mention that uh in those endeavors he has been greatly assisted by Bram van Leer he's other advisor who also advised Chris uh masters thesis in arrow space engineering and so he walk away in three- in six years with three degrees right from Michigan uh and of course with lots of good experiences, he has worked with projects for uh General Motors uh projects for Ford projects for uh Department of Energy uh so he's full of rich experiences and he's a great guy who enjoys doing lots of things including playing sports and coaching kids and uh uh doing all kinds of things uh so I would like you to add anything I missed

S3: Uh really I think you captured everything quite well uh I didn't- did- do my undergrad at the University of Florida so I have to give a plug-in for that so uh but I guess we can go ahead

and start, today I'm gonna be talking about modeling reacting gases and aftertreatment devices for internal combustion engines. Now, how do you condense six years of your life into like a little over one hour? One is you can talk fast in a different language, and I do have a tendency when I get nervous to start talking fast so actually this will work very well, still I promise I can't talk in a different language where for some of you English is not your native language this will be a lot easier, so you can just start talking fast in another language and everyone is, okay, sure. Uh you can put- I can put everyone to sleep uh and as you can see I brought a lot of subways so that's part of the motivation and uh I could- or I could make a high budget movie with lots of special effects you know like Lord of the Rings like four or something, and that way you know everything is dis- displayed a visual type of image uh, however I'm a grad student so I don't have the money uh maybe I have a boring life in that I haven't done anything, well my dissertation currently stands at three-hundred and sixty pages so I really, I really do have a boring life I spent most of the time working on that so I have a lot of slides so if you bear with me I'll go through- I'll go faster in some of them but I'll get all the information out hopefully. Now what is the motivation for my work? Well my motivation is essentially emissions. Uh now the earth's average surface temp- temperature has increased by about point six degrees over the last century, now people may believe in global warming or they may not believe in global warming, I don't think Bush does, uh so but I kinda talk about him, it's not a political talk, uh but you know I consider myself an environmental engineer and my first actual major account was environmental engineering at the University of Florida, but then I realized that I'd be happier feeling what (xxx – 08:13) so I thought hmm I think the chemicals will be better uh but you know whether to believe it or not I still think that you should be limiting CO2 which started being a main culprit, and it's just fossil fuel combustion and deforestation. Now a number of comp- uh countries have decided to vote down to the Kyoto Protocol and uh what it basically says is that you trying to reduce greenhouse gas emissions by about five- uh five greenhouse emissions, actually six greenhouse gas emissions by about five per cent by about twenty ten. Europe thinks it's a great idea and but US yeah we don't really need it, that's what- it seems like uh we're (xxx – 08:58) our leaders are saying. But if you look at the overall trend in America you can see that SUV's demand is increasing significantly from about ten per cent in nineteen-eighty to about almost fifty per cent of the share uh of bought cars in two thousand, as a result the uh the SUV is actually- characterizes a light truck and a light truck CAFE standards or the corporate average fuel kind of standards are much lower than your passengers car standards so if you actually look at the results, you'll see that your overall CAFE average has decreased in the last twenty years which basically is saying that we're putting more CO2 into the atmosphere and this kind of disturbs me. Uh now whether or not you're blaming global warming and and greenhouse gases or not these other emissions of nitrogen oxides, particular matter, hydrocarbons and carbon monoxide are (xxx – 09:54)-free, they will the- some of them are carcinogenic, they'll form smog as in (xxx), they really have (xxx)-free as we can se here that in all countries including the United States they've started to legislate these uh these emissions for even stricter and stricter levels. you can see by two thousand and four we're down here, two thousand and seven we're down here if you ask me, and two thousand and ten we're way down on this corner where it's almost- we're almost at the zero emissions level. Well, you notice here, keep this in mind, this thermodynamic point and I'll talk about that in a second and that's for NOx and so as you can see there we're really trying to dry to NOx and particulate hydrocarbons down to essentially zero in the next ten years. Well, as a result, of uh global- the global warming emissions and other emissions that there's been some new policies that've tried to implement it. One is congress's tried to push for increased CAFE standards, now I believe that got voted down but they're bringing it back up cause what they wanna do is re- reduce the dependence on foreign oil cause as you know 9-11 in Iraq and Middle East

which is kind of (xxx – 11:04) uh situation uh we wanna by basically having more efficient automobiles burn less fossil fuels and we'll uh basically reduce our dependence. Now Bush's big thing is a hydrogen economy. This is a good idea in the term that the water vapor would be your only emission; uh however if you think about it where you gonna get the hydrogen, your infrastructure, it'll take billions if not trillions of dollars in order to make hydrogen available where every uh gas station is. Now as a result people thought okay let's process the fuel which means that you retake your gasoline or diesel in your car and you can convert hydrogen on board, well that works well but it still brings your efficiency down to around to this line and but the main problem here is hydrogen storage, uh hydrogen is a very diffusive material uh and gas, so let's say you get a car in a garage, you shut the curtain of the garage door you close- you close the door and you go to bed at night, let's say you get a small leak, well hydrogen will diffuse and basically fill up your garage, let's say in the morning you go and open up your garage door and you flip on the light to see what's going on in your garage [powerpoint slide shows an explosion with its sound] well maybe not to the extent of a hydrogen bomb but I don't think you really wanna be blowing up your garage, so while it's a good idea, it's really not practical during this time and I I still think that research should be done but I think that really right now it's not viable. So, what shall we do? Well the way I think we should go is and where everybody- a lot of people think we should go is to lean burning I.C. engines and we got the spark ignition direct injection, your old efficiency standard of the diesel or the compression ignition engine and or you could use the homogeneous charge compression ignition and I'll detail this one a little bit more uh a little bit latter. Now these engines were in higher efficiencies and you actually can use these engines in conjunction with hybridization to make to make'em even more efficient and actually have less CO2. now with the homogenous charge compression ignition you can get significantly reduced problem after emissions, I'll talk about that in a second, but first I'm a big uh, you'll see a big proponent of diesels, in fact so that uh my wife and I bought one last year <SS LAUGH> and my wife is over there trying to hide behind the pen right there, as you can see my wife will kill me for putting this slide <SS LAUGH> [powerpoint slide showing picture of the car and his wife] but I wanna say that if you've never driven a diesel passenger car you should, they work really nice. So needles to say uh about homogeneous charge compression ignition the way it woks so well is that essentially in a diesel engine you're injecting the fuel in the cylinder and you keep- you have these fuel rich zones where you have stoichimetric uh fuel and air and it burns at stoichimetric temperature and because of that since the temperatures are high you'll form NOx and since they're fuel-rich you'll actually form particulate matter. Now with HCCI you'll see that you have no fuel rich zones they will all be essentially at bulk gas temperature which will burn instantaneously or supposedly instantaneously, and it- as a result since the temperature will be much lower you'll have very low NOx and very low particulate matter and the NOx will be up to ninety-eight per cent better than diesels; however, as with everything there's a dash, HCCIs have a number of problems, one is combustion phasing and control, it's very hard to accurately control HCCI engines, and actually Professor Assanis was talking in lecture today about how one degree in in your in your temperature can throw your combustion way off. The rate of heat release is also very very rapid which re- leads to high mechanical stresses high- high pressures and mechanical stresses. Also if you wanna use HCCI for your on road (xxx – 15:04) big trucks, you gonna have to increase slow, you'd rather have a huge engine ver- running very lean, so when you start increasing the load or (xxx) the fuel that you're putting in these engines you are coming back to the same problems that you're having with the diesel engines, and another one is how homogeneous is the mixture in in you gas and actually (xxx) can tell you a lot about that but I can hint this in my today so if you wanna talk to him later about that you'll find that it's really not that homogeneous and it's hard to control accurately the mixture

preparation. So as a result while HCCI looks very nice there still problems right now and actually having it work for uh big trucks. However, it can be used in hard load situations in that if you're uh say you're car is idling at stop signs, so there might be a perk against this use of HCCI, so there is some benefits but it's not it's not viable for everything right now. So, as a result, we have to look back at as in the other conditional lean burning diesel engines and lean burning S.I. engines, and the way to reduce the NOx and particulate matters is to through a number of in-cylinder strategies. One is injection timing, which is you retard or advance this lean (xxx – 16:22) but your actual fuel injection. Now the problem is that there's a NOx CO2 trade-off that once you start decreasing your NOx you start increasing your soot and your particulate matter and same- this is the same way as soon as you start decreasing your soot you start increasing your NOx so this won't only get you so far. Now in terms of injection rate shaping you can do a number of multiple injections of fuel actually Tim over there can talk about how many how many kill-pulses you can get in his engine and that will help with your overall uh emission standards em- em- emit- lowering the emissions but it only works so far. Charger cooling the water fuel emulsions will help lower the combustion temperature in order to actually prevent the unsettled NOx production but there's a huge uh penalty in terms of adding these controls on your engine and cost. Most people tend to use exhaust gas recirculation as the main add-in for meeting emission standards and this works quite well as uh diluting your mixturacy lower your combustion temperatures. However as you keep reducing- keep increasing the amount of EGR you get more and more soot production cuz you get the NOx and soot trade-off. Now I found uh a number of papers that detail where's the physical combustion limit which means that you increase the EGR to the point where your combustion efficiency starts degrading, so passing a certain point you can't loose anymore EGR otherwise you won't get a good combustion, and they found that thermodynamically the minimum NOx you can get is about one point three four grants for kilowatt hour which is about the two-thousand and seven standards. So while EGR will get you down to this level of- with NOx, you still have to worry about the soot, I mean this isn't even taking technically into account how much soot you're gonna produce. So as a result you're gonna- you realize that uh this only gets you so far, eventually you'll have to do something else, and what is something else, something else are aftertreatment devices. Most people are pretty familiar with three-way catalysts and the sparking (xxx – 18:26) car basically has'em. They work very well at reducing your NOx, your hydrocarbons and your carbon monoxide all at one time as the three-way. However not many people are familiar that there are a number of aftertreatment devices for lean burning engines, typically one such uh aftertreatment is a urea SCR device, the way it works is you add ammonia to the stream and it reduces it reduces NOx in a continuous manner, so you a continuous flow of ammonia in the exhaust. In Europe there's actually some trucks and buses that actually use this in Europe right now as we speak. Another uh avenue for uh reducing NOx is the lean NOx trap, and the way this works is you store NOx on a metal (xxx – 19:13)or an (xxx) earth metal during the in-operation, which is access oxygen. And it stores NOx up to a point that essentially metal get saturated and you can't and you can't store anymore then what you do is you send your rich charge which is you send it in an additional full- fuel pulse uh late in the cylinder uh while the exhaust valve is open to get the fuel down into the exau- into the aftertreatment device or you put an additional injection in the exhaust to get this uh this hydrocarbon of fuel in the exhaust and what it does is the hydrocarbon will cause the NOx to come out of this metal and then it'll actually reduce the NOx in your traditional three-way manner. We ought to have a good supply of NOx because it's all been stored and then this hydrocarbon will uh will react and it actually uses some of the same metallical materials as the three way catalyst in order- for reduction. Now there're other aftertreatment devices, one is the diesel oxidation catalyst and this is actually th- if you take (xxx – 20:16)) you'll have an oxidation catalyst, which is actually the first

aftertreatment device with spark ignition engines, however it di- it didn't work that well and so they saw that three-way catalysts were better and and what it does is it boosts it boosts the efficiency of urea SCRs and LNTs and the way it works is that your diesel oxidation catalyst helps promote the formation of NO2, an- and these devices right here prefer NO2 rather than NO coming out of your engine. And for diesel engine typically you only have about ten to thirty per cent of your exhaust being NO- NO2 so the more (xxx – 20:52) you can get the better these work. It can also be used to uh reform your fuel slightly in order to get carbon monoxide, and Tim who actually left the room is working on this and can tell you more about that, is that it- by getting more carbon monoxide, LNT actually prefer carbon monoxide rather than hydrocarbons in order to regenerate, so and actually we found that carbon monoxide might actually inhibit performance during NOx trap. So using an in-diesel oxidation catalyst might actually help out. Uh another one eventually takes care of all the soot is a diesel particulate filter, and the way it works is it stores all the soot in a course membrane and during normal operation and then when your (xxx – 21:34) pressure gets (xxx), in other words when the trap becomes loaded that you start getting some uh pressure drop across the trap you have degenerated, and I'll talk about the regeneration problems in a second, but this DPFs work upwards at about a hundred per cent efficiency in storing your soot and particulate matter. Now I talk, actually in great lengths in chapter three on my dissertation about all of these aftertreatment devices. But for brevity I'm gonna talk briefly about all the types of problems that they have in a couple of slides cuz the problems that they had were actually quite uh quite similar. And it- for instance in temperature issues, you have an efficiency window opened is written aftertreatment devices. As you can see for urea SCR about a hund- below a hundred and fifty degrees Celsius the efficiency drops off to zero and it's about the same thing with LNT. Now the problem with this is that when you cold-start ignition tests like the US does, the EPA does you're starting at about twenty degrees Celsius so essentially these devices have almost no efficiency at this low range, so you have to heat them up very quickly otherwise you're not gonna be able to meet ignition standards. Aging, uh when you uh- for the three-way catalyst, because it sees very high temperatures uh due to the combustion there, the actual (xxx – 23:00) metal will start to center and you'll start loosing your catalyst activity and other devices I'll mention, the LNT in particular, has significant problem with aging and I'll discuss that in a second and as you can see the emission- the efficiency drops off significantly about forty per cent here for H-LNT. Other emissions, well urea SCR since you're introducing ammonia to the flow you're introducing another uh another n- sp- uhm another avenue for N species what you can form ends well. NO is actually worse greenhouse gas than CO2, but don't think this is limited urea SCR, actually your three-way catalyst is a significant producers of NO2 and I found a number of papers actually detailing that, so don't think that this is just limited diesel aftertreatment. You see here that when I talk about the temperature issues, there's a certain lay off, lay off is about fifty per cent where- fifty per cent efficiency and I show here for diesel oxidation catalysts that as you increase the (xxx – 24:04) temperature you can see the disappearance of a number of hydrocarbons jumps of slightly about a hundred and fifty which seems to be a fairly new form of (xxx) uh catalyst. So, essentially what you wanna do with these is get'em as hard as fast as you can and that's why actually you'll see in an automobile engine and in an SI engine, sparking ignition engine, you see a closed-patterned catalyst basically right next to your exhaust (xxx) they wanna get as hot as they can the quicker they can. Now another problem that they all have are chem- are dealing with uh with your inlet composition of chemical species and the way this works is you put your three-way catalysts you have a certain air-to-fuel ratio where you get- you knock your CO, your hydrocarbon, your NOx reduction all works effectively, as soon as you're out of this range you can see that the (xxx - 24:52) of the efficiency drops off significantly. One problem that the uh diesel at the lean burning aftertreatment device has, especially diesel fuel is sulfur

deactivation and you can see here for lean NOx trap that as you increase the amount of sulfur, your ability to store ninet- your NOx goes down significantly and that's because LNT like to store uh uh sulfur compounds more readily than nitrogen oxide compounds. Also when you talk about- actually I'll talk about regeneration on the next slide and we regenerate LNT, there's a problem with sulfur and I'll mention that, NO2 is preferred like I mentioned, CO is also preferred for LNT regeneration, hydrocarbon is inhibited, and one issue is that not really relate to chemical species but space velocity. They work better, these devices work better the slower you put the flow through them. If you think about it it's the more residence time that these uh catalyst have in order to work so uh a number hav- uh a number of of companies, especially in the UK have mention that (xxx – 25:58) is a parallel operation and you'll see in a later slide what I did mean by that which had (xxx) for aftertreatment devices for which one you can significantly reduce the amount of flow per device. In regeneration uh now one one problem you have is for LNT in urea SCR is that you have to add some kind of reductant to the exhaust stream, one is- for the LNT you have a post uh in-cylinder injection late in the exhaust stroke, and- but the only problem is as you're introducing this fuel it'll start oxidizing which might actually promote more carbon monoxide but you actually have been loosing some of this hydrocarbon that can't be used in the regeneration process, and uh for the urea SCR and for the LNT you have post cylinder which you have (xxx – 26:50) an actual injection in the actual exhaust piping and that in itself will have its own additional control that you need and cost, uh now when I talked about LNTs and regeneration you can the free energy here uh of your sulfur here bearing uh the sulfur is significantly higher than your varying nitrate which is what you use to store NOx. As a result it takes a lot more energy to your soothing out of an LNT so you have to actually heat it up so over about six hundred degrees Celsius in order to get this sulfur compound out and as you do that at high temperature you start aging the material, and start loosing its catalytic activity. Now (xxx – 27:33) the UK has really started to legislate fuel sulfur in diesel fuel so they've actually reduced it significantly so what they- they're seen is that because of this they gonna have to- they gonna have to get rid of fuel sulfur. Now do you guess one problem is that you're storing all this soot or let's say you keep storing soot- keep storing soot eventually you get to a point that as soon as it starts laying off and it starts burning you got a ton of soot and because you're burning lean which means excess oxygen you can basically get thermal runaway and melt down this device and actually Ford has done that in former studies. I just went there and saw this (xxx – 28:11) so as you can see that you know when we're eventually gonna have to use aftertreatment devices for this lean burning engines by- by emission standards. As a result we can see all the modeling needs that we have and this is the real motivation, once I did this background search I saw everything that needs to get done, you have gas dynamics for the flow in the- in the piping, you need to model the wall temperature because losses to the ambient rob your- your exhaust of thermal energy, and this thermal energy can be used to heat up these different devices, you need to have catalysts models, you need to basically be able to predict uh how these models work, you need to have uh kinetics because if you pipe carbon oxidation you need to know how much hydrocarbons that you're actually getting to your LNT, uh you need to have a reductant injection model because you might have a post uh cylinder injection and the control systems is- basically make all work nicely. So what did is I- I worked at it task by task. For gas dynamics, the original intent was to do a literature search to find the best method as the one I did for my preliminary examination about (xxx – 29:25) and then professor van Leer said well you forgot to look at this type of gas dynamics and as a result, because I trusted professor van Leer because he knows a lot more than I do, I did a cross-discipline search and he mentioned that there's a certain type of method that actually works quite well, and current I.C engine simulations are not using this method, I'll talk about that when- in a second, but first let me give you a little background as to what type of gas

dynamics we're dealing with. We're dealing with equations of motions for one- we're using the one-dimensional Euler equation of motion which are the envisaged uh set of uh equations of motion uh and we're dealing only with the one-dimensional uh only the one-dimensional equations because you wanna have uh you wanna be able to model things fast and as well as accurate, and now well some flow patterns are going on that are inheritably three-dimensional if you're gonna do an entire exhaust simulation in three dimensions it'll take forever, especially if you wanted to change it- change it quickly, and a number of numerical codes such as DT power use the this one-dimensional equations and it works to good accuracy, and sometimes very good accuracy, depends what's going on, and in order to get some boundary layer effects and overall three-dimensional effects you add source terms, you source kinds of friction, you transfer area variation and chemical kinetics, which people really have done a good study up to this point as to incorporate chemical kinetics with your gas dynamics and good validation, and you can see momentum includes friction, energy you transfer, you can see the area variation terms as the DMEX, and your chemical species variation, and also I found that when people have been dealing with variable properties, which means that your ideal gas is dependent on the temperature and the chemical composition, that there have been neglecting in that. and so what I did I said okay what everyone has to do is do a comparison through a shock tube, and a shock tube is nice because all your pertinent phenomena are modeled in terms of shocks, contact discontinuities, expansion waves, and it uses extensively in chemical kinetic mechanism formulation, and this is nice because it actually provides an avenue for validating my gas dynamics against actual real the- as detailed kinetics as you can get. What's even better is that for the shock tube the exact solution is known for the ideal gas with constant properties, what people do is they- they check a numerical method against this constant properties of the exact solution, and they way I went about this is I end up creating a Graphical User Interface, I say GUI's your friend here because it ends up working out very nicely once you know how to program a GUI effectively you can hav- immediately see your post-processing and know what you're doing. This works out great because otherwise you have to take your results and put them in certain programs in order to see the results, whereas this way I can tell right away if I'm right or if I'm wrong, uh and it took me a year worth of night courses to learn how to program a GUI but I can trust enough it's- it's very- it helps out tremendously because you know it takes longer to start it out but I can do a lot of stuff a lot faster now. Now the previous methods used were uh typically back in the eighties they like to use the method of characteristics, and actually Bansen pioneered that work and the only problem is that it's only first-order accurate which means it's only accurate to your your delta times that- and your actual discretization. However it still actually used, people still like to use it and so I found a recent paper in nineteen-ninety-nine that still uses it. As a result because of the first-order accuracy people liked to used this- the two-step Lax-Wendroff and MacCormack methods, however they're only second-order accurate, however they are second-order accurate but they are oscillatory and if you recall the oil equations in motion, there is no viscosity on that equation and since there is no viscosity there is nothing to damp the solution, as a result, as you can see here, the (xxx – 33:40) two-step method against the exact solutions you'll see that you have these oscillations and here's actually- here's your shock which you can't detect discontinuity and here's your expansion so while you can see that the overall structure is there it's not actually modeling it too well. Now what people have done is they said okay since it's oscillatory let's damp it and this is done by actually taking your solution to these methods (xxx – 34:06) and post-processing the results either to the total variation diminishing, or flux-corrected transport, and you can here that for the total variation diminishing your oscillations are gone and you get a nice nice curve that follows the exact solution, same thing with the flux-corrected transport using three different methods. Now the problem is that these methods actually damp after the oscillations have occurred already and

as a result because urea is post-processing it- it's not a physical process and you actually can get the CFL type or time-step reduction, the CFL number basically tells you the maximum types that you can take based on your axial (xxx – 34:47) and your flow speed plus the speed of sound. So if you see here that this one is about point seven five as about point eight one, that by reducing your time-step it actually makes these problems uh these numerical methods solution-dependent, so for a different prone since you want to go as fast as you can you might actually be able to use different CFL numbers, so it's not a good way of doing it. Now your TVD scheme also, if you ever wanna take this this work and extend it to multi-dimensions you're actually including this TVD scheme you'll loose your accuracy and you'll go down to about first-order or less. Now what people have done is they become (xxx – 35:29) with those methods and think okay let's see how we can actually make it better and the way they make it better is by adding an artificial compressibility member developed by Harton and this reduces the spread in the finite-distance approximation of these discontinuities, the shock wave and these types of discontinuities. You can see that you get a great s- solution here, however it incorporates more post-processing and increases computational time. Other methods that I found in the literature was a- one was a newer method a conservation-element solution-element method developed in the nineties that you get actually very nice results and what it does is it limits uh uses a wave-average of your uh your- your weighted- it uses a weighted average in order to prevent the oscillations from actually occurring, however it uses a staggered grid, which can cause some issues in boundary conditions, and my wife will tell you that I hate boundary conditions because I struggled with them for a very long time until I understood them and anything (xxx – 36:29) mess up boundary conditions which is probably one of the hardest things to do in CFD is not a fun thing to deal with. Uh now you're- the commercial code such as Ricardo Wave and GT Power use a quasi one-dimensional method which actually writes the equations of motion a little bit differently you can- you can see as the same equations still other equations but they are a little bit different, and they incorporate the area and a number of turns and essentially they are different in terms that they use a staggered mesh system and that your time-step and your flux turns are actually writ- written for uh this staggered mesh, however uh I was unable to reproduce the results everything you see here is reproduced except for this one which is scanned uh they used artificial viscosity, yes

S4: did they also show a density plot or not?

S3: no, no there wasn't any density plot

S4: I'd like to see that

S3: I'd like to see that too, so that's why I had the right pressure I was trying to reproduce it but you know I was recreating this paper back in the eighties and it had a lot of errors and actually so I think they did that on purpose but uh it uses artificial viscosity and you can see here that it's got a nice little bump right there which is a little bit uh which is a function of using this artificial viscosity and just the name in itself artificial tells you that it's something that it's not natural that's going on and also they talk about in that paper I found that they used a safety-factor which is essentially a reduced CFL number of about point five for this method. So keeping that in mind I thought okay well doing that research and talking to professor van Leer he mentioned that they had basically neglected that these MUSCLs things which are Monotone Upwind Schemes for Scalar Conservation Laws which are very physical and elegant and they're not oscillatory methods and the first-order method people might be familiar with is the Roe's Approximate Riemann Solver, and actually professor Roe is sits

right over there, so he didn't come today so uh but he uh he's a very brilliant man and he came up with something very nice, uh however not many people are familiar with Hancock Predictor-Corrector method which is a second-order mesh of the Roe's Approximate Riemann Solver, it ac- it actually uses Roe's Approximate Riemann Solver to solve the equations and you can see here that your first-order is gonna be a little bit smoothed out because it's first-order but your second-order solution's very nice and it captured everything quite well.

S4: second-order (xxx – 38:55) and spatial?

S3: yes. So why is it better, well it prevents the oscillations actually from occurring in the first place, it doesn't do anything to post-process, it says we're not goanna allow it to occur and it does this by limiting the slopes (xxx – 39:11) this uh you're right on the CFL number one, which is very nice, which makes the problem independent, which as long as you can calculate the CFL number you can use one uh you're- I think it's got better accuracy and if you actually look at the plots you and you look at the dissertation you see it's actually- has better accuracy for every method except for the artificial compressed bill but I'll talk about that in a second and it doesn't use any goofy grids, so you can actually fundamentally understand it easier. When you go to multi-dimensions you actually re- conserve your accuracy, so if you wanna some arrow-space applications in the in the atmosphere you need to do two dimensions you can still use this method, no artificial viscosity and it's actually quite fast. If look here I normalized what I found in the literature and I actually have a table that spends two days two-two pages in my dissertation that details a number of numerical methods and normalizes against your traditional LANX when it dropped two step. You see that the ROE method is about one point six one and the Hancock is about two point four times as slo- slower than the LANX when it dropped one step, however if you go down here and you see that if you want comparable accuracy incorporating your efficiency compressibility is about eight and half times slower, so you can see that it's actually running faster than the rest of the methods with higher accuracy <p:03> so keeping that in mind I said okay well professor Raymond is right, this is the best method and so I said okay well what I have been dealing with in the exhaust is varying temperatures significantly and varying chemical compositions significantly as a result I needed to write the ideal gas law dependent on thermodynamic properties and chemical composition and you can write (xxx – 40:56) according to uh this is in case (xxx) as a function of your temperature and I used CHEMKIN coefficients because they actually match at a thousand Kelvin whereas uh if you use uh a match_ uh a massive equilibrium program uh their coefficients don't match to a thousand Kelvin which can cause problems. Uh you have to write an altered equation of state too, what I mean by that is that actually you know that your pressure is a function of your density, your gas constant, and your temperature, and what people in the (xxx – 41:28) community have done have looked at this from a point here, but actually you have to take into account this chemical composition term and so they have been neglecting this this secondary term and for rigorous- rigorous formulation of this is_ that's what comes up and actually professor van Leer had his hand in this too and in a number of other papers in nineteen ninety uh as you can see now though your speed of sound is now a function of pressure uh directives and your pressure re- respects some density, energy and chemical compositions so things are getting thick and very messy and since things get very messy because you have to write your uh equation (xxx – 42:13) you have to redo boundary conditions and I used a method of characteristics of boundary conditions and the method of characteristics for boundary conditions is fine because they say that you actually can use a lower order accuracy for the boundary conditions but still maintain your accuracy inside, So since the method of characteristics is first order, you still can maintain second order accuracy for uh the grid, and there actually more uh there actually uh uh once I found out exactly what

the hack I was doing they're actually easier to understand, and I bugged professor van Lier a lot on that. Now the Roe Solvers extensions with variable properties was already done and uh his uh you can see that uh professor van Lier among with Liou and Shuen had ended that in nineteen-ninety-nine, however they hadn't worked on the Hancock method for variable properties, in order to do so I had to change the Euler equations for primitive pressure plus species form and so they conserved set which I showed earlier and actually my master's thesis in aerospace prepared me well for this because I did a lot of uh conversions of oil and (xxx – 43:21) equations with different variables, so I was an old (xxx) at this, but you can see that your source terms now include these pressure (xxx) and everything is laid out nicely in my dissertation and so hopefully you'll be able to understand what I've done. Now the first thing is does it work? And yes it does. I compared it with my (xxx) property results and basically get the exact same solution, which is what you expect considering that I was running only with air, and air is a very inert gas, it doesn't change much over the relatively low uh temperature change that I done it. So it's nice to see I basically reproduced the results and I did a shock tube with different species based on like a typical exhaust gas and air that I found and you can see that as the shock is moving along you get a nice change uh between uh these different compositions of gas, nice and smooth. So I said okay now I think I know what I'm gonna do_ I think I know what I'm doing, I'm gonna validate all the source terms and do actually a rigorous validating (xxx – 44:30) so I looked and uh I found a paper that detailed a compressed air shock tube study that then has significantly different conditions between the driver and driven pressures, it's only three point five bars versus one bar, and since you're dealing with air there wasn't uhm any chemical reactions that were going on since the temperature wouldn't be changing much you wouldn't have to deal with uh with the transfer uh because your wall uh time scale to your wall d-transfer is much larger than your gas dynamics, and so I basically used their initial conditions and found that, if you look here, it suffered this initial uh initial miss right here, and follows the results extremely well and captures like these little bumps here little bumps there, and I mean it's almost exact, and this this right here can be inferred from the fact that in a shock tube simulation you have a dyer frame that ruptures and this dyer frame when it ruptures it doesn't rupture exactly in one second and as a result it- it doesn't rupture instantaneously, as a result you end up getting a 2D and 3D flow, initially, until everything smoothes themselves out, and since this this station that was measured at was closer to the dyer frame ruptured I believe that this was just a 2D or a 3D effect waiting for to damping out, and as you can see the overall results follow quite well. Now you might say like well well that's great but how important is friction, and so I ran the code of of using friction and and not using friction and the results were significantly different. Uh you can see that you need to incorporate friction, so apparen_ it appears that I've actually been able to model quite well. I said okay, well I need to model key transfer and my initial idea of modeling key transfer was through resistance networks and instead I ended up going to one-dimensional wall heat equation because professor Chan said that it was a better way of doing it and a- actually when he explained it I realized that he was right, I said well he's right, I'm going to do that so I used a four times (xxx – 46:44) space method that actually solved this one-dimensional wall heat equation, and because we're using a different solver it actually has a different time step, however your time step for your wall equation solvers is actually significantly larger than your CFL condition, and that has to do because that you're dealing with the metal, and this metal has a lot more energy storage, so you can see that, I mean it's like uh three thousand_ it's about uhm thirty thousand times bigger so uhm using it in conjunction with the a uh gas dynamics as a solver using this time step for the the the uh wall heat equation is not a problem, so that's how I was able to include heat transfer and I used this heat transfer in the wall equation in conjunction with my variable area uh terms the DA DXin order to model uh a number of results and a number of experiments by Kripatrick

and Blair in ninety four and ninety five. In these experiments they have flow from a cylinder pass a valve into the port and a single (xxx – 47:48) arrangement with all these different types of variable variation from the smooth area variation to the a very discontinuous area variation. So now I'm incorporating friction, heat transfer, and area variation all at one time, and since I know friction works I'm not worried about that, and what I did is because I wasn't able to get the the uh experimental release coefficient dis- discharge coefficient I had to use it I had to uh change the model, essentially this- this turn to fit the experimental cylinder pressure and you can see basically I matched it exactly. And if you look at the results for a diversion taper and sonar expansion I basically can model uh both these uh events quite well, and you can see here with the sonar expansion I I captured little bumps here little bumps there and little bumps there. So while the pressure mainly deviates slightly in a number of these I get the time scales very exact, and I think some of this variation has to do with the fact that I was using data from scan and papers and I was basically trying to grab the data from these scans, so things are probably a little bit off uh but you can see that it it it does the job quite well. Now what hadn't been done is a quite- is a rigorous use of these gas dynamics with chemical mechanism uh with uh actually with chemical kinetics and the way this is done is I wanted to do validation with these full chemical mechanisms, the reason being is these chemical mechanisms are supposed to be your most complete description uh detailed kinetics. So instead of using some kinetics that I could've essentially tuned, I wanted to use kinetics that were considered to be you know these are the kinetics you shouldn't have to adjust them. And so uh how- when I first did it I realized I would get an error and the reason being is that my gas dynamics are optimized for Hancock method but your kinetics are very stiff and just calculate the reaction rate with (xxx – 49:48) will cause an error, cause your code to b- to blow up, so what I did is I said okay I need to find essentially this megadot term so I just gonna solve your your derogative of your mass fraction with respect to time for this chemical uh for this equation right here using uh a very uh good ordinary equation solver and then once I get the results for the next time step I know my previous time step and I know my time st- the actual time you see up here and I'll back calculate with this reaction where it should be and uhm that- because this is using this equation is very uhm it works very well I don't have any errors in terms of using in terms the Hancock method you might be wondering well how well does this work you know and I'll show you in a second, and what I did too is I created a another GUI, I love GUIs, and the way it works is I can change the system very easily and I can change all the pertinent chemical species and I can change the kinetics just through a couple of input text files so if you can go from one system to a completely different system in a matter of a couple of minutes. And now in terms of results I found a paper by Manson and Harrison which deals with your OH radical production, however the initial conditions of the simulation did not exist so what I did I had to basically adjust my driver and driven pressures in order to match experimental uh experimental uh release in final pressure and temperature and so basically making sure that this was consistent with what was given experimentally I was basically able to measure an incident shock and a reflective shock quite nearly exactly and as you can see that it's almost possible how the experiment was computed. Now I had a question before and as to well the CF here really did play a role because you can use (xxx – 51:48) in itself to actually wit these kinetic mechanisms in order to calculate these OH patt- these radical productions and so as you can see here that your temperature basically jumps off and stays constant and so that's when it comes into play it is that if your temperature stays constant then you're really not having your gas dynamics in terms of these kinetics now actually this was not this is not in the dissertation because this was through a personal communication and I've mentioned that actually in my dissertation that they actually uh Daniel Davidson in Stanford actually used this constant values models essentially (xxx) to try and model did some experimental results for pressure in OH radical production and as you can see it cannot model

uh the pressure using an energetic hydrogen and oxygen shock, and as can look using my gas dynamics uh it models it quite well it measures the bumps uh exactly and even captures some of these wiggles that are going on, and in terms of experimental and simulated OH production I basically nailed right on that top of the production, so you can see that in this case gas dynamics is important you can't use kamkin to model it and my simulation models it quite nearly exactly. Now so the conclusion is for the gas dynamics is that I believe the ICN community is using the incorrect method. Yes it works with good accuracy but there's a better one out that they should be using is faster and more accurate and I converted it to a variable property formulation that has excellent agreement with all the important source terms including kinetics which is a rigorous formulation like it rigorous rigorous validation like I mentioned before hadn't been done. So looking at your modeling these now <p:03> you can see that my model of gas dynamics, wall temperature, and gas states kinetics quite well, all (xxx) for accuracy. So I said here now okay I'm gonna take a look at reductant injection, and the way I did this is I looked at and I said okay I'm gonna create a post-cylinder reductant injection model and I mentioned briefly why it is important you gonna be injection urea through your RSCR you've been injection uh hydrocarbons or fuel or maybe even some other species for LNTs and if you have too little or if you have too much you can have either ammonia slip or hydrocarbon slip and you can have too little, we gonna have NOx leftover that's coming out and you might have partial regeneration and not actually recover all your NOx uh conversion uh your NOx storage to acid. So the model formulation uh detailed actually more extensively in the dissertation obviously but it's based on a Keba-Cole formulation uh nineteen eighty seven and this Keba-Cole was meant for uh combustion of uh combustion of cold water slurry inside internal combustion engines and I was looking at the equations and the equations are very applicable for heat transfer to these particles as they're flowing actually in-cylinder or it doesn't actually have to be in-cylinder. So in in my case the water in this urea particle is- urea is injected as an aqueous solution is in the core regency interstitial sta- spaces of the solid particles and when your water vaporizes from this particle your radius stays constant when it when the urea actually decomposes then the particle's sizes'll change. So if we look at urea injection you'll see that the particle is first raised to the boiling point of water, waters vaporize on, then the particles raise to urea decomposition temperature and urea basically is a solid particle on this in this at this phase, and that's what they're saying in the literature that it actually is a solid it's not it's not a uh a gas or a liquid and so what happens is you have thermal decomposition of urea into ammonia (xxx – 55:47) now for our LNT if you look uh you can use the same equations but you only have two phases, one your particles raise the boiling point of your hydrocarbon and you have vaporization of this hydrocarbon, now uhm I made assumptions here that it's injected as packets of equal uh particle distribution and it all flows with the gas there's no puddling but this is meant to be a simple model that can be used by control engineers that that you don't have to do uh it'll run fast and it won't require too much computational time, now what I had to do is I had to determine create new sources terms for the equations of motion in order to put it in my gas dynamics and this works by uh the fact that if you're loosing uh if you're loosing uh uh water or urea from the particle it has to- it goes into gaseous forms so the mass had it the the gas your gas exaust mass had to gain this mass, and this comes into uh in the form of a density change, so you have to include this additional D component that deals with the different phases and what's going on. Uh now in terms of urea decomposition running my model I basically showing here the four phases or urea decomposition. As the particle heats up initially, it goes to the boiling point of water, the water boils off at a constant temperature, then it heats up to the urea decomposition temperature and then the urea decomposes, and as the urea decomposes your radius of your particles start to decrease and during this entire time while you're loosing your uh water or you're loosing your urea and you can see the mass is

decreasing during those phases, and your volume pressure of water initially in phase one was being heated up now what's happening during phase two you loose all your water so essentially your volume pressure of water goes to zero and the zero (xxx – 57:45) now the intention of this model was to make it run fast and that's what it does and what'll give you is a whole bunch of plots and can be used basically to time your residence time of urea and how far it travels in the exhaust, and so you can see here the a log log uh actually one log plotted against temperature based on your velocity you can see that well if you're running it at low temperatures with a higher velocity it might take you take you ten meters for urea to complete- completely decompose which means that you have to inject urea ten meters up in the urea RCR device otherwise it'll get puddling of urea right after the urea RCR device. So I have a number of plots like this detailed in the dissertation that are meant to help out uhm for uh control engineers, but but the real the real value of this model in addition to that is that it is tunable what I mean by tunable is since is a simple model and you need to validate it experimentally you're gonna have to you know since is a simple model it's not gonna be, it's not gonna actually tell you the picture unless you get a little tweaky, and the way you do your tweaking is through multiplying your turbulence by essentially adjusting your heat transfer coefficient, and by adjusting your heat transfer coefficient you can see that it changes you resistance time and distance of you urea and so the way that I envision it to work is that once you have your injection you know inject- you know what type of injector you gonna use and you know you're trying to figure out you mass fl- flow rate to urea you can actually use it to to you can actually use the model to tune it against this experimental results and then once it's tuned you can say okay well according to these situations if I want to inject this much of urea how much it's gonna decompose in this amount of time, so it wasn't it wasn't meant to be the most accurate three-dimensional description as praised out there, it was meant to be something that's that can run very fast and is very tunable. Now what I did is I said okay well let's look at_ that was just for a single particle, let's look at the complete urea injection model. What I did is I used a sample exhaust flow and I injected urea as mass core packets every X number seconds, this translates to a mass flow of urea in the exhaust and you can see that things are happening the way you would've believed them to happen. One is that I'm holding the (xxx – 1:00:14) temperature at two point seven Kelvin and the wall temperature at seven hundred Kelvin, you can see that your gas actually decreases in temperature, which is what you would expect because you're injecting these particles at a lower temperature, your energy has to come from the gas and go to your particles so you're actually reducing your temperature of your gas cuz heat transfer is occurring. Same thing with your density, well actually the reverse with your density, since you're injecting these urea particles and they're decomposing and adding more gas to the mixture your density is going up which essentially saying that your mass and your gas is increasing, and it has some interesting effects on pressure and velocity but they're very small effects your pressure I mean it's hardly even noticeable it's uh point two k.p.a uh actually point two p.a so, you know your pressure is essentially constant. your velocity will change a little bit and the reason your velocity changes is because you're changing all these other properties, and as I mentioned we're dealing with an ideal gas with its properties depending on chemical species and temperature, so when you're changing these chemical species it'll have an effect on your overall process, however it doesn't change much.

S5: when it's packets is it like each packet is just one big lump of

S3: each packet is uh I'm injecting a certain amount of mass and then I know the size of the particle so then I can figure out are in this whole packet and then those particles are all same subject to the same heat transfer and uh loss for that specific packet

S6: they're all dispersed they don't have any interaction

S3: no, they don't have any interaction, it's meant to be a simple model.

S1: are they all the same size as they come in?

S3: they're all the same size as they come in. uh now when I said what I wanted to do I said okay let's look at the complete injection model deplaning what species and I used a full detailed kinetic mechanism while Bolmann that details reduction of actually it's called the SNCR selective non-catalytic reduction of ur- actually of ammonia and isocyanide gas as a function of uh uh ammon- as a function of NOx, actually I figured (xxx) but I think you know what I mean uh as you can see here that things are behaving the way you would expect them to behave, essentially you're coming in with no ammonia, and then as urea de- particle decomposes it goes up to the point where right here you are essentially out of urea uh this is basically between this this would be a residence distance of urea and now you essentially have a constant stream of ammonia, and while this NOx trade NOx curve looks like it's grea- you know is doing a great job, uh reducing NO it's not actually the case because you have to take into account this mol fraction, and since your mol fraction decreases you have to look at your concentration, and since your density is increasing your mol fraction is decreasing it ends up being that your concentration is pretty much uniform, and the reason I presented mol fractions is because typically that's what you see in the literature, you gave someone a concentration they would might be a little bit confused, so what I found is that even if even you look at the relative concentrations of mol fractions it's about point zero zero three times ten to the negative fifth that is changing so if you look at the overall concentration it it ends up being uniform, and you can tell that also by your radicals that are produced like N2O and uh NNH cuz for N2O it's bei- it's producing species in the order of ten to the negative thirteenth which is basically uhm imperceptible uh measured experimentally. Your water, you know it's loosing water initially and then there's no more water to loose, and then so this changes according to it it ends up being constant if you look at the concentration, so N2O is being produced which is important

S6: sort of wiggles, isn't it (xxx – 1:04:14)

S3: no the the wiggles are just a function of uh the kinetics, they're just uh

S5: those numbers are too small anyway so [S3: yeah] I wouldn't even [S1: sure] put it in your figure [S3: xxx] that's extravagance so [S3: okay]

S6: are these wiggles real or your

S3: uh this is just a mech- uh the kinetic mechanism, and since they're so small that's essentially uhm the uh they're probably getting down within the accuracy of the numerical solver I'm assuming <p:03> now I wanted to say is okay I did find a whole bunch of papers dealing with this uh SNCR process and the selective non-catalytic reduction process and I wanna see how pertinent it is for typical engine exhaust. And we can see that for a mixture of pressure at relatively high gas temperatures at seven hundred Kelvin for lean burning ends it's really not that important, I was hoping that you know I would find you know something that people had been neglecting and then you have a significant amount of reduction uh however it ends up being that you're only dealing with a fraction or percent so the selective non-catalytic

reduction incorporating this kinetics along with the urea decomposition model doesn't really make much sense. Uh however it does make sense if you're gonna use my code in addition to actual industrial or stationary power plants which are actually run at very uh in much hotter temperatures and uh with starting at a thousand Kelvin us you can see that actually uh one process is called the thermal deNOx, which is the reduction of NOx by ammonia and the other is called paraNOx which is reduction of NOx by isocyanide gas, and these graphs, well there's a lot of information here, basically you have your experimental results and then my simulation results along with some other guys' simulation results, this guy Bolmann who did a detailed kinetic mechanism, this is basically his results or as- this is as good as they can get and so this is where the state of detailed kinetic modeling is uh my gas dynamics essentially reproduce this result, so you could actually use my code of the gas dynamics and select the non-catalytic reduction for industrial and stationary application.

S6: well I bit confused [S3: yes] because it seems that what Bolmann did was the more uh physics of the kinetics [S3: yes] right and what you did is you provided a code and the framework to put some physics in there [S3: yes] but you did not have your own piece of evidence so how can you say that with your code you reproduced the same that Bolmann

S3: I only used his his [S4: can you excuse me] kinetic mechanism, I did not use his uh I don't uh he just used basically uh Chemkin along with this kinetic mechanism in order to reproduce and to get these results. So what I did is I actually put the Chemkin mechanism along with the gas dynamics and the residence time reenter

S6: you used his physics into your model [S3: yes]

S7: so it's actually a validation of his results, cuz he'll use some kinetic rules whereas [S3: yes] you're using full gas dynamics [S3: yes] so he should be glad

S5: this is a (xxx – 1:07:26)

S1: yeah, I think so

S3: I think so

S5: the uh NOx mol fraction is at the end of the reactor?

S3: yes, NOx's out

S5: so it's pretty much like a homogeneous reactor [S3: yeah] right in the end [S3: yeah] so [S3: yeah, yeah] as far as you're giving enough resonance time using the same kinetic mechanism you expect to get the same

S3: yeah, the same [S4: cuz that's what it is] results, yeah so

S1: I think it's fair to say though that since he used Chemkin as a framework without gas dynamics and he used his gas his kinetics but with gas dynamics you can also interpret this as the difference that gas dynamics make for the problem right [S3: yeah]

S5: but is as long as you have enough reason (xxx – overlap) convert it into the final kilogram [S3: that's true] right so gas dynamics it's not surprising to see that there is a little effect of the different gas dynamics, that's an elaboration to Mike's question I guess <p:03>

S3: now in terms of hydrocarbonite station well I mentioned that urea SNCR processes isn't that important uh hydrocarbon and NOx kinetics would be significantly important especially for spark ignition engines uh actually Stanley who was on vacation, he's taken a lot of experimental data and found out this to be uh quite important, and actually I used this set of along with my gas dynamics and a simple kinetic model uh in the literature in determining that uh what the result would be for just one representative steady state mode wiggle and using kinetics along with gas dynamics and matching exactly his exit temperature at nine hundred and eleven Kelvin if I turned of the kinetics I found it to be six degrees different and well that's not a huge difference, there might be some regions and actually he found some regions where it actually is significantly important, and for LNT this might uh quite important if your dealing uh in-cylinder inj- late injection as the exhaust temperature still high so you could be reducing a significant amount of your fuel uh before it ever reaches your LNT which actually will cause essentially a fuel penalty. So the conclusion is that I created a_ for the post-cylinder reductant injection model a simple, fast and tunable model that still needs to be validated against experimental literature uh actually experimental data, I provided an example of urea decomposition with what's going on, now I did use and create all these plots and with a simple model for helping out with the resonance's time and distance for how long urea stays in the exhaust, and once again urea SCR uh SNCR is not really important for engine applications the model can be used for industrial applications is the hydrocarbon oxidation is important and still has to be quantified uh as to how important it is depending on what control structure you're using for an LNT, so looking back at your modeling needs you can see that I put it a sort of check mark here next to reductant injection so I got four out of the six check off and so I took a big look at catalyst models and I saw that essentially the same model has been used for the last twenty years in terms of catalyst modeling, it's one dimension in that your heat conduction in the radial direction is neglected so essentially you're figuring out a uh each channel is representative of the three dimensions around that channel and it's and down each channel it's a constant pressure and velocity and this velocity is a uh huge assumption that we'll see uh late can play heavy with the with your results. You're parameters of your gas at your front face are also uniform which may not be true. Now modeling catalysts is essentially a three dimensional problem however if you're gonna do a three dimensional problem hooked in with all these these devices it would it would take you forever to change uh to change your system and as a result uh the kinetics for these processes is really kind of unknown yet so essentially I'll mention later that you probably gonna have to tune the kinetics so if you have a three dimensional model and you have to tune the kinetics it'd take you forever to run. Now most people've been modeling three-way catalysts using this model uh see even since nineteen eighty two and recently I found a couple of papers that used the same model for urea RCR and for lean NOx trap. Now the model as is details with essentially flow through uh the single channel and details two equations two equations for this bulk flow through the channel uh one for species one for temperature in that you actually have uh diffusion all over your gas and in your center line your bulk flow to a film model on surface, so you have equations for your surface species and you also have equations for the model and temperature, and your model at temp_ the surface equation energy equation is important to note that you have your reaction rates here and your hits your hits to reaction going on and actually this term can actually be exothermic or endothermic depending uh dep- depending on what type of process you're dealing with. For a catalyst us since the temperatures are high it you can be quite exothermal uhm and other examples (xxx – 1:12:53) methanol (xxx) can be

endothermic. Uhm it's also important to know here that they like to group in your external loses to the ambient uh directly into this equation for this wall and this is to me was non-physical and from the aspect that you have the single channel and you have insulation between this channel and your outer wall and this outer wall is then loosing to the environment, so grouping this in with your catalyst temperature seems uh uh to me did not make sense. So as a result I said okay well let's look at the surface energy equation and see what's going on. Essentially you had your catalyst inside an insulation which is then connec-connected to your outer wall and so what you have, if you look at it you have uh your gas here that's in uh conduction with your model at the wall your last model at the wall which is in conduction with your insulation which is then conducted to you outer wall and that's what the environment sees. So what I did is I said okay well I'm gonna update the model in temperature and take out this lost the ambient term and group and a Suto 2D resistance network that basically looks at conduction between your model at the wall and your insulation just at this this interface here and I also added a volumetric energy source term which may be important for quick heating of these devices, then the insulation temperature I wrote a uh equation for that an energy equation for that and it conducts the wall or the tube in front of the wall and the tube in front of the outer wall and then your outer wall you can see that this is where your external losses are and I'm also including radiation and radiation is because during the (xxx – 1:14:43) review for Ford one of the guys asked there well are you including the radiation and since he basically is paying for the prototype sure I'll include radiation, that sounds good

S6: how important is it?

S3: it can be actually be quite important for a three-way catalyst because you can get'em really hot specially for these close couple catalysts, so it's actually it was actually a very good idea. Uh so now I have three equations detailing what's uh the heating up of the actual materials of the catalyst uh and what I also saw was okay well they're all using the same model so how can I make it general and so I looked at what the difference is between the different types of models and one is your thermodynamic properties and essentially when you go to different types of catalysts and different types of system you're dealing with these different types of species and so as you use these different types o species they all have their own thermodynamic properties so what I did is I included a tab-based text input file of these thermodynamic properties in the program so all you have to do is if you wanna change from one chemical species to another you basically change this input file and so and now you get to deal with all these different types of species, however transfer properties were a little bit harder the fact that there's no easy per fits for thermody_ for transfer properties like_ thermodynamic properties, as a result I linked in a Chemkin program and as long as you define your species in the same order as your Chemkin program that you do here you know that you're actually uh that you're actually using the right transfer properties for the right species. Now the main problem was the kinetics and the reaction mechanism, and if you look at the really kinetics only constant to one subroutine in the overall grand scheme of things, as a result I said okay well if I create a standard polar interface to this subroutine and I send in all the pertinent variables that you know everything that I can think of that is wrong with its use I can create a supra dynamically linked workspace and someone else can actually uh separate a Fortram or a C program that someone else can use and write the wrong kinetics subroutine that links directly into your program, and in order to make it even nicer I said okay I'll rea_ I'll let'em read in a text-based file where they can adjust the number of variables in a GUI and so you can see here this is the user variable GUI and essentially all these even these these uh pre-exponential dap that's actually all in the text file so they can read in all these

variables in all these texts and write in the GUI and then all these variables are sent to these separate workspace that they can play with. So this allows them to actually use the GUI change your kinetics within the GUI but yet write their own kinetic mechanisms. Now in terms of numerical solvers for the bulk uh energy uh and the bulk species they're both hyperbolic equations that actually if you look at them are very closely resembling other Oiller equations of motion, as a result after talking to professor van Leer he said well yeah you can go ahead and use these for Stiller equations and while it has been done I actually found in the literature (xxx - 1:17:59) never thought about it using it for the Hancock corrector method for scaling uh for scalar equation so this is a new use for the Hancock method uh and then when I was writing it was ended up when I first started running it it was running very well and I was happy with myself and I started analyzing Ford data and Ford data they gave me as a transient cycle so that every second the species change and when that happened and started crashing I started to get really upset and then professor Assanas mentioned and said well why don't you look at it one more time and when I when I actually did it a (xxx) analysis to figure out essentially the stability I realized that as the species change your source term ends up being important because these can be significantly large compared to these other these other components, as a result I had to do a new stability analysis where in the case where your uh source term is not is not there your time step is really a function of your (xxx) your full velocity and void fraction. Well with the source term you end up getting this mess, but this mess when you put it in the code it works so uh and you can see that as these as these J turns go to zero uh you end up recovering essentially your your your same step time as before, so when I when I did this analysis I put it in it worked nicely

S5: how did you derive that, did you derive that expression?

S3: This expression?

S5: yeah

S3: yes, yes I did, it's actually detailed in chapter five. Uhm now for the other numerical solvers uh the surface species is essentially an ODE uhm you only have one derivative here with respect to time, you can use an Oiller explicit differentiation or most likely you'll probably use an implict Oiller which is needed for if you have very high reaction rates, so that's pretty simple programming. Now ok_ implicit takes a little bit of care but it's not is it wasn't much of pain compared to the other equations I had to deal with. The wall equations all have to be at the same energy for and I had already done that for my wall heat equations for my gas dynamics so I already knew what type of uh what type of solver to use and I knew the time step wouldn't be a problem and actually I do detail in the dissertation a sampler example of what the time step is. Now so the question is does it work uh and it ends up yes it does I reproduced an example from a three-way catalyst back in nineteen eighty two because it used a simple force-step kinetic mechanism so I didn't what to get too complicated with kinetics yet, as you can see that right here I'm showing the model of temperature of Ion Cavendish paper versus my general catalyst model and you can see that there are some differences but the overall trend in shape of everything is pretty much the same along with your conversion rates as a function of CO and C rigid six and I only used the first order solver in this case with the for the bulk gas equations and these differences can be inferred from in their paper their actually using constant thermodynamic properties, they don't allow'em to change where I do uh I have an insulation equation which they don't have and so these little differences can be inferred I think from the differences between (xxx – 1:21:28), but overall I think it captures the results quite well. Now I said okay I know the first order solver works

how does the second order solver for the bulk gas so the Hancock method for the bulk gas equations worked and it's really <LAUGH> showing pretty much the same results, you see a little bit of difference here and really the difference between the first and second order results is more observable during discontinuities and transiences and so this this test was essentially a step heating in temperature so the model heated up very slowly so you really won't be able to detail too much difference between the first order and the second order solvers in this case, however if your dealing with an FTP transient cycle you might have a significant difference. Now in terms of_ I wanted to see how well my insulation equation worked and you can see here is counter it's almost counterintuitive when you see it in the first the first time but if you theorize through it it makes sense as your insulation layer increases your steady state temperature uh will be higher and you can see that at three hundred seconds it actually keeps more heat in the modeling, it's very hard to notice, but what's interesting to note is that your actual model heats up faster when you have lower insulation and the reason being is that your monolith, your insulation and your outer wall all start at four three hundred Kelvin for this step change and their heated up slowly as a result you have as you increase your insulation layer you have more insulation to heat it up and since it's at a lower temperature in what speed then then uh your monolith it's gotta heat it up so that's why actually you see the reverse what should be the first thing cuz it's going on, uh if you're actually going in the opposite direction if you're actually cooling down the catalyst you would see that it would be the opposite because you'd actually your monitor would be warmer having the more insulation because it's it's the insulation will be at a higher temperature than the (xxx) and also if you look at the outer wall temperature you see that at three hundred seconds your outer wall is significantly hotter than in the case of lower insulation that's because more heat is being transferred from the monolith to the outer wall. Now what I wanted to say is okay when I looked at the equations and I looked at them in depth I realized that they were just a variant of the Oiller equation as a result I said well I have this great gas dynamics method let's see how it works as a catalyst model and I only used it to replace the bulky equations and I came_ I kept a surface species in temperature equations the same and I actually detailed in in the dissertation how you can change_ this looks kind of goofy with this GA(xxx) - geometric surface temperature area (xxx) term how_ actually that boils down to essentially what you would expect for a source term and inflowing the pipe it's pretty much the same and uh so [S6: can you uh] yes

S6: just remind me of what you had preached the acquiescence single scalar equation right

S3: yes I had I had one scalar equation detailing the species uh actually I had I had two scalar equations one detailing the energy flow [S6: energy] and one detailing species but they were not coupled together [S6: coupled together yes] so now I'm including a momentum equation and friction, and as we can see that if we look at the full gas dynamics (xxx – 1:24:55) flow method there a significant difference and this there's uh there's a few differences but it can be basically boiled down to your flow velocity. If you look here at your velocity you can see that it's no longer constant along the channel it actually goes from about nine meters per second to about six meters per second and as your flow slows down within the catalyst you actually have more resonance time in the catalysts which causes things to heat it up faster, as a result you'll see that you have a temperature peak which actually they call it the wrong way phenomenon that actually occurred at the back of the catalyst and moved forward in this case it actually occurs about uh let's say about point four meters or close to half way through the catalyst and as a result you can see a huge difference between your model and the temperature in the case of the (xxx) flow I call the (xxx) flow for the simple catalyst models and the full gas dynamics so this thing this details that there's a huge difference between using the full gas

dynamics and the simple catalyst model. Now you might think that this might put all the catalyst people, catalyst modelers uh out of work because they're using the wrong model, but actually if you think about it uh kinetics really aren't that well known for these types of devices so what they end up doing is they tune their results they tune their kinetics according accord- according to their results, because they're tuning their kinetics they're reproducing what they see so actually it's actually more accurate than if I was going to use the full gas dynamics with their tuned kinetics so that's how they get away with it now if you gonna if you knew what the kinetics were then you would probably wanna use the full gas dynamics and (xxx) if you knew the exact kinetics

S6: so when you say they called it wrong way for, they meaning the catalyst modelers who who tuned their [S3: yeah] kinetics

S3: yeah they see these people

S6: they understand that there is this phenomenon

S3: yeah yeah for this [S6: yeah] for this case there is this it only it happens in a few catalysts but in it it for a three-way catalyst in their example they tuned it so it would start back here and go forward cuz that's what they saw experimentally

S6: you show here [S3: where] that's a kinet_ it's a gas dynamics effect [S3: yeah] <p:04>

S3: uhm and now for kicks I said okay uh how long does the catalyst model work for other types of catalyst I said okay well I found a paper by Teplidge and (xxx) in nineteen ninety nine along others that details a methanol steamer formula example for isothermal reaction devices so I held the temperature constant and basically detailed these three kinetics equations and actually I in the appendix it's a huge uh mess their their kinetic expression and I used equilibrium constants too, essentially I can mesh their exit mol fraction of methanol with my model uh across all their runs, so it seems like it works well as a thermo reactor run and I did the same thing for urea SCR, the example you're seeing is more simple kinetic mechanism so basically reproduced uh the experimental results so it's seems like the model can change pretty quickly between the different types of catalyst and reproduce the results seen in the literature, however I hadn't talked about the lean NOx traps yet and lean NOx traps detail significantly with intermediate surface chemistry and what I mean by intermediate surface chemistry is that the catalyst it it has some (xxx) surface in a (xxx) like before I was saying that there's a film layer on the surface and this film surface is essentially your NO NO2 your hydrocarbons your carbon monoxide. Well you also have to deal with your surface interaction with your metals on the surface like your baryon nitrate for your uh for lean NOx trap, for free way catalyst oxygen storage on serial, for urea SCR you can have ammonia storage uh there's a uh Chemkin also comes at surface Chemkin, which can actually process this model using actual detailed kinetics and I included that in the program to actually give the user an option to write their own kinetic mechanisms for the surface intermediates or use a surface Chemkin mechanism, and you can see here that the equations is is actually pretty simple and you can use a uhb Oiller implicit uh mod- uh integration in order to solve and essentially is just one more equation in the model detailing with your coverage fractions this this uh uh this term with your coverage fractions and so now your reaction rate is a model of your function at temperature your uh your surface concentrations your and your surface side density and your coverage fractions. and for an example I set I found a paper by (xxx) who details what the the effects (xxx) has on your exhaust gas oscillation, (xxx) can store oxygen in the form of CEO2

and this is the mechanism they use and what I did is I adjusted the kinetics and from a paper by Kolsaconson and Slomatlus, I said that right [S1: approximately] <SS LAUGHS> I knew I was going to get that one wrong and uh I modeled two (xxx) a step case from (xxx) to ridge and a lean excursion and actually I was able to get close to their results and actually it depends on how you wanna look at it maybe actually better results uh for this step composition when you go from uh lean to a rich charge and you s- and your rich uh when it goes rich it actually uses this stored oxygen to reduce your your uh CO, so that's why there's a little bit of a hesitation as to what you'd be expecting you would except that it just jump straight up as it goes rich but because you have stored oxygen and actually is uh is delayed somewhat as the oxygen in the stored cerium uh helps decomposes CO2 and you can see that you're oxygen storage goes from a hundred percent down to about zero percent and during the lean excursion uh it basically it it does the same thing except for you do a quick lean uh lean event which would essentially uh store uh your oxygen and it would then do the reverse to these kinetics and your CO would be adjusted and you can see basically that I modeled as well as they do if not better in some cases. And I said okay well what about an LNT, well I found a lean red cycle test by Kobiashi and uh Yamada, all right anyone [S4: sounds good, sounds good] sounds good, all right <SS LAUGHS> uh in which you go from a lean storage to a rich uh a rich uh regeneration to lean to rich and I was able to model uh using a simple kinetic mechanism the (xxx – 1:32: 10) sling storage event uh quite well and you can see that as your empty your sites your barium oxide sites as they decrease they first form your barium carbonate through this equation and then this barium carbonate is a precursive of your barium nitrate formation so it's doing exactly as you would expect I wasn't able to do the regeneration case uh because I didn't have time so but it it appears that I can model at least the storage dimension quite well and since the model has been used for LNT before I'm pretty confident that I can use it for regeneration. As for the surface Chemkin I wanna see if I can actually model surface_ actually use surface Chemkin within my model and uh I found a simple paper uh details what oxygen absorption and distortion in platinum and aluminum oxide and the simple kinetic mechanism I found two detailed kinetic mechanisms in the literature one by Deutchman and one by Zircle and I tuned a couple of catalysts' parameters cuz they weren't given in the paper in order to try and mesh the experiments all outlet uh exit O2 concentration and using a detailed using the Deutchman kinetics I can only- I didn't get the profile they got and that's because I think in the detailed mechanism they used surface coverage terms and what surface coverage terms mean that essentially as something com- as something is as uh in contact with the surface the coverage terms depending on how large they are like so basically just stick through it and I think what's happening here is from t- the kinetics because the O2 concentration is actually relatively large in comparison to uh a a uh in comparison to the platinum and everything it actually was resorting and you can see that in the actual concentration of uh OPT sites is that it actually starts coming out as you would expect but it ends up being resorted and goes to an equilibrium down here. Now using the Zircle kinetics and not tuning it is using the same parameters you can start to see that you're gonna- you're getting sort of the same shape and so while this isn't like explicit validation the Chemkin surface works perfectly you know it shows that it is doing some things as you would expect and I can use it within the model but it probably warrants probably a little more validation. So in conclusion uhm I believe I developed a general catalyst model that applicable for all after treatment devices except for the DPI uh for a single tap channel type (xxx – 1:34:53) alternating channels and uh I detailed its validation and uh in terms of surface and mediates so I believe it can be used for that too, it's fast uh actually a Ford transient test twenty-four hundred seconds would take about an hour to run which is not which is not real time, it's not one-to-one second, but it's getting down there. And so looking at the modeling needs I uh I checked off everything except for the control system I spent basically all the

dissertation and the time developing the different models and actually trying to do a good job uh validation all the different models and I think at this point I do have all the formul- all the models that I well not all that I need but most that I need for a complete system. So in terms of future efforts what what will go on well in order to use the catalyst model as is, is the simple catalyst model uh you'll basically since the kinetics aren't really known you gonna have to tune the kinetics and the best way to do this is through optimization techniques and I did use some optimization techniques for the lean NOx trap for a work that I did but their routines that are fortune- unfortunately their belt direct into the program and basically no one would have any idea of what I did and they wouldn't be able to understand it so it's really not a good utilization uh so the best way I'm gonna do it the the way I'm gonna do it is rewrite the programs now that I know what we're doing and uh link to another program such as Eye Sight so that people can use it and run Eye Sight to optimize the catalysts before you uh however I believe that Eye Sight will probably need a DOS version of G-Cat but as I'll detail in a second that won't be a problem because I'm planning on building three G-Cat version and while I say three people might like geez that's too much but actually it all gonna be the same code built as C which is essentially different wrappers around it or may build the GUI version first which is easier to use people can use cuz it it uses these tutorials for other people you have the post-processing built right in so you can what you're doing and see if it's right or not but it's gonna be the same code as C that's a way from your GUI wrapper and so the C code is- will go with this DOS-based version well everyone will be able to use and kink to other programs and what I'm gonna try and do is actually have your input file for this DOS-based version safe in the GUI version so you can run the GUI version say save as DOS you know input text file and then all you need to do to run that DOS program is input that text file and then those input parameters would be the ones I'll link to Eye Sight. And then uh would be nice is using the same code I can mix it within (xxx – 1:37:44) to basically create a complete system picture in which many devices can be hooked and serially- series in parallel with my gas dynamics and the urea and the injection models. Now I haven't talked about detail modeling too much, actually probably not at all, well TPF models as they are in literature are well validated in terms of pressure and velocity profiles for this alternating channel through this porous membrane wall so because I I realized that I wanted recreate you know what had- what other people had already done I would've said okay well let's- in my mind how I put the two together well the catalyzed DPFs were firstly non-existant, the ideia with DPFs now are deploy a whole bunch of DPFs catalyst materials under DPF in order to get complete regeneration of everything at once people are puttng lean NOx trap materials in your DPFs in order to store NOx and at the same time they're storing suit, so as a result I said okay well if I use this pressure and velocity profiles through this porous membrane and rewrite the bulk and surface energy formulations I think that my general catalyst model can be extended to a general catalyst DPF model and I actually detailed these equations in chapter six and they're there to promote discussion, uhm I'm not sure how well they're gonna work I just thought that you know I have this idea that I'd like to see someone else uh you know (xxx – 1:38:18) full of it or you know if it's a good idea and I'm at the and so I realize taken quite a lot of time I'd like to acknowledge my wife specially who puts up with me a lot <S1 LAUGHS> specially this last week and uh and my family of course who were wonderful not to to come to me to make an ass of myself <SS LAUGHS> and uh I'd like to thank professor Denis Assanis whose done a wonderful job venturing me during the entire time here uh it's been a lot of fun and it's been a lot of work but you kept me on track which sometimes is hard to do uh professor van Leer who uh does the same thing keeps me on track and I spent many hours talking CFU at the end, he's always been friendly kept his door opened, professor (xxx) professor Cheng who I had uh numerous discussions with, they've helped me out

tremendously, and all my friends in core research I'm glad everyone showed up, it means a lot so thank you <APPLAUSE>

S1: yeah, great, wonderful job so questions, maybe we can take questions from the floor first see if uh you guys have <p:03> ready to ask some questions <p:08> you've left everybody speechless <SS LAUGH>

S3: I think they're all just waking up now so

S1: yeah

S8: how important are the angle additions since (xxx – 1:41:02)

S3: uh N- N2O [S8: yeah] uh well people still can't quantify the CO2 emissions and how important they are uh they know that N2O is more important but since they cannot quantify CO2 then they really can't quantify N2O, I think it's from a stand point that you believe that this is happening so you should do what you can to prevent it from occurring, does that answer you r question <S1 LAUGH>

S5: Chirs [S1: yes] uh does this replace uh the Ford models that they have, I know they have a model that will do all this kind of stuff and you mentioned at the very end that you_ takes an hour to run your model are they actually compared second by second

S3: no but

S5: your model with their model

S1: no but actually when I've talked to the four people they have very simple kinetic mechanisms that they use and they don't deal with uh uh heating up the cata_ they do more simplified models that don't deal with uh profiles through a catalyst uh in terms of uh who I've been in contact with does so they are actually quite interested very interested in using these models in conjunction with their work and they haven't given me any of their data to to compare against and so that will be interesting but one of the the product on of the uh the Ford projects one of the outputs is to actually give them this model and let them play with it

S1: a nice thing to do is you can just uh use only the modules you need like if you have a great DPF model and you need the lean NOx trap you can use this lean NOx trap with your DPF model <p:05> (xxx) you have some I've seen you

S3: he's afraid to ask <SS LAUGHS>

S1: then tell us, it actually Chad Teddy has worked uh very closely with Chris uh for a long time so he's right to pick up the tree <S1 LAUGH> (xxx) uhm maybe Kong do you have some uh questions

S4: well yeah, excellent work, we uh a lot of uhm too many contributions so it's really kind of just hard to <S3: LAUGH> (xxx) for all the reading assignment <S1: LAUGH> uh really uh congratulations on your excellent accomplishment I have just a couple of minor detail [S3: okay] questions and kind of one rather big conceptual question, uh do you mentioned in the uh somewhere at the the boundary condition is first order and then the rest of the domain is

second order [S3: yes] and then there was a kind of uh you referred to Kristofferson paper saying that this is actually okay [S3: yeah] can you elaborate a little bit on that that is there's some rational proof on it or is it some more like a hand waving

S3: I think, I think that there is the the rational proof that is pretty well accepted that [S4: uhu] that's the case and uhm uh I basically just took it as is because it was in the book it was in the book and I said these authors have verified that it's okay to do so [S4: is there on something special]

S6: it seems to me that should depend on the condition because [S4: that's what I was gonna ask] I mean if you have yeah go ahead

S4: yeah there are so is it kind of universally true or is it some particular circumstances where you take great care of the boundaries to make sure that there's nothing there's nothing really happening over there then there then then it's okay right [S3: yeah] that's that's understandable [S3: yeah] is it that kind of uh I would say like hand waving type of argument or is it kind of mathematical derivation to derive all the all the properties and to prove that indeed is mathematically second order

S3: I don't know [S4: I] explicitly

S4: I'm actually curious about it myself because we because we do that all the time especially I'm using a lot of high order schemes and that has to sacrifice your order ranks down at the boundary, I have yet to see any clear explanation [S3: any clear proof] explan- explanation about that justifying that use other than just kind of

S6: I would seem to me that your kind of determinacy is less important and that your space is originally [S3: uhu] more important that this would be a bit questionable

S3: yes

S6: right

S3: yes, I can see that

S6: so it's probably not general

S3: no, probably yeah

S4: and the uh second question was in the in your reductant model [S3: uhu] you decompose you're the individual physical processes as a like phase one to [S3: uhu] four uh as you showed the result seems to me like uh, I don't know this is just my you know pure guessing but it looks like the result probably depends is_ it depends pretty much on the actual kinetic gas phase kinetics in your test of the uh non-calorie reaction [S3: uhm] so have you ever done any test on those uh fourth phase uh couple of phases of like a conduction model (xxx – 1:46:16) model and its eff_ there reflects on the final outcome

S3: no, I haven't done that yet

S4: okay so, yeah I'm just curious you know probably they really as long as you're giving enough reasons time probably they don't really matter at all they just evaporate everything and all it boils down to is a final gas phase kinetics that in terms of final NOx production so. Probably the model the model may not have to be all that complicated in the end [S3: yeah] depending on the

S3: yeah we could go for revision and make it even simpler and

S4: so it may be worth checking out those uh the parametric study on the effects of other parts (xxx) [S3: uhu] and the uh another rather kind of big question I would say is the uh this is more like fundamental question and perhaps it's too late to ask this kind of question is that you used the gas dynamic model [S3: yes] and test- tested all the things with the uh top two tests and all that but in the end actually your calories calorie reactor model does not involve that much of these continuities and all the compressibility effects [S3: yes] uh what I mean by compressibility is effects is that something related to acoustics [S3: uhu] (xxx – 1:47:29) that kind of nature that professor van Leer is really an expert of so I was wondering whether this could have been approached in a totally different path, I understand there are a lot of other like uh Ford models use the same type of gas dynamic models but what if you just used like incompressible (xxx) equation with_ including those variable density effects which can be done by by (xxx) approximation so that you can completely eliminate the acoustic things because you're not really interested in the acoustic things [S3: yeah] right [S3: yeah] and by using the gas dynamic compressible code you have to your time step is limited by the acoustic time step [S3: yeah] which is much much smaller [S3: much smaller] what you're really interested in looking at in terms of physical time scale

S1: may maybe I can respond a little bit uh this is historically the engine in the community for the exhaust flows and they make flow too, tuning phenomena in some of those acoustic things are very important so these codes are being used uh for the flow part a lot [S4: uhu] you know because tuning how an engine sounds is a good thing [S4: that I can understand] so because you do the environment is often the (xxx) effect you know so you go into the catalyst with the same kind of codes and that wasn't thinking like keeping one modeling environment but I personally think that what you're suggesting is excellent you know could be done if you were interested only in these devices [S4: right] but that's the main motivation that it was done this way

S3: yeah it would be interesting to do a comparative study there

S4: but but that involve another hole in the relation of the formulation and the [S?: xxx] <SS LAUGHS>

S1: next guy <SS LAUGHS> I see some light (xxx – 1:49:13) yep

S6: can I have a run? Uh first would like to complement you for this work had I known you were doing so much work for this us <S1 LAUGH> besides listening to my numerical uh advising I would've been much more uh modest <S1 LAUGH> because you also uh produced a one hundred and fifty pages masters thesis or so around_ while you were doing this uh it pleases me to see that the Hancock method which is our standard method in (xxx) to uhm to do anything form uh multi-fluid calculation to hypersonic combustion also works for this and even pleases me more that the uhm work on variable property gas dynamics which was done by you and and myself and others around nineteen ninety which was meant for the aerospace

plane when it was still uh alive is now <S6: LAUGH> competing of for after treatment uh simulation uhm I recall one instance that we were uh not quite successful and I'd like you to comment on that, there's the sudden area variation which I thought [S1: uhu] could be handled quite well with the so called area conservative version [S1: uhu uhu] of the quasar one dimensional flow, can you re- recall uh how those experiments and other experiment went and what was the culprit and could we revisit that

S3: uhm

S6: I remember we stopped at a certain time because you needed to get these uh

S3: well I seem to recall that I I if I understood you correct here yeah (xxx) you were talking about including the area in terms [S6: in the flow variables] in into the flow variables and by doing so uh we ended up having a problem with uh determining actually writing uh and having to determine uh the area change uh properly otherwise that you were getting flow when there shouldn't be no flow and so now I'm not I

S6: or no flow, [S1: there's] there shouldn't been flow I forgot what

S3: there's there's flow when there should not've been flow and everything was constant if you defined the area like you think you should've defined the area then then their causing oscillations in in in the pipe and uh I'm not sure where that uh where that uh why we couldn't get that to work properly, it it I think it has to go back to how you define your variables in that case and

S6: I wonder whether we goofed somehow

S3: it's possible

S6: it's sounds like sounds like cuz it uh

S3: I think

S6: there's no reason why it shouldn't work [S3: yeah] cuz I I read in your thesis that you and this is actually what you resorted to spreading them jump over a few meshes this is what you what you describe.

S3: I know there is_ they they have found in uh a number of uh actually a couple of papers that using the non-area conservative variables like I did like I did here can have so mess conservation errors and [S6: yeah] I think I do mention that in the dissertation and I talk about how you want_ maybe it it would be better to go to the area conservative variables but that that warrants a little more research and it may have been that I could've just programmed something wrong [S6: yeah] one two or three

S6: I think that we were just very close, I think this is something that uh uh needs to be revisited [S3: uhu] that's all

S1: good Mike

S5: well I'd like to start by saying that uh by complementing you on the huge amount of work that you have done and uh at least in principle we come here as examiners we're supposed to be ad- adversaries <S1 LAUGH> you basically conquered us by the idea of a massive attack <SS LAUGHS>

S3: I gave I gave you so much stuff

S5: this is the this is the very much the principle in the American military <SS LAUGHS> so basically it's a overwhelming force right [S1: yeah] <SS LAUGHS> I uh <S1 LAUGH> have been overwhelmed and uh not only by the volume of work you were basically rushing through one test after the others and and looking at the thesis uh I gotta say my expression uh the- this is actually a a bit of a suggestion but maybe it's a bit too too hard to do it for such a voluminous thesis uh at least in principles should be written not to the very limited community of specialist [S3: uhu] uh and it_ so the language used should be (xxx –1:54:22) easy to read to other people and I find that the combination of the letters in your [S3: okay] they're about_ they appear everywhere and it seems to me I need a uh a need a uh huge [S1: a dictionary] a dictionary of these letters to uh read it, I can see that's very hard to avoid but on the other hand uh it actually was part of my problem reading this thesis, uh there are a couple of others which may or may not be my problem because it seems to me, maybe you can clarify this to me uh it seems to me that you are doing you have done really two things but you used the same word to describe it, two types of things and you use the same word to describe them, maybe you can correct me if I'm wrong, one is indeed they were modeled in here [S3: uhu] for example by adding gas dynamics and other people didn't add gas dynamics in their_ and you added here in a one-dimensional way so it's in a sense it's a model but uh when when you use the word model you also seem to be describing your code which is a thing which basics wrap around what other people can put different components into it [S3: uhu] uh I wonder whether that could have been clarified in the right place basically, the the idea as a model is a mathematical concoction which simplifies the physics [S3: uhu] so it's a physical thing whereas the other one is a code that you you basically it's it's something that you fit in here [S3: uhu] so to be able for other people to put things in here and test out all the calculation [S3: uhu] uh that does or does not mean that it supports a visible code [S3: okay] so I see a lot of results that you have shown and it's not clear to me whether it shows the flexibility of your code because you can do this and you can do that or the ability of levity of the physics involved because in each case the physics was not clear to me I I_ from listening to me though I get the impression that there were few things that were really physical models that you have proposed at that that uh and some of that also have a look of the question for example I get the impression that you have uh put gas dynamics into it but according to professor Assanis's answer to (xxx – 1:56:59) uh question it seems that this idea of gas dynamics is uh really build in the community so was gas dynamics something that you have put in there together with professor van Leer or was it something that was really pressing in the community

S3: uh well the gas dynamics I guess was present in the community as the catalyst model

S5: but they did not use the right equations

S3: but no they they simplified down to essentially eliminate the momentum equation [s5: okay] and so what I did is I said okay but I (xxx) the fact that this momentum equation that's what you can essentially boil down to results there

S5: okay you see this question also there's (xxx) ask you about a bond uh because of all these names in here the only person I really know [S1: yeah] is Bauman and uh I know that he's perfectly familiar with gas dynamics and he is uh he is uh a very capable person, so the_ you were indicating that he did not use gas dynamics he must have a reason not to use not consider gas dynamics [S3: uhu] so uh in how way would your calculation be an improvement over what he has done that wasn't clear to me

S3: I wasn't I wasn't I wasn't saying that mine was an improvement I think I would think I was saying that mine was another avenue that you can use to model these industrial power plants and if there's a situation that uh the gas dynamics maybe gets complex and uh you need to use it then you can actually use my gas dynamics with detailed kinetic mechanisms the model (xxx) and I remember when I worked at a power plant actually in Jacksonville Florida I mean these were huge devices and the they had a huge fan and and blowing and uh blowing air up the stack and I was just envisioning that as a gas dynamic process but from what professor (xxx) says is really uh it it might be just more of resonance time issue is that if you know the resonance time in the stack then you may never have to deal with the gas dynamics

S5: there's one picture that you showed that did show something with gas dynamic though I don't remember whether we there's no way we can find out <S3: LAUGH> [S3: okay] but uh actually the terminology or something might uh end up backward thing or whatever [S3: oh oh uh uh]

S4: backward wind

S1: for for the tuned uh catalyst

S3: yeah the tuned_ wrong way phenomena

S5: wrong way phenomena <S5 LAUGH>

S3: yes

S5: that that obviously is a gas dynamic [S3: uhu] uhm tuned tuned is another the word that it's uh it's it's also uh interesting in the sense that is one dimension not not as (xxx – 1:59:45) but uh tuned is used uh has many many different connotations or many ways of being received because when you have a lot of ability to tune, certainly shows its flexibility [S3: uhu] but uh the the other thing is the results with a negative connotation is that it does not prove whether you're right anymore because you can always tune it to look right [S3: uhu] so uh you_ in presentations in the future you'd be more careful you'd be a bit more careful so that you can get the full credit for what for what you have accomplished, I don't have any

S6: I'd like to make a comment on the word_ use of the word model you're absolutely right there, people who do uh numerical modeling of mathematical equations which physic_ which model physics also talk about model, for instance the atmospheric scientists talk about general circulation modeling they do not mean that they model the physics of general circulation in the atmosphere but they mean that's their numerical code that does the uh prediction

S5: there's some other (xxx) when you use a mesh size of five miles that's a model <SS LAUGHS> the way we [S4: sure] basically there's so much physics that has been been been been sort of smeared when you have [S4: sure sure fine fine] a mesh size [S4: it's true]

S6: and then but that they they call that uh you know sub-ridding modeling or parameterization and so on

S4: but they they probably

S5: but there is_ it's true that the word numerical modeling uh that modeling uh actually has now also the connotation of just a numerical code built on some physical principles so that

S6: the turbulence people try to say simulation [S5: yeah] (xxx)

S5: simulation is also uh used but that has that also has different connotations cuz there's all simulation community you know for instance there's flight simulation so and and modeling simulation so it's not all that can also be misunderstood but it's good to warrant against overuse of one word and then I really tune from from my experience in my in my experience tuning is bad <SS LAUGH> is something people tune their codes to get uh to get better agreement with their with the experiments [S6: but apparently] the way the way uh [S1: fudging fudging] yeah fudging literal way this is usage is that you know when [S1: calibration] if there's calibration [S1: calibration] you're right to calibrate the code but certain processes are not well known to to produce one set of experimental data and then hopefully they will do other calculations with that without any further tuning so but it is probably a good idea to uh clarify the word tuning to the uh audience.

S1: well I don't feel like asking Chris anymore questions you know I've asked him enough for the last five years during a lot of hard time and uh it's been a great experience but you know I do want to say that uh Chris needs to be complimented for trying to put into the word of those dirty engineering devices some real science and you know anytime you go and try to take uh these type of application and other sciences to it because (xxx – 2:03:11) are crossed communities so it was a challenge cuz that's the communication and the vocabularies are challenged but I personally really enjoyed this kind of think all of my life and though all our students and uh Chris's maybe the primmest of the prime examples here of uh trying to do this I'm sure that he will enjoy doing (xxx) so uh with this uh I would want to ask the audience to please excuse us for a few minutes it won't be long my son is playing a soccer game so <SS LAUGHS>

S5: I said to my wife I wouldn't be long

S6: Chris is going to so

S1: yeah yeah Chris will go

{End of transcript}