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The Acquisition of English Initial /s/ Clusters by Brazilian EFL Learners

por

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Abstract

The Acquisition of English initial /s / clusters by Brazilian EFL learners

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The production of English initial /s/ clusters in various phonological contexts by Brazilian EFL learners was analysed based upon universals of syllable structure regarding cluster length, strength relations within the syllable and syllable contact, with the Markedness Differential Hypothesis (MDH) and the Structural Conformity Hypothesis (SCH) as predictors of learners difficulties. Longer initial /s/-clusters were expected to cause a greater rate of epenthesis than shorter ones. In addition, initial clusters which violate Hooper's (1976) Syllable Structure Condition (SSC) were expected to be more difficult than those which do not violate it. Finally, based on Murray and Venneman's (1983) Syllable Contact Law (SCL), the greater the degree to which the strength of the final segment of the context word surpassed the strength of the initial /s/ of the target word, the more difficult the structure was expected to be. In order to investigate these aspects of the syllable, six Brazilian learners of English from the extra curricular course at UFSC read aloud sentences containing initial /s/ clusters in controlled environments. The results yielded by this study demonstrated that the universal CV syllable structure, the SSC, and the SCL were not sufficient by themselves to predict the degree of difficulty learners found in producing English initial /s/ clusters. Rather, L1 transfer of voicing assimilation and the resulting markedness relationships of /s/-nasal and /s/-liquid onsets in relation to /s/-stop onsets, in addition to markedness relationships regarding voicing in the environment, were considered to be the most crucial variables affecting the rate of epenthesis. The results of the present study complement those of previous research in the area, since additional aspects of the syllable were taken into consideration, and since this study dealt with Portuguese as the native language, as opposed to Spanish or Asian languages.

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Resumo

A Aquisição Dos Encontros Consonantais Iniciais Da Língua Inglesa iniciados pelo segmento /s/ Por Estudantes Brasileiros Da Língua Inglesa

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Baseando-se nos princípios universais da estrutura silábica no que se refere ao tamanho dos encontros consonantais, relações de força consonantal dentro da sílaba, e contato silábico, foi analisada a produção dos encontros consonantais iniciais da língua inglesa iniciados pelo segmento /s/ em vários contextos fonológicos por estudantes brasileiros. As hipóteses usadas para predizer as dificuldades dos alunos foram : a Hipótese da Diferencial de Marcação e a Hipótese da Conformidade Estrutural. Os encontros consonantais iniciais mais longos causariam um maior índice de epêntese do que os os encontros consonantais iniciais mais curtos. Além disso, os encontros consonantais iniciais que transgridem a Condição da Estrutura Silábica (SSC) (Hooper, 1976) seriam mais difíceis de serem adquiridos do que aqueles que não o transgridem. Finalmente, baseando-se na Lei do Contato Silábico (SCL) (Murray e Venneman, 1983), quanto mais o grau de força do último segmento da palavra contexto ultrapassasse o grau de força do segmento inicial /s/ da palabra alvo, mais difícil seria a estrutura. Para que fosse possível averiguar estes aspectos da sílaba, seis alunos brasileiros do curso extra curricular de inglês da UFSC leram em voz alta frases que continham encontros consonantais iniciais iniciados pelo segmento /s/ em contextos controlados. Os resultados obtidos por este estudo revelaram que o grau de desvio da estrutura silábica universal CV, a Condição da Estrutura Silábica (SSC), e a Lei do Contato Silábico (SCL), não foram suficientes para predizer o grau de dificuldade que os alunos encontraram na produção dos encontros consonantais da língua inglesa iniciados pelo segmento /s/. Pelo contrário, a tranferência da assimilação de sonorização da língua materna e as relações de marcação resultantes dos onsets do tipo /s/-nasal e /s/-líquido, em relação aos onsets do tipo /s/-oclusivo e

também as relações de marcação em relação a sonorização no contexto, foram consideradas as variaveis mais cruciais a afetar o índice de epêntese. Os resultados do presente estudo complementam os resultados de estudos realizados anteriormente na área, uma vez que aspectos adicionais da sílaba foram levados em consideração, e uma vez que em este estudo a língua materna pesquisada foi o português, e não o espanhol ou línguas asiáticas.

Número de páginas : 207

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Chapter 1- Introduction

The acquisition of a second language sound system has always been a challenging task to learners. This fact can be easily observed in foreign language classrooms, where the majority of post-pubescent learners demonstrate difficulty in losing their foreign accent. Grammar and lexicon, on the contrary, are areas in which many of these learners succeed in acquiring a native-like competence. The frequent lack of complete phonological attainment in second language acquisition made researchers aware of the importance of L1 transfer in this particular area of language.

Brazilian EFL learners share many difficulties regarding English pronunciation. The most obvious reason for these shared difficulties is that the Portuguese and English phonological inventories differ not only in terms of manner and place of articulation of sounds but also in relation to distribution. Two less obvious, but equally important factors which influence their oral performance are the differences in syllable structure and phonotactic constraints of English and Portuguese. That is to say, sequences of segments- both within and across syllables- which are permissible in English may not be permissible in Portuguese, and vice-versa.

This study focuses on one particular aspect of English pronunciation frequently found to be difficult to Brazilians: the production of English initial /s/- clusters. These structures are known to cause epenthesis due to the fact that they involve a longer and different distribution of segments than that permissible in Portuguese. The phoneme

/s/ in /s/-nasal and /s/-liquid clusters is also known to be frequently voiced by these learners due to native language interference. Thus, it is important to verify the frequency to which these clusters are modified, which ones are more frequently modified and in what context. It is worth pointing out that native speakers of English depend heavily on rhythm for comprehension and that epenthesis interferes a lot with it.

Natural generative phonology has been chosen as the phonological model of this research due to the fact that it offers the most relevant work in terms of syllable structure. This model takes into consideration strength relations within and across the syllable, aspects frequently neglected in previous research in the field of interlanguage phonology. Also, the Markedness Differential Hypothesis (MDH) (Eckman, 1987a) and the Structural Conformity Hypothesis (SCH) (Eckman, 1991) have been chosen as the predictors of learners' difficulties. These hypotheses were chosen because they base their predictions on the comparison of the L1 and L2.

This study was carried out with two main purposes: (1) to evaluate the difficulties Brazilian EFL learners would encounter in relation to the production of the various initial / s / clusters, (2) to verify the possibility of making predictions, based on Natural Generative Phonology, regarding the degree of difficulty students would have in producing /s/-clusters in different phonological contexts.

The thesis is organised as follows: Chapter 2 reviews the relevant literature in the area. Syllable structure in general is discussed mainly from the perspective of natural generative phonology, the theory on which this research is based. Then Portuguese and English syllable structures are described and compared. The hypotheses used to predict learners difficulty, the Markedness Differential Hypothesis (MDH) and the Structural Conformity Hypothesis (SCH), are also compared and commented on. Several studies on second language phonological acquisition are also presented in this chapter.

Chapter 3 presents the three hypotheses elaborated for this study and it also describes the method used. The first hypothesis compares /sC/ clusters with /sCC/ clusters in respect to length, the second hypothesis deals with strength relations within the syllable, and the third, with strength relations across the syllable. In regard to the method, details are given concerning the subjects who took part in the experiment, the material and the procedure used for the data collection as well as details concerning the transcriptions.

Chapter 4 presents and discusses the results. The main divisions of this chapter are related to the three hypotheses proposed: a) comparison of /sC/ clusters and /sCC/ clusters in terms of length, b) the consonantal hierarchy within the syllable, and c) the consonanatal strength hierarchy across the syllable. At the end of this chapter a summary of the overall results is presented.

Chapter 5 presents the conclusions of the study. The limitations of this research, theoretical and pedagogical implications are presented along with suggestions for future research.

Chapter 2- Review Of Literature

2.1- Phonological Considerations on the Syllable

The concept of syllable as a phonological unit has been a rather controversial subject amongst professionals in the area of phonology. There have been many attempts not only at defining it, but also at including it as a unit within phonological theory. Hooper (1972) claims that the insertion of syllable boundaries between sequences of segments leads to a formal and universal definition of the syllable, and that phonological processes are directly affected by such boundaries, since in many languages they are dependent upon syllable structure. Redenbarger (1979:40), on the other hand, criticises Hooper's (ibid:536) universal rule of silabication by stating that each language should develop its own rules. Evidence in support of his claims is found in the necessity of language-specific rules of syllable parsing for the Portuguese language. Saussure (1915 [1959], in Hooper 1976) defines the syllable in terms of the degree of opening of the sounds. He states that the margins of the syllables are formed by the least open of the sounds whereas the nucleus, by the most open ones. This classification in terms of the opening of the sounds is similar to that of the degree of sonority.

According to Ladefoged (1982:224), there has not been an agreement on a phonetic definition of the syllable. There are two theories which attempt to define it.

On the one hand, there are those who claim that the syllable should be defined in terms of the properties of sounds, such as sonority or prominence. On the other hand, there are those who propose a definition of the syllable in terms of what speakers do, such as their production of chest pulses or their organisation of the components of utterances. As Ladefoged (ibid) claims, none of the available phonetic theories which attempt to define the syllable seem to be adequate.

The syllable has been thoroughly analysed within Natural Generative Phonology, which places special emphasis on phonotactic constraints and strength relations. The adoption of this theoretical model is linked to the fact that both aspects, phonotactic constraints and strength relations, are paramount to the work I propose here. In addition to that, there is the need to fill in an existing gap in the SLA research on the syllable, since most studies in the area involve the composition of the syllable only in terms of CV (Broselow,1987a, 1987b ;Tarone, 1987a ; Anderson, 1987a), not in terms of natural classes or strength values as proposed in this study.

2.1.1- Syllable Structure

Hooper (1976) proposes a theory of universal and language-specific syllable structure. Within her theory there is also an explanation for the constraints related to the syllable structure itself. She analyses the syllable structure of Spanish and concludes that the occurrence of segments within a syllable seems to be dependent on their natural classes, i.e., "whether it is an obstruent, nasal, liquid, glide or vowel." (ibid:196).

Below is the hierarchy of suitability of segments in initial and final positions within the Spanish syllable as proposed by Hooper (1976:196).

Optimal syllable-initial ↓

obstruents
nasals
liquids
glides
vowels

↑ Optimal syllable-final

Hooper (ibid:206) has also proposed a universal consonantal strength hierarchy as follows:

glides	liquids	nasals	voiced continuants	voiceless continuants voiced stops	voiceless stops
1	2	3	4	5	6

Based upon the strength scale above, it can be noticed that glides are the most sonorant, therefore, the weakest segments on the scale while voiceless stops are considered the strongest, i.e., the least sonorant segments. The position of affricates on the scale is not determined, but Hooper (ibid :206) believes that voiceless affricates are probably the strongest consonants on the scale, due to their complexity. Their voiced counterparts are said to be weaker. She also states that the degree of strength of affricates is very much language specific, i.e., it depends on how they relate to the other segments in the language and also to their specific phonetic properties. In spite of strength scales being to a certain extent language specific, there is a universal tendency for the general location of segments along them.

The degree of strength a segment is said to have determines the positions it can occupy within the syllable. Syllable-initial position is said to be universally stronger than syllable-final position. This is supported by the fact that fortition processes, such as aspiration of voiceless stops in English and the changing of the glides /y/ and /w/ into obstruents (fricatives) in Spanish, "always occur in syllable-initial position and never in syllable-final or second position" (Hooper, 1976 :199). On the other hand, lenition processes, such as assimilation and deletion, tend to occur in syllable-final position. According to Hooper (1976) the nucleus of a syllable is always occupied by the most vowel-like segments, while the segments at the margins especially in syllable-initial position, are the least vowel-like.

One can say, then, that the syllable structure of languages varies not only in relation to the optimal CV universal syllable, but also regarding phonotactic constraints on the syllable, associated with differences in strength relations amongst segments, helping to make each language a unique system of communication.

Returning to the issue of CV as the optimal universal syllable structure, this implies that all languages of the world allow this type of syllable. In fact, for some languages this is the only type permitted. The CV syllable is also said to be the first syllable type learned by young children. The fact that the CV syllable type is universal predicts a preference for consonants in initial position over consonants in any other position and a preference for consonants over vowels in initial position.

Hooper (1976:229) proposes a universal condition on preferred syllable structure as stated below:

P (C): $\$C_mC_nC_pC_qVC_rC_sC_t\$$

where m > n > p> q

r > s> t [sic][1]

m > t

m ≠ ø

According to Hooper, this universal condition on syllable structure establishes that the C elements are to be found at the margins of the syllables, and that an obligatory element V comprises the nucleus. As we can see, the universal preferred syllable structure allows up to three segments in syllable-initial position and up to four segments in syllable-final position. The English words *spree* and *splash* are examples of three-member initial consonant clusters while the words *texts, bursts* and *glimpsed* are examples of four-member final consonant clusters (Bowen, 1978 :150). In relation to the degree of strength of the consonantal segments involved, their values should decrease not only from syllable-initial position toward the nucleus, but also from syllable-final position toward the same point. In English, the words *smile, snail,* and *sleeve* decrease in terms of strength value of their consonantal segments from syllable-initial position toward the nucleus, and the words *fans* and *north* decrease from syllable-final position toward the nucleus. Exceptions to Hooper's conditions are

[1] The arrows should be pointing toward the opposite direction.

found in the English language. For instance, all words which have initial and final-clusters with the fricative /s/ plus a stop (*speak, sky, store, cramps, bags* and *bats*) violate this condition. Thus, m is greater than n, which is greater than p, which is greater than q. The same occurs in syllable-final position where t is greater than s, which is greater than r. What is implied by the preferred syllable structure universal condition $m > t$ is that "...the strongest C permitted in syllable-initial position must be stronger than the strongest C permitted in syllable-final position." (ibid:230). The condition $m \neq \varnothing$ establishes that CV type must be allowed in all languages.

Based upon the theory of universal syllable structure associated to the universal strength hierarchy as presented above, some claims can be made concerning syllable initial clusters. The implicational universals to be discussed here were first discovered by Greenberg (1965) and later reformulated by Cairns (1969, paraphrased in Hooper 1976:230-1):

a) "...if a language allows syllable-initial clusters of $CNV (where N= nasal consonant), it must also have syllable-initial clusters of $CLV (where L= liquid)."

b) "...if a language allows syllable-initial [two-] obstruent clusters , it must also allow obstruent-nasal clusters."

c) "...if a language allows the syllable-initial cluster $cNV (where c= voiced consonant), then it must also allow clusters of $CNV (where C= voiceless consonant.)"

d) "...if a language allows an initial sequence of $NLV, then it must also allow $CLV."

e) "...the non-existence [sic][2] of clusters of two liquids in syllable-initial position is ruled out by the requirement that m > n and the condition that there be some minimum difference in strength between the first and the second C in the cluster.".

The syllable structure condition is also meant to explain possible syllable-final clusters. However, the details regarding these sequences of segments will not be covered here since final-clusters are not within the main scope of this research.

The consonantal strength hierarchy proposed by Hooper (1976:208) is similar to that proposed by Hankamer & Aissen (1974) with the difference that the latter use the opposite term sonority rather than strength. Thus, the sonority hierarchy works in the opposite direction, i.e., stops are located at the very beginning of the scale instead of at the end. Hankamer & Aissen (ibid:131) point out that their theory differs from that proposed by Chomsky and Halle (1968) in the sense that phonological rules no longer distinguish segments based upon their binary-value distinctive features; Instead, phonological processes depend upon hierarchical relations amongst phonological classes. In order to show that phonological rules can be stated in terms of hierarchical relations amongst classes, Hankamer & Aissen present an assimilation rule in Pali which can be formulated in such a way.

The range of values of the feature sonority is from 1 to 9 on Hankamer & Aissen's scale (ibid :137), stops being located at the low end with a value of 1 and vowels at the high end with a value of 9. According to Hankamer & Aissen (ibid:138) the scale is universal, but the placement of segments along its extension is language

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[2] This should read existence. since the ruling out of non-existence means obligatory existence, which is obviously not what Hooper wants to say.

specific. Classes such as stops, fricatives and nasals are said to vary very little from language to language, and an inversion of order amongst these three classes is never expected to occur. On the other hand, glides and liquids vary considerably from one language to another. This means that the region along the scale between nasals and vowels is determined by each language, by the articulatory nature of segments of the language being described.

2.1.2- Syllable Contact

It was seen above that strength relations within the syllable are paramount in differentiating the syllable structure of languages, and it will be demonstrated in this section that syllable contact is another important factor to be taken into consideration when investigating syllable structure. According to Hooper (1976), the relative strength of segments which occur in a given sequence is the basis for assigning syllable boundaries. In her discussion of Spanish syllable structure, Hooper (ibid:220) adds to her Syllable Structure Condition (SSC) for Spanish the further condition that "requires that a syllable -initial C be stronger than the immediately preceding syllable-final C:

12) If $XVC_r\$C_mV$, and there is no pause between C_r and C_m, then $_m > _r$.".

What Hooper means by the previous condition is that when a consonant in syllable-final position (C_r) is followed by a consonant in syllable-initial position (C_m) and no pause is produced between them, the consonant occupying syllable-initial position must be stronger than the one occupying syllable-final position. An example which obeys Hooper's condition would be the sentence *"ten soaps"* /tɛnsəups/ pronounced without a pause between the words. One which disobeys her condition would be the sentence "Guess what ?" /gɛswɔt/ also pronounced without a pause between the words. This condition that Hooper added to her SSC for Spanish was generalised to historical change in all languages by Murray & Venneman (1983:520), who proposed the Syllable Contact Law (SCL), based on a reformulation of this principle. They claim that "the tendency for a syllabic structure A$B to change, where A and B are marginal segments and *a* and *b* are the Consonantal Strength values of A and B respectively, increases with the value of *a* minus *b*." That is to say, the more the consonantal strength of A exceeds that of B, the greater the syllable structure violation will be, and the more likely some remedial measures will be employed in order to improve syllable contact. Some of the measures used on these occasions are: epenthesis, metathesis, assimilation, gemination, ressyllabication with vowel lengthening, and strengthening of glides.

In Natural Generative Phonology, the Syllable Structure Condition (SSC) is what accounts for epenthesis when violations of the syllable structure occur (Hooper, 1976:235). Therefore, there is no need for the application of a rule of epenthesis such as those proposed in Traditional Generative Phonology. In the case of the treatment of loan words in a given language, such as initial /s/ + C cluster words borrowed by Spanish, whether the vowel will be placed before or after the first consonant of the cluster is not predicted by the Syllable Structure Condition. Rather, the position of the epenthetic vowel will usually be the one causing minimal change in the original form-. before the /s/ in the following examples: *sport-* /es'pɔrt/, *spray-* /es'preɪ/, *status-* /es'tatus/ and *standard-* /es'tandar/. Once the syllable structure of the loan word has been adapted to that of the native language, the new item is then added to the lexicon of the native language.

As stated by Hooper (ibid 236), the vowel to be inserted can be predicted on the grounds of its features, i.e., "The epenthetic vowel must always be the minimal vowel or a vowel whose features are copied from a nearby segment". In both English and Portuguese a minimal vowel is used in epenthesis, as opposed to tone languages and vowel harmony languages which employ a vowel whose features are similar to those of a neighbouring segment. Hooper (ibid:238) proposes a universal rule to explain the quality of the minimal or weak vowel inserted. In order for this rule to operate a strength scale of vowels, which may vary from language to language, is needed. The rule is as follows: an unspecified vowel becomes a minimal or weak vowel.

$$\begin{bmatrix} \mathrm{V} \\ 0 \text{ features} \end{bmatrix} \dashrightarrow \begin{bmatrix} \mathrm{V} \\ 1 \text{ strength} \end{bmatrix}$$

By relating the Syllable Structure Condition to the strength scale of vowels and to the rule described above, Hooper (ibid) believes that the epenthetic vowel can be generated in new loan words, without the need of specific rules. The addition of an epenthetic vowel to a loan word, which in this case begins with the cluster /s /+ C, is motivated by the syllable structure of the language and by its phonotactic constraints, which in turn means that there are principles within the language which govern such insertions.

When violations of Hooper's condition occur, second language learners often employ epenthesis in order to make the syllable structure of the target language (TL) conform to the universal CV syllable structure, especially if the native language (NL) conforms to this structure. According to Weinberger (1994:287), epenthesis is a common strategy employed by adult L2 learners in order to simplify the syllable structure of the target language. This strategy differs from that used by young L1 learners who adopt consonant deletion instead. When epenthesis is used, the underlying form tends to be preserved, making it possible for the listener to recover the underlying form. Thus, Weinberger claims that the use of epenthesis by adult L2 learners shows that a subset of universal grammar which includes the recoverability principle, is still available in second language acquisition. Epenthesis is said to be employed by these learners because their level of phonetic accuracy is low at a stage when they can still access the recoverability principle. In the case of young L1 learners, the epenthesis stage is passed over since by the time the recoverability principle becomes available to them, they already possess the phonotactic ability to handle complex syllable structures (1994 :294).

Returning to the issue of Hooper's Syllable Structure Condition principle, it is crucial to mention that violations of it do occur in the underlying phonological structure of Brazilian Portuguese. Whenever they appear, however, some strategies are employed in order to improve syllable contact. For instance, an epenthetic vowel /i/ is inserted in words in which A is greater than or equal to B - *obtuso*. In this example, the strength of *b* is very similar to that of *t* - value 7 on the strength scale proposed for Portuguese by Baptista (1987:9). According to Istre (1983:193), the mid vowel [e] is also used as an epenthetic vowel in some dialects of Brazilian Portuguese in order to break consonant clusters which initiate with an obstruent. To illustrate this phenomenon, Istre (ibid:193) mentions the word *advogado* and the two possible pronunciations which are [adivo'gadu] and [adevo'gadu], and proposes the following general rule of epenthesis, using Transformation Generative (TG) notation :

$$[\varnothing] \rightarrow \begin{bmatrix} \text{V} \\ \text{-recuado} \\ \text{-baixo} \end{bmatrix} \; [\underline{\text{sic}}]^{3} \; / \begin{bmatrix} \text{C} \\ \text{-contínuo} \end{bmatrix} \dashrightarrow \begin{bmatrix} \text{+consonanta} \\ \text{vocálico} \end{bmatrix}$$

[3] The slanted line meaning "in the environment of" was omitted in the book.

An epenthetic vowel is also used at word boundaries in order to cause syllable-final obstruents to become syllable-initial, such as in the loan word *bike* ['baiki].

In some instances, even when A is weaker than B, some lenition processes will occur in Brazilian Portuguese in order to make A still weaker in relation to B. This is the case of the final /r/, which is realised as a flap as opposed to a trill in dialects where initial /r/ is realised as a trill, and frequently elided in dialects in which it would otherwise be realised as the fricative [x], as discussed by Baptista (ibid:11). The fact that sonorants become more vowel-like in syllable-final position also makes it easier for Brazilian Portuguese to conform to the Syllable Contact Law. Two illustrations of this phenomenon are the production of final /l/ as the glide /w/, and the weakening or deletion of final nasals as the previous vowel takes on the [+ nasal] feature.

Not only are the sequences of segments allowed in Portuguese different from those allowed in English, but also the strength values of the segments are not the same. Both factors associated with the syllable structure permitted in each of the languages under discussion makes the acquisition of the target language syllable structure a challenging task for Brazilian learners. The syllable structure of both languages is the topic to be discussed next.

2.2- The English Syllable

The syllable structure of the English language can be described in the following simplified formula as proposed by Prator and Robinett (1985:174):

(C) (C) (C) V (C) (C) (C) (C)

On a phonological level the syllable in English must always contain a vowel which forms its nucleus. This is an obligatory element in the syllable, as it is in the syllable structure of any of the languages of the world. The other elements are optional. That is to say, the onset of the syllable can consist of zero to three non-syllabic elements while the coda can be formed by zero to four non-syllabic elements. This, as we shall see later when the notion of markedness proposed by Eckman (1987) is presented, will determine that final clusters in English are more marked than initial ones, because the universal preferred syllable structure allows up to four non-syllabic elements in initial position but only three non-syllabic elements in final position [4].

The way in which non-syllabic elements cluster within a syllable is determined by phonotactic constraints, i.e., there are limitations regarding what sequences of consonants may or may not occur within the onset and the coda in a particular language.

Wolfram and Johnson (1992), in their TG description of the phonology of English, establish some conditions regarding the syllable structure of the English

[4] When the above authors refer to initial and final clusters , they mean to say word-initial and word -final, although this is also the limit for the syllable.

language, as well as the phonotactic constraints related to it . They make use of feature specifications in order to state the sequences permitted in the language. The first condition proposed by them regards the syllable structure of initial clusters.

Condition 1- (ibid:80).

1) + # # ([-syl]) ([-syl]) ([-syl]) [+syl]

Condition 1 as stated above means that combinations of the following kinds will be accepted initially: # # CCCV, # # CCV, # # CV, or # # V. Although Wolfram and Johnson are referring here to word-initial clusters, as indicated by the double boundary symbol # #, the same condition applies to syllable-initial clusters in general, as we saw in Prator and Robinett above. Since Wolfram and Johnson do not pretend to give an exhaustive analysis of the phonological structure of English, they do not include conditions on final clusters. Based on Prator and Robinett and using Wolfram and Johnson's notation, however, a condition for final clusters could also be stated in the following manner:

Final clusters- [+syl] ([-syl]) ([-syl]) ([-syl]) ([-syl]) # # +

Wolfram and Johnson's condition 2 pertains only to initial three consonant clusters. It is expressed as an if-then condition, which means that a preliminary condition must be met in order for a second one to apply. The second one indicates which consonants are allowed in each position of a three-consonant cluster.

Condition 2- (ibid:81)

$$\begin{array}{llll} \text{If: } \# \# & [-\text{syl}] & [-\text{syl}] & [-\text{syl}] \\ & \downarrow & \downarrow & \downarrow \\ \text{Then: } & \begin{bmatrix} +\text{ant} \\ +\text{cor} \\ +\text{str} \\ -\text{vd} \end{bmatrix} & \begin{bmatrix} -\text{vd} \\ -\text{d.r} \end{bmatrix} & \begin{bmatrix} +\text{son} \\ +\text{nas} \end{bmatrix} \\ & (\text{s}) & (\text{p,t,k}) & (\text{r,l,y,w}) \end{array}$$

Condition three is related to consonant clusters of three segments which end in the liquid /l/.

Condition 3- (ibid:81)

$$\begin{array}{llll} \text{If: } & \# \# [-\text{syl}] & [-\text{syl}] & \begin{bmatrix} +\text{cons} \\ +\text{lat} \end{bmatrix} \\ & & \downarrow & \\ \text{Then: } & & \begin{bmatrix} +\text{ant} \\ -\text{cor} \end{bmatrix} & \\ & & (\text{p}) & (\text{l}) \end{array}$$

This condition states that the second segment must be /p/ when the final one is /l/. In relation to the liquid /r/, which is not included in this condition, it could be preceded by any of the voiceless stops in the second position.

Condition four deals with glides as the third segment in three-consonant clusters.

Condition 4- (ibid:81)

$$
\begin{array}{llcc}
\text{If: } \# \# & [\text{-syl}] & [\text{-syl}] & \begin{bmatrix} \text{-syl} \\ \text{-cons} \end{bmatrix} \\
 & & \downarrow & \downarrow \\
\text{Then:} & & [\text{-cor}] & \\
 & & (\text{p,k}) & (\text{w,y})
\end{array}
$$

Condition four states that whenever there is a glide in the third position, the second segment must be a /p/ or /k/. The glide /y/ can be preceded by either /p/ or /k/, but the glide /w/ cannot. It is a restrictive case. Condition five expresses this restriction.

Condition 5- (ibid:82)

$$\text{If: } \#\#\,[-\text{syl}]\ \ [-\text{syl}]\ \ \begin{bmatrix}-\text{syl}\\ -\text{cons}\\ +\text{bk}\end{bmatrix}$$

$$\downarrow$$

Then: [+bk]

(k) (w)

Acceptable English sequences should be allowed by the conditions mentioned above. These conditions eliminate all non-permissible initial three-consonant clusters in the English language and reflect the knowledge of native speakers of English.

In their discussion of two-consonant initial clusters, Wolfram and Johnson (ibid:83) did not formalise the conditions to be applied. The sequences of segments to be permitted in each of the positions will therefore, be discussed here in a different fashion.

When the second segment in a two-consonant cluster is anything apart from /r/ and /l/, then the first one must be /s/. Here are some examples of these clusters: /sp/, /st/, /sk/, /sm/ and /sn/.

The segment /r/ can be preceded by /p, b, t, d, k, g, ʃ, θ, f/ whereas /l/ can be preceded by /p, b, k, g, f, s /.

The discussion of final consonants in English will be based on Kreidler (1989:122-23) and it will not be in the form of conditions established in order to describe the constraints of these clusters.

The English language allows open and closed syllables. An open syllable does not contain a coda ; it ends with a vowel. A closed syllable, on the other hand, has at least one consonantal phoneme as part of the coda. Directing our discussion toward closed syllables, it can be stated that the English language allows up to four consonantal phonemes in syllable final position. All possible patterns for syllable-final position will be described below:

- Syllables ending in a single consonant

a) any consonantal segment but /h/.

- Syllables ending in two consonants

a) rC clusters- where C can be /p, b, d, y, k, g, f, v, s, m, n, l, θ, ʃ, dʒ/;

b) lC clusters- where C can be /p, b, t, d, tʃ, dʒ, k, f, v, s, m, n, θ, ʃ/;

c) NC clusters (nasal+consonant)- / mp, nt, nd, nf, ndʒ, nk, mf, nθ, ns/;

d) FS clusters (fricative+stop)- /sp, st, sk/;

e) SF clusters (stop+fricative)- /ps, ts, ks, dz/ ;

f) SS clusters (stop+stop)- /pt, ct/.

A scale of sonority has been established by Kreidler (1989:124) based upon the sequences described above.

vowel r l nasal obstruent #

Kreidler claims that either of the liquids could come before a nasal and that liquids and nasals occur before obstruents in syllable-final position. He goes on to state that the four consonants represented in the sonority scale above cannot occur together due to constraints on clusters of more than three consonants. Clusters of four consonants will be discussed later based on Bowen (1978). Below is the structure of final clusters of three consonants in English as proposed by Kreidler (1989:125).

- Syllables ending in 3 consonants

a) Three obstruents (stop+fricative+stop)- / kst, dst/;

b) Nasal + two obstruents- NSS: /mpt, nkt/, NSF: /mps, nks/, NFS: /nst, ŋst/

c) Liquid+stop+fricative (LSF)- /rps, rts/;

d) Two liquids+stop (LLS)- /rld/.

According to Bowen (1978:150), instances of four-consonant clusters also occur in the English language. They always consist of at least one suffix and may occasionally contain two, which is possibly the reason they are not considered by

Kriedler. He also states that the three-member cluster can either be an inherent cluster or it can be the result of an intrusive stop. Below are the possible sequences of segments of four-member final clusters and the examples of words as proposed by Bowen (ibid):

Cluster	Examples
1a. ks-th-s	sixths
b. kst-s	texts
c. rst-s	bursts, thirsts, firsts
2a. rm[p]-th	warmth
b. m[p]-th	tempts, prompts
c. m[p]f-s	nymphs, lymphs
d. m[p]f-t	triumphed
e. m[p]s-t	glimpsed
f. n[t]-th-s	thousandths, ninths, tenths,months
g. n[t]s-t	danced, pranced, fenced, chanced
h. ng[k]-th-s	lengths, strengths
i. ng[k]-st	amongst
j. l[t] s-t	waltzed, pulsed
k. l[t]-th-s	wealths, twelfths

2.3- The Portuguese Syllable

The description of the Portuguese syllable structure will be given within the natural generative phonological framework, which takes into consideration the strength of the elements which comprise a syllable. Baptista (1987:7) described the Portuguese syllable based on previous work done by Hooper (1976) on the universal preferred syllable structure and on Spanish syllable structure. Below is her representation of the syllable structure for the Portuguese language.

$CmCnVCpCq$

m1 = /p, t, k, b, d, g, f, v/ = initial, may be followed by Cn

m2 = /s, ʃ, z, ʒ, m, n, ñ, l, ʎ, r, r̃/ = initial, may not be followed by Cn

n = /r, l, w/ = may follow Cm1 /w/ follows only /k/ and /g/)

p = /y, w/ = may follow V; may be followed by Cq1 (as in Spanish, /r/ occasionally occurs in this position)

q1 = /s/ = may follow V and/or Cp

q2 = /s, m, n, l, r, or r̃/ = may follow V (/m/, /n/, and /l/ are doubtful in this position)

Based upon the representation of the syllable structure given above, it can be seen that the sequences in which segments can occur in the Portuguese language is strictly determined by language-specific phonotactic constraints. There are restrictions concerning initial clusters as well as final clusters. These restrictions are part of what makes Portuguese different from English, for example.

Below is a hierarchy by natural classes for the Portuguese language also proposed by Baptista (ibid:8).

Portuguese

Optimal syllable-initial

obstruents

nasals

liquids

vowels

glides

Optimal syllable-final

This hierarchy establishes that the optimal syllable-initial segments for the Portuguese language are obstruents in the first place, followed by nasals, liquids, and finally vowels, which are the least preferred segments to begin a Portuguese syllable. Baptista (ibid) first proposed the above positions for vowels and glides in the hierarchy due to the fact that Portuguese, as opposed to Spanish, does not generally accept on-glides (the sequences /kw, gw/ are considered exceptional), but concluded later (personal communication) that the proposed order was problematic for Optimal Syllable-Final, because it would imply that the glide occupied the nucleus position rather than the vowel. The orders for Optimal Syllable-Initial and Optimal Syllable-Final would therefore have to be different in Portuguese. Connecting this hierarchy of classes to the universal preferred syllable structure CV, we can state that the Portuguese language has a tendency to adhere to universal principles of syllable structure. That is to say, open syllables tend to predominate over closed syllables.

A strength scale for the Portuguese language has also been developed by Baptista (ibid:9) based upon Hooper's work.

			ʎ			v f	
			m			b p	
y		r	n	s	z	d t	
	w	l	ɲ	r̃	ʒ ʃ		k g
1	2	3	4	5	6	7	8

$CmCnVCpCq$

$2 \leq n \leq 3$	*If $n < 3$, then $m > 7$
$m > n$	$p \leq 2$
If n, then $m \geq 7$	$q > p$
	$q \leq 5$

In this scale, the value of each segment is given in terms of strength. Also, the possible sequences in which these segments of different strength values can occur within the syllable is established by a hierarchy.

In the representation of the Portuguese syllable structure above, it can be seen that its nucleus is always occupied by a vowel. The remaining parts of the syllable, i.e., the onset and the coda, are optionally occupied by limited sets of segments which are allowed to occur in these positions. Camara (1970:42) points out that the only consonantal segments found in the syllable coda are the archiphonemes /S/ and /N/, and the liquids /l/ and /r/, corresponding to q ≤ in Baptista's scale above.

Even these, however, are marginal and thus weakened by most Portuguese speakers. The liquid /l/ in final position in the syllable becomes more vowel-like. The fricatives /s, z, ʃ, ʒ/ neutralise and are represented by the archiphoneme /S/. Vowels become nazalized before nasal consonants in final position and the nasals are usually deleted. Final /r/ is also often deleted. When one of these four elements which may constitute the coda of the Portuguese language is followed by any consonantal segment except /s/, it establishes the end of the syllable.

The syllable structure of Portuguese complies more closely with that of the universal preferred syllable structure than the English syllable structure. In Portuguese only two consonantal segments are allowed in syllable-initial position while in English three consonantal segments are allowed. In relation to syllable-final position, again we have two elements permitted in this position in Portuguese in opposition to four elements in the English Language. Besides the reduced number of elements in syllable-final position in Portuguese, the ones which may occupy this position either become more vowel-like (nasals and the liquid /l/) or are often deleted (/r/ and /s/ in some contexts of certain dialects). All these factors make the Portuguese syllable structure closer to that of the optimal CV syllable, and thus less marked than its English counterpart.

2.4- Markedness Differential Hypothesis (MDH) and Structural Conformity Hypothesis (SCH)

Many studies in the area of second language acquisition have made their predictions concerning the areas of difficulty second language learners would have, based upon the Contrastive Analysis Hypothesis (CAH) proposed by Lado (1957). The CAH simply suggests that by comparing both the first language and the target language the errors learners will make can be predicted. That is to say, the areas in which the languages differ would be areas of difficulty. A comparison of descriptions of the target language and the native language per se has not always been successful in determining these areas of difficulty, though. Consequently, certain principles of the universal grammar (UG) have been suggested to be incorporated into the CA in order to make it possible to predict the directionality of difficulty. Eckman (1987a), the proponent of the Markedness Differential Hypothesis (MDH), claims that the CAH by itself is unable to predict the areas of difficulty or the relative degree of difficulty. He, therefore, suggests that a universal notion of "relative degree of difficulty" be incorporated into the CAH. This notion, as stated by Eckman (ibid:60) "...must be valid on the grounds which are independent of the facts surrounding second language acquisition." This notion of "relative degree of difficulty" is based on "typological markedness", which he defines as follows (ibid:60):

"A phenomenon A in some language is more marked than B if the presence of A in a language implies the presence of B; but the presence of B does *not* imply the presence of A."

The notion of markedness can be applied not only to phonology but also to syntax. One example from phonology would be the voiced and voiceless obstruent phonemes. Voiced obstruents are said to be more marked than their voiceless counterparts, since the presence of voiced obstruents implies the presence of voiceless obstruents.

To apply the Markedness Differential Hypothesis, the grammars of both the native language and the target language are systematically compared with the markedness relations stated in UG. Based on this comparison, the following predictions can be made, according to Eckman (ibid:61):

(a) Those areas of the target language which differ from the native language and are more marked than the native language will be areas of difficulty.

(b) The relative degree of difficulty of the areas of the target language which are more marked than the native language will correspond to the relative degree of markedness.

(c) Those areas of the target language which are different from the native language, but are not more marked than the native language will not be difficult.

Eckman mentions as an example of the application of the MDH the facts regarding English and German final obstruents. In order to predict if German learners of English would have more difficulties in producing final voiced obstruents than English learners of German would have in suppressing this contrast in final position, since both voiced and voiceless obstruents are allowed in final position in English, the notion of markedness as proposed by the MDH can be applied. The contrast of voiced and voiceless obstruents in final position is more marked than in medial or initial position. Thus, since Germans do not contrast these sounds in the most marked position, they have difficulty in acquiring this contrast in English, while English speakers do not normally have difficulty suppressing the contrast when acquiring German.

All in all, Eckman (ibid) believes that the comparison of the native language and the target language is important for the prediction of errors to be made by second language learners, but has incorporated markedness into the CAH in order to make it more effective in the prediction of the direction and relative degree of difficulty.

In order to complement the MDH, Eckman, Moravicsik, & Wirth (1989, in Eckman 1991 :24) developed The Interlanguage Structural Conformity Hypothesis which was defined as follows : "The universal generalisations that hold for the primary languages also hold for the interlanguages." The two justifications for this hypothesis is that Interlanguages are languages and that universal generalisations hold for both primary and non-primary languages. This hypothesis differs from the MDH in the sense that it is more easily falsified, since there are facts that falsify the SCH but not the MDH, and facts that falsify the MDH also falsify the SCH. In the SCH, predictions are based only upon implicational universals whereas in the MDH, they are based upon implicational universals and differences between the NL and the TL (ibid :33).

Eckman (1991) tested The Interlanguage Structural Conformity Hypothesis against two implicational universals concerning initial and final consonant clusters formulated by Greenberg (1978, in Eckman 1991 :24) :

a. "Fricative-Stop Principle: If a language has at least one final consonant sequence consisting of stop + stop, it also has at least one final sequence consisting of fricative + stop.

b."Resolvability Principle: If a language has a consonantal sequence of length *m* in either initial or final position , it also has at least one continuous sub-sequence of length *m* -1 in this same position."

A strong version of the Resolvability Principle predicts that a language that has a tri-literal consonant cluster should also have both of its bi-literal sub-sequences. That would be the case of /spl/ cluster and the bi-literal subsequences /sp/ and /pl/. The weak version, on the other hand, predicts that a language that has a tri-literal consonant cluster should have at least one of its bi-literal subsequences, but not necessarily both. In this case, a language with /spɹ/ cluster should contain either /sp/ or /pɹ/, but not necessarily both of them.

No such distinction between weak and strong version was proposed for the Fricative-Stop Principle in Eckman's (1991 :30). This principle was simply confirmed or not.

In order to perform the testing of the hypothesis, data from the interlanguage of Korean, Japanese and Chinese (Cantonese) learners of English were gathered. These data included initial and final consonant clusters related to both the Fricative-Stop Principle and the Resolvability Principle. Results showed that only a very few number of the tests of the generalisations were counter to the universals. The majority of them supported both universals under study. Thus, Eckman (ibid) concluded that the results substantiated the Interlanguage SCH, since the generalisations made in the principles above also held for the interlanguages tested. This in turn meant that universals that hold for primary languages possibly hold for non-primary languages as well.

2.5- SLA Phonological Studies on the Syllable and Others

A great deal of research has been done in the field of phonological acquisition regarding the syllable. These studies generally investigate patterns of behaviour of EFL learners in the production of initial and final clusters in English, and the extent to which native language transfer of rules and language universals affect learners' oral performance. Most studies to be mentioned in this section treat the issue of syllable structure in relation to the learner's preference of a CV syllable structure or a CVC syllable structure. They are, therefore, studies which completely neglete other linguistic aspects which are of extreme importance when analysing the syllable structure of any language. This trend of research, however, has not yielded conclusive results because a preference for different structures has been demonstrated in different studies (see 2.1). This restricted view of the syllable has been expanded in very few studies conducted in the field over the past fifteen years. These studies, discussed in 2.5.2, take into consideration aspects of the syllable, strength relations within and across syllables, which have demonstrated to influence the oral performance of EFL learners.

2.5.1- Studies focusing on the learners' preference for a CV syllable structure or a CVC.

One study which focus upon the learner's preference for a CV or CVC syllable structure is that of Broselow (1987a), who examined the production of initial clusters by Iraqi and Egyptian learners of English. The focus of her study was to check how the epenthetic vowel would be employed by these two groups in order to make the syllable structure of English conform with that of both dialects of Arabic. Egyptians and Iraqis approached initial clusters of two segments in different ways. While Egyptians would insert the epenthetic vowel between the first and the second consonant in the cluster, the Iraqis would insert it before the cluster itself. However, in two-consonant clusters initiating with /s/ plus a stop, Egyptians changed their pattern of error and placed the epenthetic vowel before the cluster itself. On the other hand, in clusters of /s/ plus any consonant other than a stop, such as /sl/ and /sw/, their pattern of error was to place the epenthetic vowel between the first and the second segment in the cluster. In clusters of three elements, i.e., /s/ plus stop plus another consonant, the epenthetic vowel also occurred before the cluster. Broselow explains the exceptionality of the production of /s/ + stop clusters by Egyptian learners as being related to the fact that these clusters are also exceptional in the English language, due to the fact that they violate the sonority hierarchy within the syllable. Selkirk (1984) claims that the behaviour of Egyptian learners toward /s/ plus obstruent clusters could be explained on the grounds that these segments, /s/ plus obstruents, can function as single consonants. Hence, Egyptian learners would hesitate to break them up. Broselow concluded from her findings that some of the errors committed by both groups of learners could be attributed to the use of a phonological rule of the first language in the production of second language forms, which in turn means that language transfer played a significant role in the production of the initial clusters by Iraqi and Egyptian learners. Errors related to clusters which violate the sonority hierarchy within the syllable, such as /s/ plus stop clusters, could not be attributed to language transfer, but rather to universal principles.

In a very similar study Broselow (1993) investigated the production of English initial clusters by Iraqi and Egyptian learners, and observed that their pattern of behaviour in regard to these structures varied. The systematicity of certain errors led her to believe that learners did transfer NL phonological rule into the second language. Even when the NL and the TL differed in some respects, some aspects of the NL predicted the sort of error these learners committed. There was only one type of error detected which could not be attributed to NL transfer, that related to the principle of sonority within the syllable. This fact was observed since the Egyptian learners treated the marked clusters s + stop different from the unmarked obstruent-sonorant. The same treatment of these exceptional clusters was found in the in the production of loan words by Hindi, Bengali, Central Pahari, and Sinhalese speakers (ibid :82).

Broselow (1987b) also investigated the perception and production of American learners of Egyptian Arabic in relation to word juncture. The way in which crossword linkage of syllables is allowed differs in these two languages. Consequently, the errors committed by these learners are said to be associated mainly with language transfer, since they tend to use the syllable structure of English when producing the target language forms. According to Broselow (ibid:275), the findings of this paper support the fact that transfer plays an important role in the acquisition of a second language phonological system, specially in regard to syllable structure restrictions. However, the fact that learners preferred a less marked syllable structure indicates also the importance of universal principles of markedness in second language acquisition.

Initial clusters have also been investigated by Karimi (1987), who observed the strategies employed by Farsi speakers in the production of these clusters in English. Difficulties handling initial clusters were expect to occur since the syllable structure of Farsi differs from that of English. Farsi allows only one consonant before the vowel while English allows up to three. The epenthetic vowel was the strategy used by all speakers before initial clusters in order to overcome syllable structure differences. In relation to the /s/ clusters, Farsi speakers inserted a vowel before both /s/ plus stop and /s/ plus nasal clusters, regardless of the differences in terms of violation of the sonority hierarchy within the syllable. Therefore, their pattern of error differed from that of the Egyptian speakers mentioned by Broselow (1987a), who treated these clusters in different ways. Karimi concluded that neither the use of the epenthetic vowel nor the speakers' treatment of initial /s/ cluster could be traced to their native language. Yet the fact that all speakers employed the same strategy in handling initial cluster and different strategies in handling /s/ clusters, was an indication of the necessity of a better understanding of the syllable structure of Farsi and interlanguage as well as of the exceptionality of /s/ clusters, in order to analyse the results from a different perspective.

Tarone (1987a) analysed the syllable structure of the interlanguage of speakers of Brazilian Portuguese, Cantonese and Korean. The main purpose of her work was to compare how interlanguage syllable structure differs from that of the target language and also to determine the processes involved in the elaboration of interlanguage syllable structure. The processes expected to occur were language transfer, reactivated first language acquisition processes and different universal processes. Each of these would suggest a different behaviour on the part of the learner towards the syllable structure of the target language. That is to say, language transfer would be connected to the use of first language syllable structure in target language forms. Reactivated first language processes would mean the use of common first language acquisition processes, such as deletion, in the shaping of the syllable structure. And finally, universal processes would mean that the interlanguage syllable structure would be influenced by the universal preference for the open CV syllable. The results yielded by this study indicate that language transfer was perhaps the most dominant process affecting the syllable structure of interlanguage phonology. Epenthesis and deletion were employed by the learners as a way to simplify syllable structure. The choice of the strategy used by the learners seemed to be directly related to their first language. Brazilians, for instance, applied epenthesis instead of deletion. Another interesting factor observed by Tarone was the preference learners showed for the CV open syllable in shaping the interlanguage syllable structure. All these factors contributed to the differences detected between the syllable structure of the interlanguage and that of the target language.

Anderson (1987a) also conducted a study on the syllable. The Markedness Differential Hypothesis was applied in order to predict the relative frequency of errors of learners of two dialects of Chinese (Amoy and Mandarin) and of colloquial Egyptian Arabic in their production of English. The predictions made by the MDH were in terms of the length of the clusters and their positions within the syllable, since these languages differ from English in both respects. Neither of the Chinese dialects allows clusters in initial or final positions. In addition to that, there are restrictions concerning what consonants may occur in final position. Colloquial Egyptian Arabic, on the other hand, allows clusters only in final position. These clusters cannot consist of more than two consonants before a pause. Thus, for the Chinese groups final clusters are expected to be more difficult to learn since they are more marked than clusters in initial position. For the Arabic group no predictions can be made, since the language allows clusters only in marked position. The results of this study proved the MDH to be a good predictor of the performance of these learners in relation to syllabification, since the production of less marked shorter clusters was superior to that of more marked longer ones for both the Chinese and the Arabic group. Also, the Chinese group performed better on the unmarked initial clusters than they did on the marked final ones. Unmarked forms were well performed by both groups, regardless of the fact that they could be new to some of the learners. On the other hand, when forms were marked and new to some of the learners, the results differed.

Eckman (1987b) attempted to elucidate issues regarding interlanguage phonological rules, such as the constraints and limitations that govern these rules, their relationship with the TL and the NL phonological structures, and also the simplicity of interlanguages in relation to a certain TL. Word-final consonant cluster reductions produced by Japanese, Korean, and Cantonese learners of English served as the basis for the analysis of the interlanguage phonological rules. A certain systematicity was detected in the shortening of clusters these learners produced. For instance, when a tri-literal consonant clusters was reduced, it resulted in a less marked bi-literal form, i.e., in a fricative-stop or stop-fricative cluster instead of a stop-stop or fricative-fricative cluster. Bi-literal clusters, on the other hand, had equally either their first or second segment eliminated. Thus, the reduction of both types of clusters (tri-literal and bi-literal) showed that more marked forms were reduced to less marked ones. Based upon these facts, it can be said that the shortening of the clusters by these learners served as a means to approximate the phonetic representations of the IL to those of the NL. Concerning the simplicity of ILs in relation to a given TL, Eckman concluded that the forms found in the IL of these learners were relatively less marked than the TL forms. Regarding the constraints and limitations that govern ILs, results show that violations of universal principles on final bi-literal clusters occur only when such clusters are not the result of the shortening of a tri-literal cluster.

One interesting similarity between L1 and L2 acquisition is that of the application of universal principles. To illustrate this fact, Major (1987:215) mentions Donegan and Stampe's (1979) principles which govern fortition processes, such as epenthesis. Their first principle is that fortitions precede lenitions. Major exemplifies this principle by showing the behaviour of L1 learners in relation to /sC/ clusters. He states that a child often deletes the initial /s/ as in the word *spoon*- /spun/ -- [pũn] or insert a vowel [əspũn] or [səpũn] but never inserts a vowel after deletion (a lenition process) has occurred - /spun/ → [pũn] → *[əpũn]. Their second principle regarding fortitions is that they never occur twice on the same segment. Major (ibid:216) gives some examples of children learning English as their first language and Brazilians learning English as their second language concerning the production of /sC/ clusters. Children would produce [səpun] or [əspun] but perhaps never *[əsəpun]. Also, Brazilian learners would produce [ispun] or [əspun] but rarely if ever *[isipun] or *[əsəpun]. The oral production of both groups of learners (L1 and L2) demonstrates one phenomenon of language speech, vowel epenthesis, that could be considered either a developmental or an interference process within Major's theory. According to his findings, interference processes predominate at the early stages of L2 acquisition at the expense of developmental processes, which appear at later stages. In L1 acquisition, on the other hand, only developmental processes are to be found.

The acquisition of second language syllable structure was also investigated by Ross (1994) who analysed two phenomena present in the interlanguage of Japanese EFL learners of English. The first phenomenon was the preference learners showed for open syllables as demonstrated in the use of paragogic epenthesis. The second was the developmental process of apocopation of final segments in first language words.

Ross (ibid: 3) observed that learners applied the process of epenthesis, paragoge, in order to make the target language word conform with the syllable structure of Japanese. This meant transfer of syllable structure constraints of the first language to the second language. The process of apocopation, on the other hand, appeared at a later stage in the interlanguage of these learners when they already had some fluency in the language and had acquired some of the stress rules of English. Thus, Ross (ibid) concluded that learners attempted to suppress open syllables in the second language due to the influence the acquisition of L2 stress rules exerted on syllable structure constraints. The appearance of epenthesis (a transfer process) at the early stage of acquisition and of apocopation (a developmental process) at a later stage, supports Major's (1987) claim that interference processes predominate at early stages of acquisition at the expense of developmental processes which appear at later stages (Ross, ibid :5)

2.5.2- Studies focusing on strength relations within and across syllables

Tropf (1987) analysed the production of single syllable final consonants and of initial and final consonant clusters in the interlanguage of 11 Spanish learners of German. The main focus of the study was to verify if L2 phonological acquisition is influenced by the sonority factor, specially considering the variability that may occur in the IL of learners. Not only was the difference in terms of the syllable structure of both languages observed, but also the relevance of sonority in the integration of co-occurrent variants. That is to say, there was an interest in verifying the connection of the feature "sonority" with the fact that certain "free" variants occur more often and cannot be explained based upon the differences between he native language and target language. The results provided by this study demonstrated that the sonority factor influenced the choice for certain variants in the production of initial and final clusters and of syllable final consonants, regardless of the syllable structure condition of both the NL and the TL. For instance, in the production of syllable initial plosive-fricative clusters /pf/ and /ts/, learners showed a preference for fricatives to plosives. Whenever a plosive was realised a fricative was also produced. Tropf (ibid:187) could not explain this phenomenon in relation to NL or TL influence. Further evidence in support of the sonority hierarchy as an explanation for the results was demonstrated in the production of the syllable initial cluster /tsv/. Whenever a plosive variant occurred, two fricatives were also realised in the same cluster. And the realisation of a sibilant involved the realisation of a [v]. Tropf (ibid) could not say whether the regularities presented were due to the sonority factor alone, or also to the fact that the clusters were in conformity with the canonical syllable structure of the TL. It can be said, though, that the facility learners have in acquiring a TL form is related to the degree of sonority of single consonants and of the components of consonant clusters in a given context. In this particular study Tropf (ibid) did not control for environment, the sonority relations mentioned here are those within the syllable, i.e., within the given clusters.

One study which takes phonological environment into account is that of Carlisle (1991). He verified the performance of Spanish learners of English in relation to the production of three-member initial clusters of the type /sC/, where C was a voiceless stop. His main objective was to check if the frequency of epenthesis of these learners was influenced by the environment which preceded the onsets. Results demonstrated that subjects used epenthesis more often after word-final consonants than word-final vowels. Thus, strength relations across syllables seem to have affected the oral production of these learners.

2.5.3- Studies focusing on the principles and parameters of UG

Young-Scholten (1994) conducted a study in L2 acquisition to verify whether second language learners have access to the principles and parameters of UG (Universal Grammar). She commented on the results obtained by some studies (Broselow, 1987; Broselow and Finner, 1991) and the extent to which they supported the view that UG is directly accessible in L2 acquisition; that learners' ILs conform to its principles and also that parameters can be reset. The question posed by Young-Scholten (ibid:195) research was, then, why only a very limited number of L2 learners acquire the target language phonological system completely if the principles of UG are accessible and parameters can be reset.

One of the principles of sonority, the sonority sequencing generalisation, was discussed by Young-Scholten (ibid) in relation to the choice of placement of the epenthetic vowel by Egyptian Arabic learners in Broselow's (1987) study. The fact that these learners were sensitive to the violations of the sonority hierarchy in some of the initial /sC/ clusters, showed that phonological principles of UG are still accessible to second language learners. The minimal sonority distance parameter was also discussed in relation to Broselow and Finner's (1991) study. In this case, learners reset this parameter at an intermediate stage in relation to the NL and the TL, i.e., the new parameter setting allowed more clusters than permitted in their first language but less than permitted in the second language. Young-Scholten (ibid:198) explained that lack of complete L2 phonological attainment is related to some learnability considerations which go beyond parameter resetting and access to the principles of UG.

Thus, the Subset Principle was examined in order to explain these differences in L2 phonological attainment. The basis for this explanation is related to the fact that when a learner must acquire the superset, a less restricted grammar, in the L2 and has the subset, a more restricted grammar, in the L1, s/he is at disadvantage. The opposite occurs when the subset has to be acquired in the L2 and the learner has the superset in the L1. In this case, the learner is at an advantage. In order to obtain more conclusive results, Young-Scholten claims that further research is necessary in the field involving EFL learners at the final stage of acquisition.

Chapter 3- Method

3.1- Hypotheses

Universal principles, strength relations within the syllable and syllable contact are the key elements to be taken into consideration in this research in order to predict the behaviour of Brazilian EFL learners in relation to the production of initial /s/ clusters in English. The Markedness Differential Hypothesis (MDH) and the Structural Conformity Hypothesis (SCH) will be used as predictors of the difficulties learners are to be confronted with in terms of the length of initial clusters, and of strength relations both within and across syllables.

Anderson (1987a:283) claims that longer clusters are more marked than shorter clusters, therefore, more difficult to be acquired. This statement leads to the elaboration of the first hypothesis, i.e., that due to the effect of universal syllable structure, learners will have greater difficulty in producing initial three-segment clusters than two-segment ones.

Hooper (1976:206) proposes a universal strength hierarchy of segments by natural classes and establishes the positions each of these segments can occupy within the syllable, which in turn means that these elements relate to each other and are directly interwoven within the structure of the syllable. The second hypothesis, based on this aspect of the syllable, states that due to the effect of strength relations within the syllable, learners will have greater difficulty in producing initial /s/ clusters which violate the sonority hierarchy principle within the syllable than those clusters which do not.

Hooper's (1976:220) principle of strength relations across syllables, which was further reformulated by Murray & Venneman (1983:520), will serve as the basis for the third hypothesis, which involves phonological context. This hypothesis states that due to the effect of strength relations across syllables, learners will have greater difficulty in producing initial /s/ clusters preceded by segments of greater or equal strength value than those preceded by segments of lesser strength value.

3.2- Subjects

Six subjects from English extra-curricular courses at UFSC were selected to take part in this experiment. The levels of instruction chosen were 3, 6 and 9 respectively, and two subjects were selected from each of these levels. The reason for having selected subjects from three different levels was to verify whether their level of instruction influenced their performance. Only one out of these six subjects was a female, and their ages ranged from 19 to 31 years old. All of them were university students enrolled in different courses at UFSC. Their experience as EFL learners varied from 1 to 8 years of instruction at private institutions. None of these subjects had ever spent any time abroad. They were considered by their teacher to be average students within their groups in relation to the accuracy of their pronunciation, and none of them spoke any other language fluently apart from Portuguese.

The fact that only six subjects participated in this research is related to the large number of phonological contexts included in the corpus and also to the limited scope of this study, since it is a Master's thesis. A larger number of subjects would certainly make results more reliable, but the large number of examples per consonant found in the corpus somehow make up for the small number of subjects.

3.3- Material

Isolated sentences were chosen as opposed to free speech, a common procedure in phonological research, in order to ensure that all relevant phonological contexts were included in the corpus. The corpus consisted of a total of 312 sentences distributed as follows. Each of the seven two-segment /s/- clusters / sl, sw, sp, st, sk, sm, sn / and five three-segment /s/- clusters / spr, str, skr, spl, skw / was contextualized in 312 sentences, in each of which the cluster was preceded by a different phonological context including all of the 21 consonants /p, t, k, s, f, ʃ, θ, b, d, g, z, v, ʒ, ð, m, n, ŋ, ɹ, l, tʃ, dʒ/, two of the six vowels/diphthongs /i, u, oʊ, aɪ, aʊ, ɔɪ/ (varied at random) and silence (i.e., when the /s/-cluster was at the beginning of the sentence.

The establishment of different contexts was an essential feature of the corpus because of the objective of determining under which circumstances an epenthetic vowel was more likely to occur in the speech of these EFL learners. Final consonant clusters in the context words were avoided in order not to complicate the syllable structure at the boundary of the words under investigation. Also, reduced vowels were avoided in the context since they would make it more difficult to tell whether epenthesis had occurred or not.

Since the pronunciation of one sentence may affect the pronunciation of the following, each subject was given a different sequence of sentences to be read. Thus, similar mistakes related to the sequence of sentences would be avoided amongst subjects. In addition to that, special attention was paid to alternating clusters of the same type and similar environments, so that they would not occur in a row. This was a way to keep subjects from perceiving the purpose of the study as well as to avoid the influence of one cluster or context on the following one.

3.4- Procedure

A pilot test was conducted prior to the data collection itself in order to ensure that the procedures established were correct and efficient. Although no major alteration had to be made in the original set of procedures, this test helped the researcher be more certain that neither time nor subjects would be wasted due to its possible mishandling.

Subjects were recorded individually reading the 312 sentences, on a small Sony cassette recorder, in a quiet room of the Centro de Comunicacao at UFSC. The time spent for each recording varied from 30 to 50 minutes, depending solely on the subject. Subjects were first asked questions regarding personal information such as age, EFL experience as a learner, level of education, time spent abroad, and command of any other language besides Portuguese. After this short interview, instructions were also given in Portuguese concerning how the test would work. Subjects were then informed that the test consisted of four sittings and that they would have to read aloud approximately 78 sentences in each of them. A two-minute interval was allocated between the sittings to give them a little rest. Subjects were asked to cover the sentences they had read in order not to get lost. They were not allowed to read the test beforehand, but they were made aware of the fact that many of the words in the text could be unknown to them in terms of meaning as well as pronunciation, but that for the purpose of the research it was not necessary to be acquainted with all of them. Subjects were also asked to make a pause between sentences and to repeat the entire

sentence whenever they hesitated ; since only their last attempt would be considered.

3.5- Transcriptions

In relation to the transcriptions, only the target word and the word supplying the context were transcribed. Because of the large amount of work involved in analysing the data, it was impossible to find another rater to make the data more valid. However, the researcher had been previously well trained in transcription and every sentence was listened to several times before making a decision as to whether epenthesis had occurred or not. An acoustic analysis was not necessary in this study, since what was taken into consideration was the perception of the listener. It would be necessary in studies focusing on detecting epenthesis not perceived by the listener.

The lack of fluency in the subjects' speech and the change in the vowel quality, facilitated the perception of the epenthetic vowel, specially when the vowel /i/ occurred in the position of environment.

Chapter 4- Results and Discussion

This chapter is comprised of the results and discussion concerning hypotheses 1, 2 and 3. The analysis of the results obtained for these hypotheses did not take into consideration the /sw/ cluster, since none of the subjects inserted a vowel before this structure, although some subjects substituted the high vowel /u/ for the glide /w/, causing, for example, the bisyllabic English word *sweater* /swɛ.təɹ/ to be pronounced with three syllables : /su.ɛ.təɹ/. By excluding /sw/ from the analysis, the variable transfer was not confounded with the variable cluster length. Of all clusters investigated in this study, /sw/ is the only one that also occurs in Portuguese ; The only difference is that its second element can be either the glide /w/ or the vowel /u/, depending on the dialect spoken. For instance, the name *Sueli* may be pronounced either as /su.e.li/ or as /swe.li/.

4.1- Epenthesis by class level

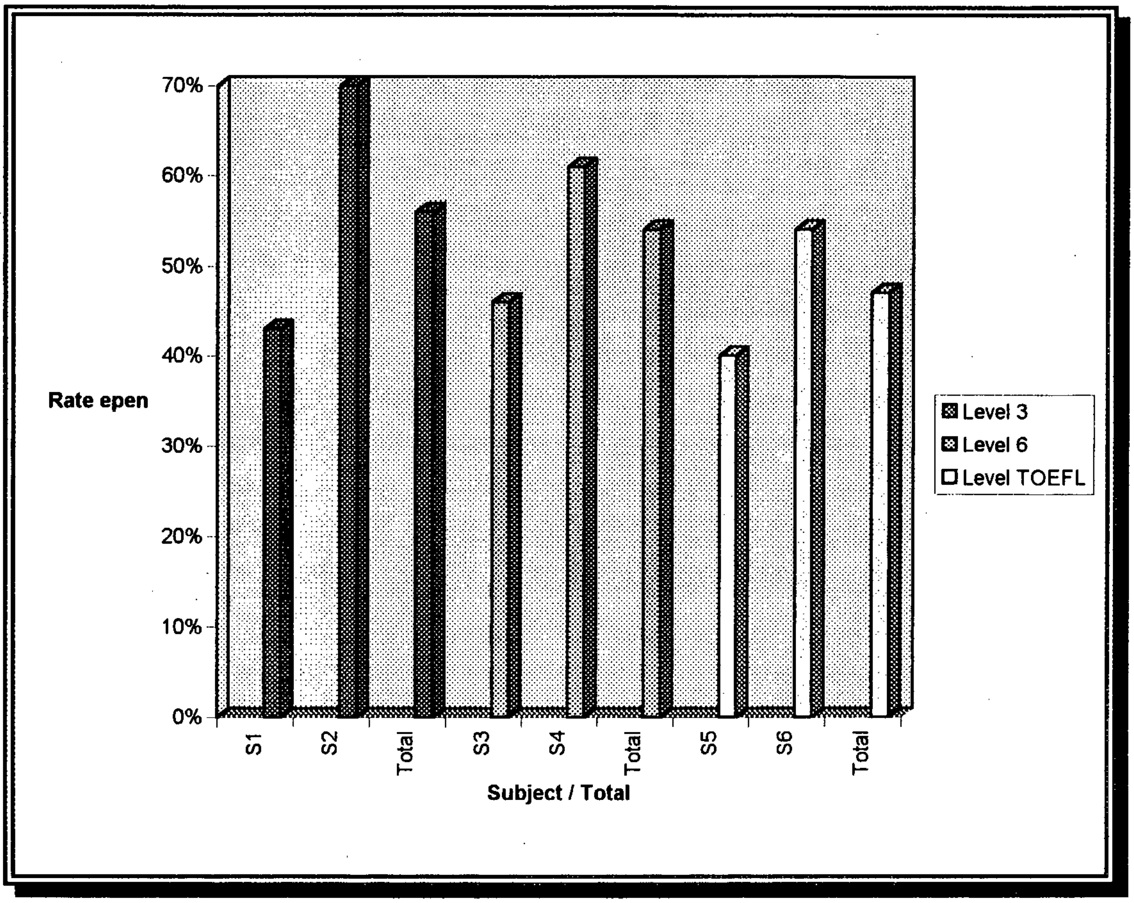
Three levels of instruction (3, 6 and TOEFL) were dealt with in this research. Table 1 and Figure 1 show that for each of the levels there is a low and a high rate of epenthesis. The lowest rate, 40%, comes from level TOEFL (subject 5), followed by

43% from level 3 (subject 1), then by 46% from level 6 (subject 3), 54% from level TOEFL (subject 6), 61% from level 6 (subject 4), and finally by 70% from level 3 (subject 2). The results of both subjects within each level collapsed together show that there was very little difference amongst the total rates of epenthesis. Level 3 was only two percentage-points higher than level 6 and nine percentage-points higher than level TOEFL Level 6 was only seven percentage-points higher than level TOEFL. The results indicate that the levels had no relation to the rates of epenthesis, since the difference amongst the total rates of epenthesis was rather small and probably not statistically significant . Thus, no claim can made in this study concerning the influence of level of instruction on the production of English initial /s/-clusters.

Table 1 : Rate of epenthesis by level

	Level 3			Level 6			Level TOEFL		
	S1	S2	Total	S3	S4	Total	S5	S6	Total
N° prod's	312	307	619	310	309	619	312	307	292
N° epen	133	216	349	143	190	333	125	167	292
Rate epen	43%	70%	56%	46%	61%	54%	40%	54%	47%

Figure 1 : Rate of epenthesis by level



4.2 Analysis of /sC/ clusters vs. /sCC/ clusters

This section reports the results concerning the first hypothesis, which, based on Anderson (1987:283), states that because longer clusters are more marked than shorter ones, they will be more difficult to produce. Two types of analysis were carried out in order to compare the subjects' production of /sC/ clusters in opposition to /sCC/ ones.

First, the percentages of error committed in the production of these bi-literal and tri-literal consonant clusters were calculated in broad terms, i.e., without focusing on the elements which make up these structures. This analysis is reported in 4.2.1.

The second type of analysis consisted of a comparison of each two-segment cluster with the three-segment cluster composed of the same second element. Specifically, /sp/ clusters were analysed in relation to /spɹ/ and to /spl/ clusters, /st/ clusters in relation to /stɹ/ clusters, and /sk/ clusters in relation to /skw/ and /skɹ/ clusters. This procedure comparing pairs of clusters with the same second element, was important to eliminate the influence of other phonotactic variables. The results of this analysis are reported in 4.2.2.

Results in relation to the subjects' production of all /sC/ and /sCC/ clusters will be first displayed showing the different epenthesis rates obtained by each subject individually, and then summarised with all subjects together. Epenthesis rates are expressed in percentages, calculated by dividing the number of occurrences of epenthesis within each cluster type by the total number of sentences involving that particular type of cluster. Mispronunciations not involving vowel epenthesis, i.e., a small number of consonantal insertions not counted, since they did not serve to simplify syllable structure, but rather were probably caused simply by distraction or other non-linguistic factors.

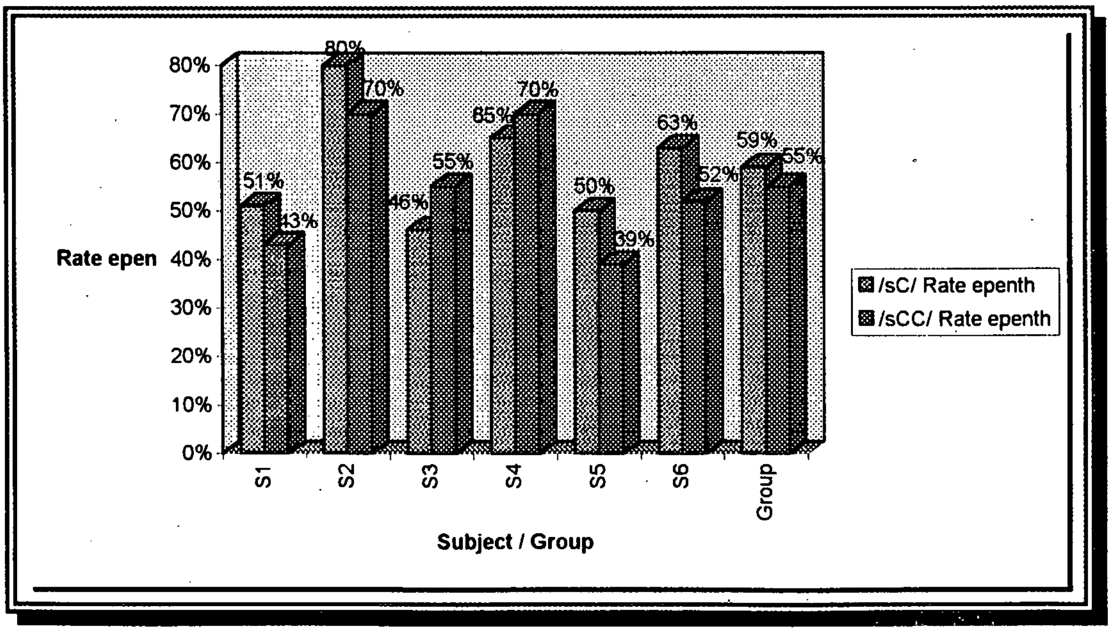
4.2.1. General analysis of clusters independent of components

The results concerning the individual performance of the six subjects and of the group as a whole are displayed in Table 2 and Figure 2 below. Four subjects (1, 2, 5 and 6) produced more epenthesis with /sC/ clusters than with /sCC/ : subject 1 had epenthesis rates of 51% and 43% respectively, subject 2 rates of 80% and 70%, subject 5 rates of 50% and 39%, and subject 6, 63% and 52%. Subjects 3 and 4, on the other hand, produced less epenthesis with /sC/ clusters than with the /sCC/ clusters : their rates of epenthesis were 46% and 55% (subject 3) and 65% and 70% (subject 4). The group results in the bottom line also show a greater rate of epenthesis for the /sC/ clusters in opposition to /sCC/. Vowel epenthesis occurred in 55% of the sentences with /sCC/ clusters and 59% with the /sC/ clusters. In sum, contrary to the expectations of hypothesis 1, Table 2 and Figure 2 below show that there was very little difference between the total rate of epenthesis for /sCC/ clusters and the total rate for /sC/ clusters. The former actually being four percentage-points lower. In fact, only two of the six subjects had a higher rate of epenthesis for the tri-literals. Therefore, it cannot be said from these data that the tri-literal clusters caused more difficulty.

Table 2 : Rate of epenthesis by subject and by group

	/sC/			/sCC/		
	N° prod's	N° epen	Rate epen	N° prod's	N° epen	Rate epen
S1	156	79	**51%**	130	56	**43%**
S2	154	124	**80%**	128	90	**70%**
S3	155	71	**46%**	130	72	**55%**
S4	153	99	**65%**	130	91	**70%**
S5	155	77	**50%**	129	50	**39%**
S6	156	98	**63%**	130	68	**52%**
Group	929	548	**59%**	777	429	**55%**

Figure 2 : Rate of epenthesis by subject and by group



4.2.2- Analysis of clusters, grouped by second component

A comparison of the second element of the cluster was paramount to this part of the analysis. It helped make the results more reliable, since intrinsic characteristics of these bi-literal and tri-literal clusters were taken into consideration. Results concerning rates of epenthesis are discussed by cluster type, first, in terms of individual subjects and, then summarised, in terms of the group.

4.2.2.1 Cluster /sp/ vs. cluster /spC/

Table 3 and Figure 3 below illustrate the individual and group frequencies of epenthesis regarding clusters /sp/ and /spC/. Two subjects (1 and 5) did worse with the /sp/ cluster than with the /spC/ clusters /spl/ and /spɹ/. The frequencies of occurrence of epenthesis for subject 1 were 54% for the /sC/ structure and 48% for the /sCC/ clusters, and for subject 5 the frequencies were 54% and 43% respectively.

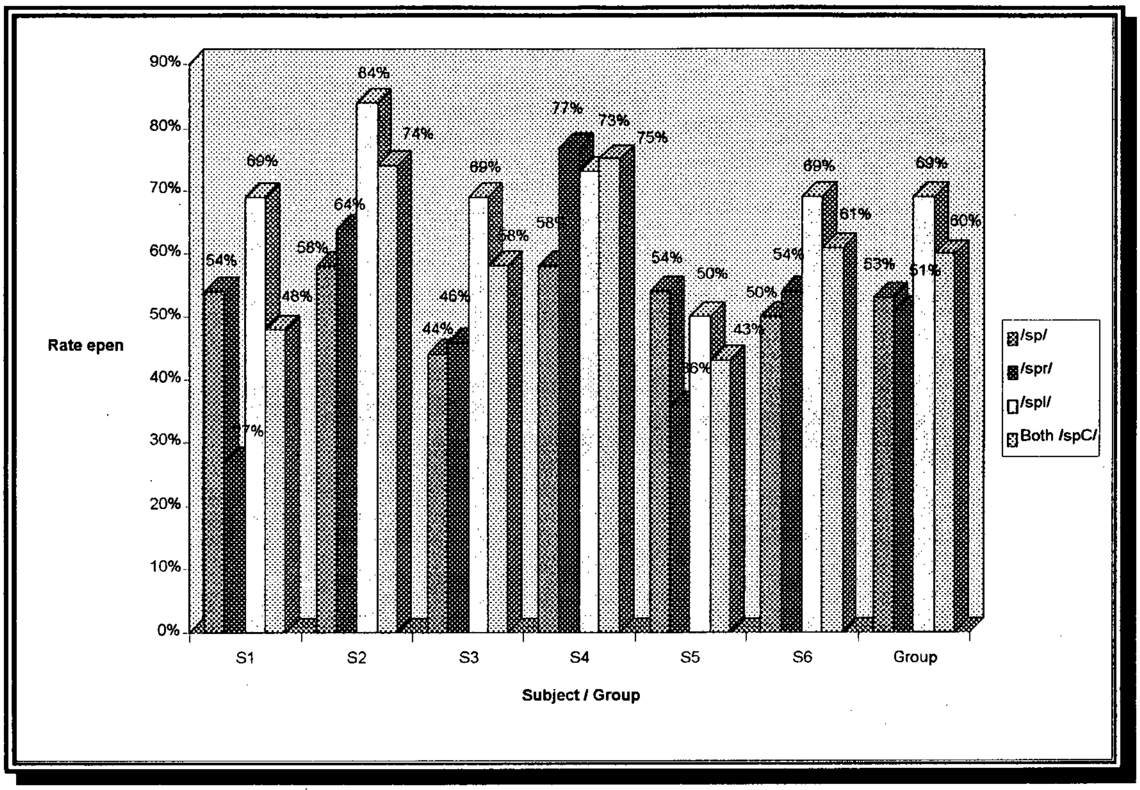
Four subjects (2, 3, 4, and 6) produced less epenthesis before /sp/ than before the /spC/ clusters. The frequencies of epenthesis for subject 2 were 58% before cluster /sp/ and 74% before clusters /spC/, for subject 3 the frequencies were 44% and 58% respectively, for subject 4 they were 58% and 75%, and for subject 6, 50% and 61%.

The group rates corroborate the individual results showing that, on the whole, the difference between the total rate of epenthesis for /spC/ clusters and that for the /sp/ cluster was small (seven percentage-points lower for the /sC/ structure). Thus, it cannot be said from this small difference in the rates of epenthesis that tri-literal clusters were more difficult to produce than bi-literal clusters. The total frequency of epenthesis for /sp/ was 53%, for /spɹ/ 51%, for /spl/ 69%, and for both these /spC/ structures together 60%.

Table 3 : Individual and group rate of epenthesis of cluster /sp/ vs. cluster /spC/

	/sp/			/spɹ/			/spl/			Both /spC/		
	Prod	**Epen**	**Rate**	**Prod**	**Epen**	**Rate**	**Prod**	**Epen**	**Rate**	**Prod**	**Epen**	**Rate**
S1	26	14	**54%**	26	7	**27%**	26	18	**69%**	52	25	**48%**
S2	26	15	**58%**	25	16	**64%**	25	21	**84%**	50	37	**74%**
S3	25	11	**44%**	26	12	**46%**	26	18	**69%**	52	30	**58%**
S4	24	14	**58%**	26	20	77%	26	19	**73%**	52	39	**75%**
S5	26	14	**54%**	25	9	**36%**	26	13	**50%**	51	22	**43%**
S6	26	13	**50%**	26	14	**54%**	26	18	**69%**	52	32	**61%**
Gp	153	81	**53%**	154	78	**51%**	155	107	**69%**	309	185	**60%**

Figure 3 : Individual and group rates of epenthesis of cluster /sp/ vs. /spC



4.2.2.2 Cluster /st/ vs. cluster /stC/

The individual and group results of clusters /st/ and /stɹ/ are displayed in Table 4 and Figure 4. As we can see, subjects 1, 5 and 6 produced more epenthesis before the /sC/ structure. The frequencies of epenthesis for subject 1 were 46% for /st/ and 38% for /stɹ/, for subject 5 they were 36% and 35% respectively, and for subject 6, 54% and 46%.

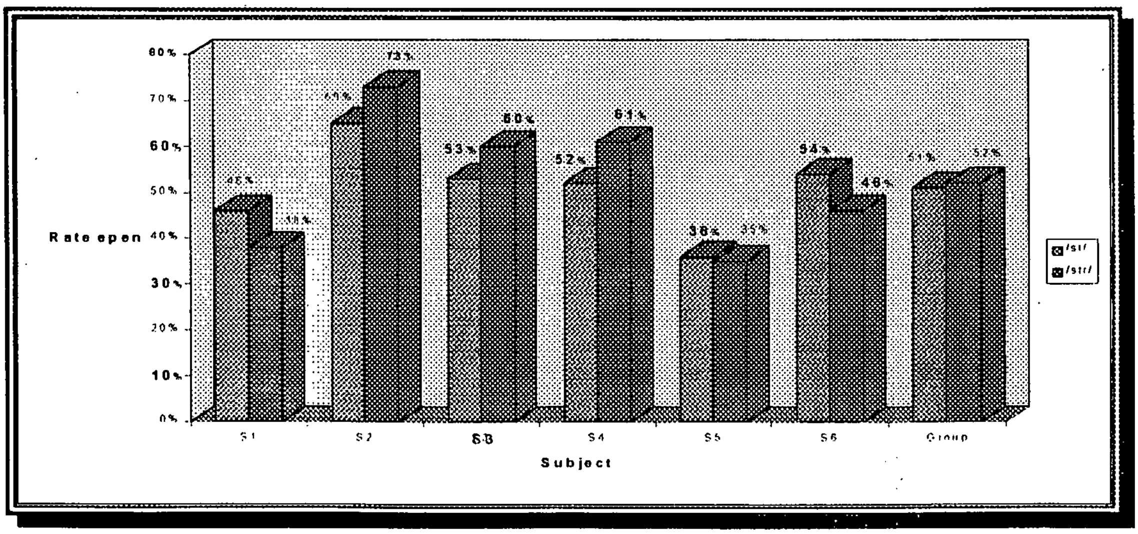
Subjects 2, 3 and 4, on the other hand, produced less epenthesis before /sC/ clusters than before /sCC/ clusters. The frequencies of occurrence of epenthesis for subject 2 were 65% before /st/ clusters and 73% before /stɹ/ clusters, for subject 3 the frequencies were 53% and 60% respectively, and for subject 4 they were 52% and 61%.

In regard to the group performance of clusters /st/ and /stɹ/, the /sCC/ structure caused only slightly more epenthesis (52%) than the /sC/ (51%). The /sCC/ structure was only one percentage-point higher than the /sC/. Also, the number of subjects who performed worse with the /sCC/ cluster was the same as that for the /sC/ cluster. Thus, it cannot be stated that /sCC/ clusters caused more epenthesis than /sC/ clusters.

Table 4: Individual and group rates of epenthesis of cluster /st/ vs. cluster /stɹ/

	/st/			/stɹ/		
	N° prod's	N° epen	Rate epen	N° prod's	N° epen	Rate epen
S1	26	12	**46%**	26	10	**38%**
S2	26	17	**65%**	26	19	**73%**
S3	26	14	**53%**	25	15	**60%**
S4	25	13	**52%**	26	16	**61%**
S5	25	9	**36%**	26	9	**35%**
S6	26	14	**54%**	26	12	**46%**
Group	154	79	**51%**	155	81	**52%**

Figure 4: Individual and group rates of epenthesis of cluster /st/ vs. cluster /stɹ/



4.2.2.3 Cluster /sk/ vs. clusters /skC/

The percentages obtained for clusters /sk/, /skw/ and /skɹ/, displayed in Table 5 and Figure 5, demonstrate that /sk/ caused slightly more epenthesis than the /skC/ structures. Four subjects (1, 2, 5 and 6) produced vowel epenthesis more frequently before the /sk/ structure than they did before the /skC/ clusters : their rates of epenthesis were 54% and 36% respectively for subject 1, 73% and 65% for subject 2, 61% and 36% for subject 5, and 69% and 48% for subject 6.

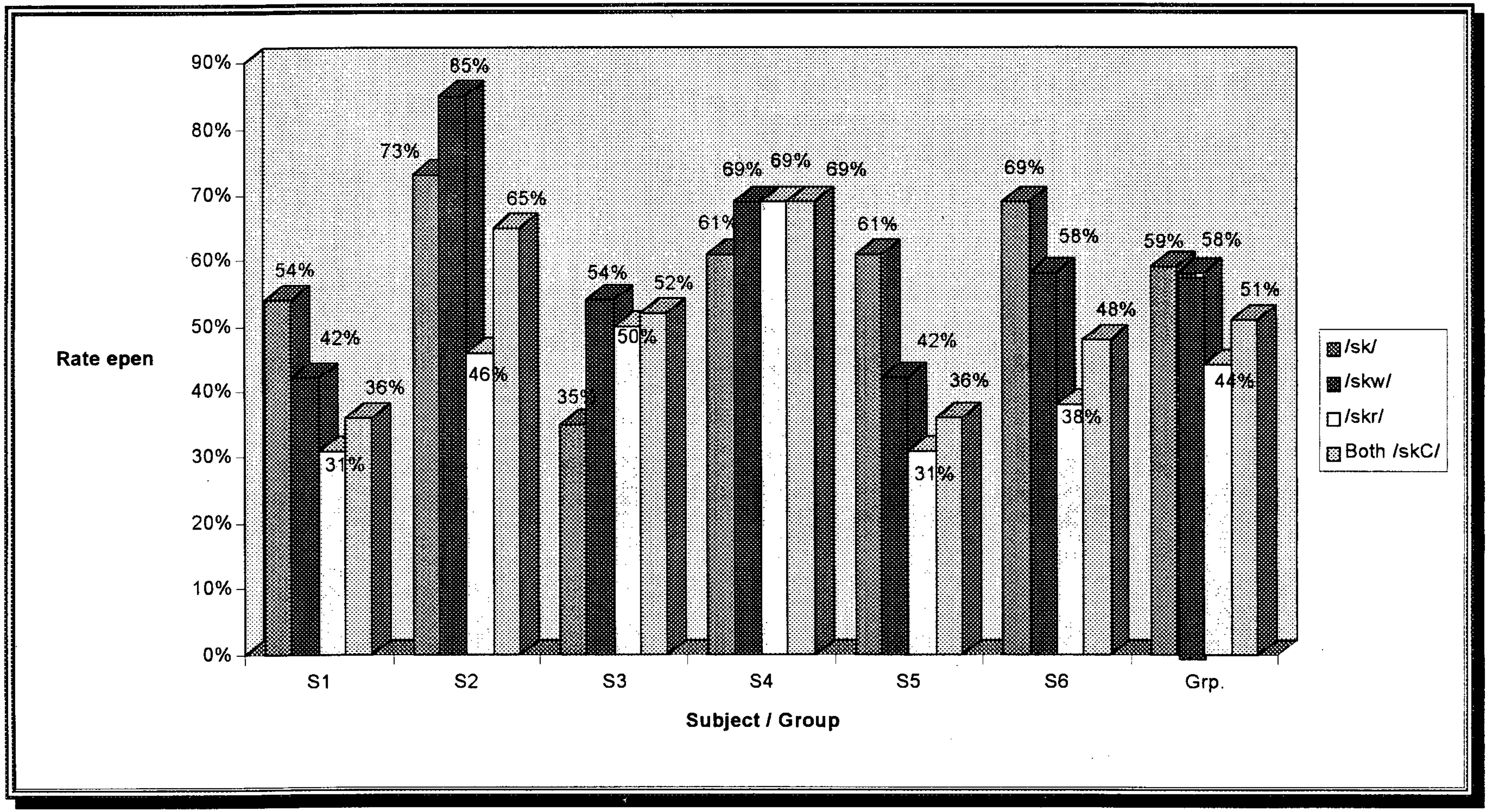
Only subjects 3 and 4 did better with /sk/ than with the /skC/ clusters : subject 3 produced rates of 35% and 52% respectively, and subject 4 rates of 61% and 69%.

The group results for clusters /sk/, /skw/ and /skɹ/ also show that there was very little difference between the total rate of epenthesis for the /sC/ structure and the total rate of epenthesis for the /sCC/ structures. The former actually being eight percentage-points higher. Although four of the six subjects had a higher rate of epenthesis for the bi-literal structure, the small difference in the total rates of epenthesis cannot be used to say that the /sC/ cluster was more difficult, but the results were certainly not in the expected direction of more frequent epenthesis for the /sCC/ cluster.

Table 5 : Individual and group rates of epenthesis of cluster /sk/ vs. /skC/

	/sk/			/skw/			/skɹ/			Both /skC/		
	Prod	**Epen**	**Rate**	**Prod**	**Epen**	**Rate**	**Prod**	**Epen**	**Rate**	**Prod**	**Epen**	**Rate**
S1	26	14	**54%**	26	11	**42%**	26	8	**31%**	52	19	**36%**
S2	26	19	**73%**	26	22	**85%**	26	12	**46%**	52	34	**65%**
S3	26	9	**35%**	26	14	**54%**	26	13	**50%**	52	27	**52%**
S4	26	16	**61%**	26	18	**69%**	26	18	**69%**	52	36	**69%**
S5	26	16	**61%**	26	11	**42%**	26	8	**31%**	52	19	**36%**
S6	26	18	**69%**	26	15	**58%**	26	10	**38%**	52	25	**48%**
Gp	156	92	**59%**	156	91	**58%**	156	69	**44%**	312	160	**51%**

Figure 5 : Individual and gronp rates of epenthesis of cluster /sk/ vs. /skC/



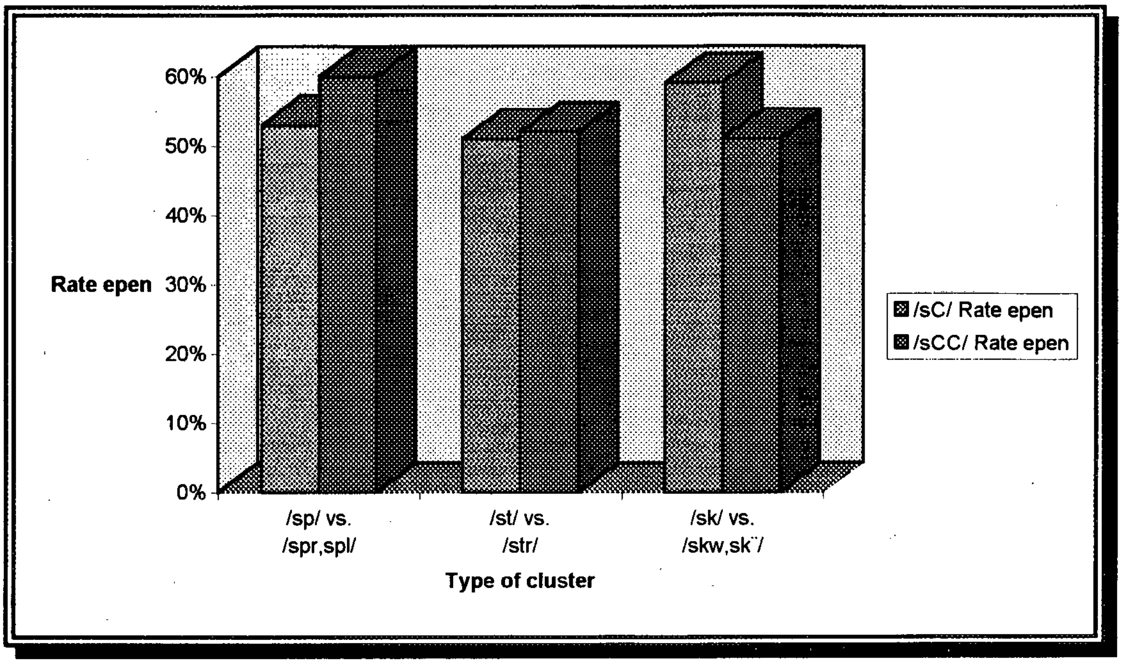
4.2.2.4- Summary of results

Although it was shown in the general analysis in 4.2.1. that the total rate of epenthesis for /sCC/ clusters was slightly less than for /sC/ clusters, Tables and Figures 3, 4 and 5, as well as the collapsed results of Table and Figure 6, show that the rates of epenthesis for the tri-literal structures were somewhat higher for two of the three groups of clusters. The differences in the rates of epenthesis, though, especially for the /st/ clusters, are rather small. In fact, what we have is a seven-percentage-point advantage for biliteral /sp/ clusters, an eight-point advantage for triliteral /skC/ clusters, and an almost identical rate for biliteral and triliteral /st/ clusters.

Table 6 : Group rates for all clusters

	/sC/			/sCC/		
	N° prod	N° epen	Rate epen	N° prod	N° epen	Rate epen
/sp/ vs. /spɹ, spl/	153	81	**53%**	309	185	**60%**
/st/ vs. /stɹ/	154	79	**51%**	155	81	**52%**
/sk/ vs. /skw, skɹ/	156.	92	**59%**	312	160	**51%**

Figure 6 : Group rates for all clusters



4.2.3 Discussion of /sC/ vs. /sCC/ clusters

The individual and group results obtained for analysis 1, where clusters were considered independent of their components, show that /sC/ clusters caused slightly more epenthesis than /sCC/, although the differences in the percentages were small. In analysis two, however, where bi-literal and tri-literal clusters were grouped according to their second component, we observed a balance in terms of number of subjects who produced more epenthesis before /sC/ clusters and before /sCC/.

In both analyses concerning hypothesis 1 the difference in the total rates of epenthesis was very small. Thus, the data provided were insufficient to state that /sC/

clusters caused more epenthesis than /sCC/ clusters. The results clearly do not, however, support the hypothesis based on the MDH, that longer clusters are more difficult to acquire than shorter clusters (Anderson, 1987 :283). According to this hypothesis, /sCC/ clusters were expected to cause more epenthesis than /sC/ clusters, since neither occurs in Portuguese and this length of initial cluster is more marked in English. Thus, what these results seem to indicate is the need to consider other possible intralinguistic factors which may influence the frequency of certain phonological variants in the interlanguage of second language learners.

In relation to the Structural Conformity Hypothesis (SCH) (Eckman, Moravicsik, & Wirth 1989, in Eckman 1991), it is paramount to say that no data were collected in regard to some of the bi-literal subsequences of the tri-literal clusters /spɹ, spl, stɹ, skw, skɹ/. For instance, the subsequences /pɹ, pl, tɹ, kw, kɹ/ were not included in the corpus as initial clusters. The first reason for leaving them out was the fact that this study is concerned only with the production of initial /s/-clusters. The second reason had to do with the fact that these clusters exist in the L1, and would probably exist in the Interlanguages of these learners. The bi-literal subsequences /sp, st, sk /, which do not exist in the L1, were not frequently present in the subjects' interlanguages. The fact that /sC/ clusters caused slightly more epenthesis than /sCC/ clusters overall, although possibly not statistically significant, indicates that results were counter only to the strong version of the Resolvability Principle, since the presence of a tri-literal structure did not always imply the presence of both its bi-literal subsequences. Also, it was not possible to say from the data that neither subsequence of a given tri-literal cluster existed, but it was possible to say that for several subjects it was not true that both bi-literal existed before the tri-literal. The interlanguage of subject 5 illustrates this phenomenon, since the rates of epenthesis were 61% for the bi-literal structure-24% more than the 37% obtained for the tri-literal structure. Thus, the generalisation made by the Resolvability Principle (Greenberg, 1978 :11) held only for the primary language (English), but not for the interlanguages of the subjects, since /sCC/ clusters caused less epenthesis than /sC/ clusters..

So far, most studies concerning the syllable have not accounted for phonological environment, but rather have focused only on the learners' preference for a CV syllable in opposition to a CVC (Broselow, 1987a ; 1987b ; Tarone, 1987a ; Ross, 1994). There has also been a great concern with the length of clusters, i.e., markedness relations within onsets or/and codas. This is the case of Weinberger's (1987) study of final clusters, in which longer codas were more frequently modified than shorter codas, and also of Anderson's (1987a) study of both initial and final clusters, in which modifications of these structures occurred more often as the length of these clusters increased. Carlisle (1991) comments upon this and various other studies on initial and final clusters and suggests that their results should be taken cautiously since they lacked control of environment. Thus, the fact that environment was controlled in the present study seems to be a very plausible explanation for the difference in the results obtained. In the previous studies, the /sCC/ clusters might, by chance, have occurred in more difficult environments. In the present study all clusters occurred in the same environment.

In addition to the need for controlling for phonological environment, which has to do with strength relations across syllables, there is also a need for focusing on strength relations within the syllable. One study which takes into consideration this aspect of the syllable is that of Tropf (1987) on initial clusters. The only drawback in relation to the outcome of this study is the fact that, as in the other studies mentioned, environment was not controlled. Another limitation to her study, however, was the fact that she dealt only with the clusters not in violation of the Universal Canonical Syllable Structure.

The results of this study presented so far have demonstrated that markedness relations in terms of cluster length alone could not explain the relative frequency of epenthesis of these learners. Thus, it was decided to look at the interaction between markedness relationships in terms of cluster length and in terms of strength relations within and across syllables in order to complement this analysis. The importance of the interaction between these intralinguistic factors has been put forth by Carlisle (1994:246).

Besides the above explanations given for the different results obtained in this study, there is also the need to point out that little research in this field has examined the performance of Portuguese speakers (two studies which have : Tarone, 1987a; Major, 1987). Most studies have dealt with native speakers of Spanish (Carlisle, 1991 ;1994 ; Tropf, 1987), which according to Baptista (1987), has a less restricted syllable structure than Portuguese, and with speakers of various dialects of Arabic (Broselow, 1987a ; Anderson, 1987a). So not only may markedness relations within the TL have acted as an influencing factor on the outcome of these learners, but also markedness relations between the NL and the TL.

The focus of the following analysis will be on strength relations within the syllable, which was the key element for the elaboration of my second hypothesis.

4.3- The consonantal strength hierarchy within the syllable

My second hypothesis, based on Hooper's (1976 :206) claim, states that clusters which violate the Syllable Structure Condition within the syllable will cause more epenthesis than those which do not. In order to investigate this aspect of the syllable, clusters /sp, st, sk, spɹ, stɹ, skɹ, spl, skw/ were grouped as clusters in violation of this principle. The degree of strength of segments in these clusters does not decrease continually from the margin to the peak of the syllable, due to the fact that the fricative /s/ is more sonorant than stops. Clusters /sl, sm, sn/, on the other hand, were grouped as clusters not in violation of the consonantal strength hierarchy, since the degree of strength of the segments which comprise these clusters decreases from the margin to the peak of the syllable.

Epenthesis rates are expressed in percentages, as for the results of hypothesis 1, calculated by the total number of occurrences of epenthesis divided by the total number of sentences involving a particular cluster. Results will be first discussed on an individual basis then as for the group as a whole.

4.3.1- Analysis of /s/-clusters in violation of the Syllable Structure Condition (SSC) vs. /s/ clusters not in violation.

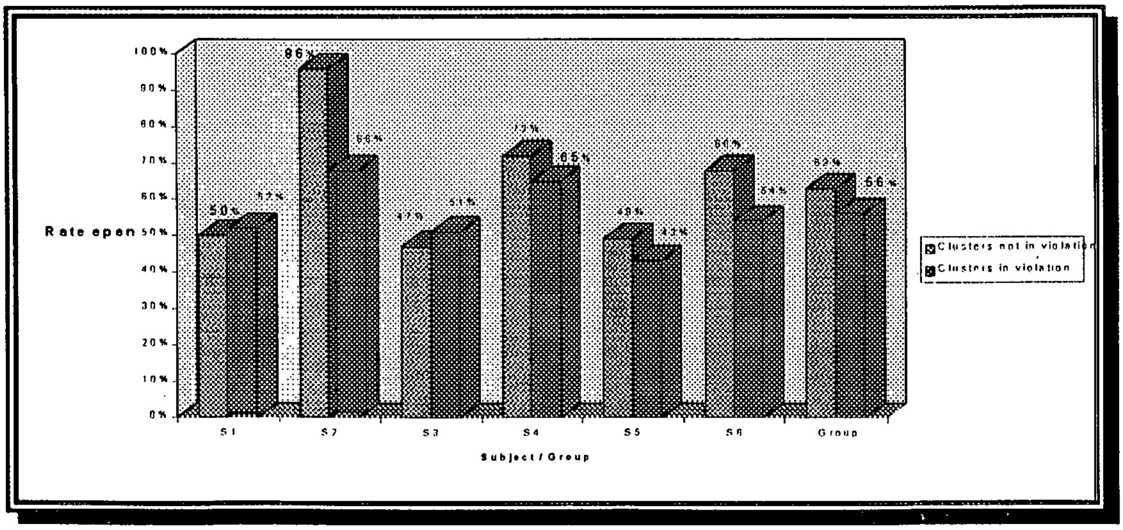
The results displayed in Table 7 and Figure 7 below show the subjects' individual frequency of epenthesis. Only subjects 1 and 3 produced more epenthesis before clusters in violation than before clusters not in violation. The rates of epenthesis for subject 1 were 52% and 50% respectively, and for subject 3, 51% and 47%. The majority of the subjects (2, 4, 5 and 6) produced less epenthesis before clusters in violation than before clusters not in violation. The rates of epenthesis for subject 2 were 68% and 96% respectively, for subject 4 rates were 65% and 72%, for subject 5 the rates were 43% and 49%, and for subject 6, 54% and 68%.

The group results in the bottom line are also not in the expected direction of more epenthesis before clusters in violation. In fact, the rate of epenthesis for clusters not in violation was actually seven percentage-points higher (63%) than for those in violation (56%), and four of the six subjects produced less epenthesis before clusters in violation. Although these differences have not been shown to be sufficient to say that clusters not in violation caused more epenthesis, the results certainly do not support the hypothesis based on the syllable structure condition (SSC), which predicted more epenthesis before clusters in violation.

Table 7: Individual and group frequencies of epenthesis for clusters in violation vs. clusters not in violation

	Clusters not in violation			Clusters in violation		
	N° prod's	N° epen	Rate epen	N° prod's	N° epen	Rate epen
S1	78	39	**50%**	182	94	**52%**
S2	76	73	**96%**	206	141	**68%**
S3	78	37	**47%**	206	106	**51%**
S4	78	56	**72%**	205	134	**65%**
S5	78	38	**49%**	206	89	**43%**
S6	78	53	**68%**	208	113	**54%**
Group	466	296	**63%**	1213	677	**56%**

Figure 7: Individual and group rates of epenthesis for clusters in violation vs. clusters not in violation



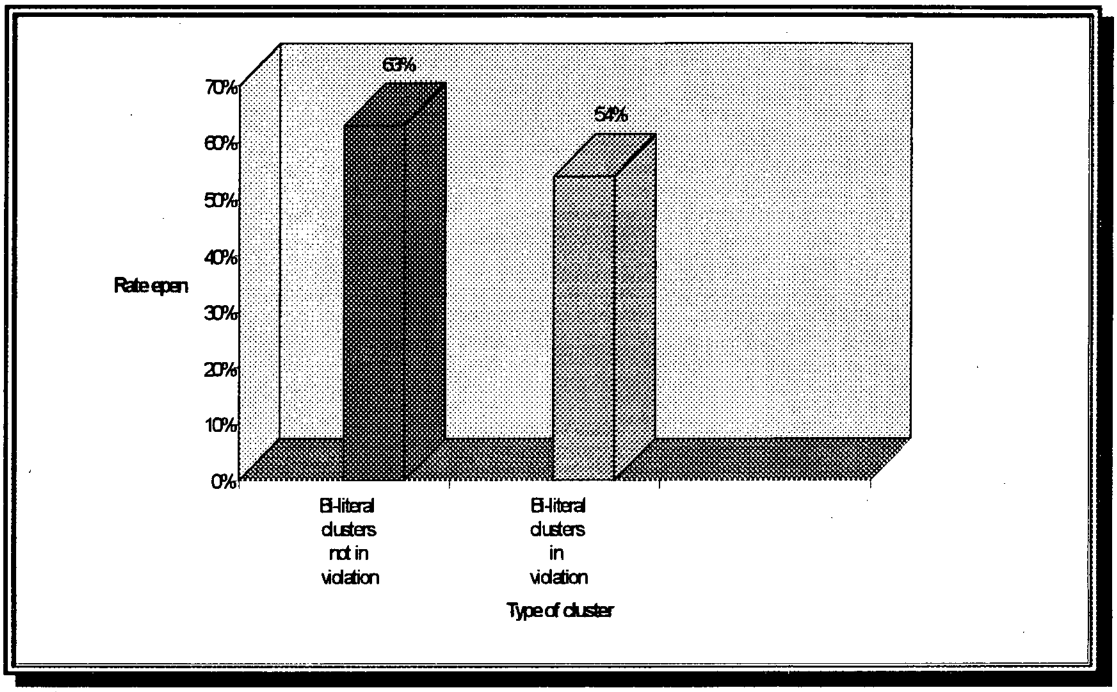
In order to verify whether the length of the clusters was an influencing factor on the general results mentioned above, an analysis was conducted comparing bi-literal clusters in violation of the universal strength hierarchy to bi-literal clusters not in violation. Also, tri-literal clusters, which are all in violation, were compared to biliteral clusters not in violation.

In the former analysis, shown in Table 8 and Figure 8 below, bi-literal clusters not in violation (/sm, sn, sl/) caused somewhat more epenthesis (63%) than bi-literal clusters in violation (/st, sk, sp/), 54%. Again, the difference between the total rates of epenthesis for these two groups of clusters may be insufficient to say that bi-literal clusters not in violation were more difficult, but the results were certainly not in the expected direction.

Table 8 : Frequency of epenthesis for bi-literal clusters in violation vs. bi-literal clusters not in violation

	Bi-literal clusters not in violation	Bi-literal clusters in violation
N° prod's	466	463
N° epen	295	252
Rate epen	**63%**	**54%**

Figure 8 : Frequency of epenthesis of bi-literal clusters in violation vs. bi-literal clusters not in violation

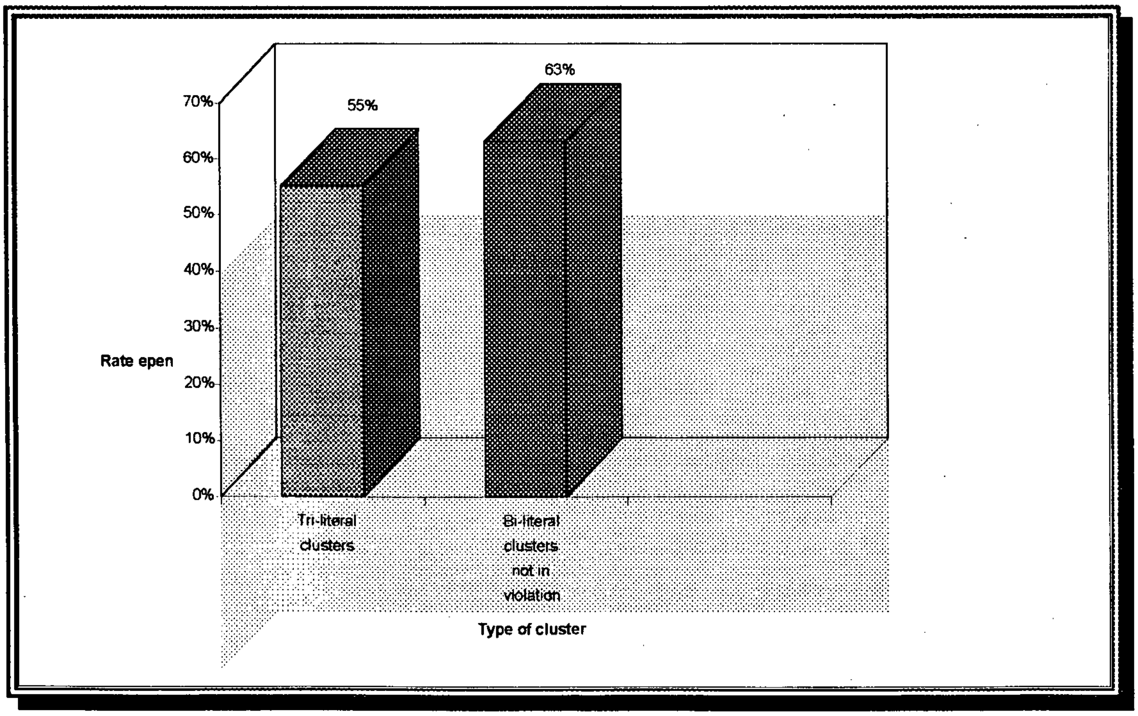


In the latter analysis, shown in Table 9 and Figure 9, the results were similar. While the tri-literals were expected to be more difficult because of their length and the fact that they are all in violation, the bi-literals not in violation actually caused more epenthesis (63%) than the tri-literals (55%). While this difference may not be statistically significant, the results again were certainly not in the expected direction.

Table 9 : Frequency of epenthesis for tri-literal clusters vs. bi-literal clusters not in violation

	Tri-literal clusters	Bi-literal clusters not in violation
N° prod's	776	466
N° epen	424	295
Rate epen	**55%**	**63%**

Figure 9 : Frequency of epenthesis for tri-literal clusters vs. bi-literal clusters not in violation



4.3.2- Comparison of /s/-nasal and /s/-liquid and homorganic advantage

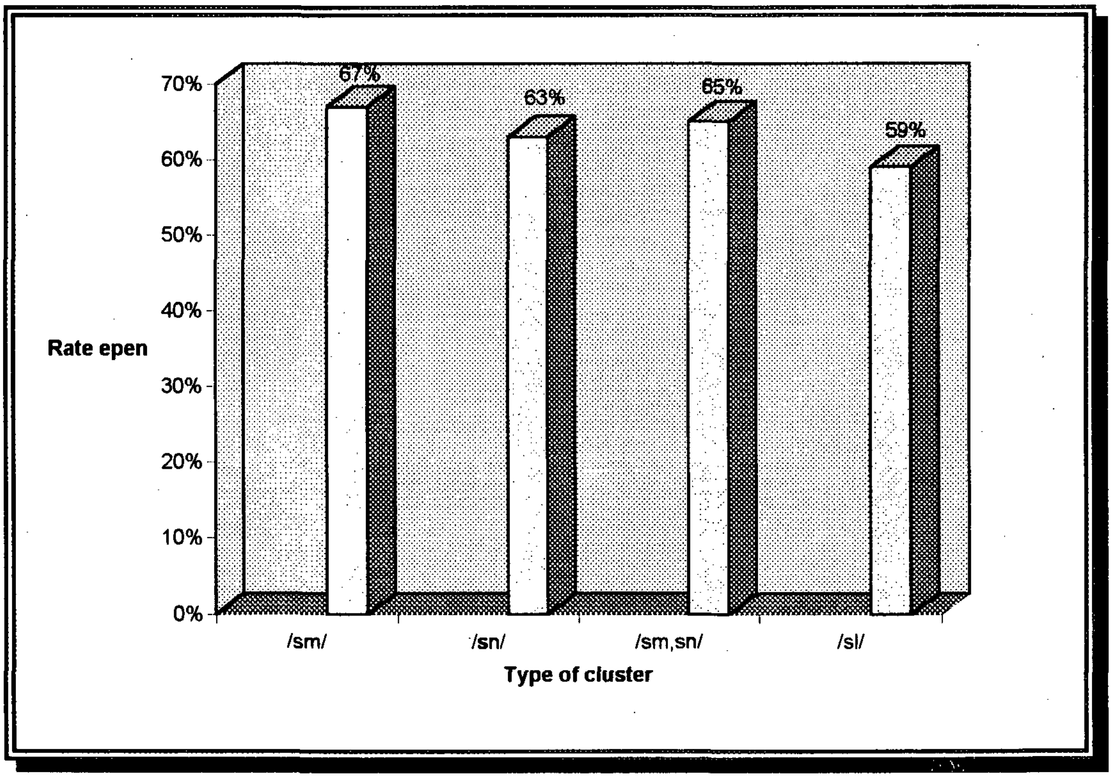
Although Hooper's Syllable Structure Condition (SSC) did not make the right predictions regarding /s/-stop vs. /s/-sonorant clusters, it did make the right predictions concerning /s/-nasal clusters, since the rates of epenthesis for the /s/-nasal clusters were somewhat higher than for the /s/-liquid clusters. This prediction was based on the fact that the difference in strength between the segment /s/ and /m/ or /n/ is smaller than that between /s/ and /l/ (Table 10 and Figure 10).

Homorganic advantage was investigated in regard to /s/-nasal clusters. Results of the whole group showed epenthesis rates of 67% for /sm/ and 63% for /sn/ (Table 10 and Figure 10). The difference between the total rate of epenthesis for the homorganic cluster /sn/ and the total rate for the heterorganic /sm/ was very small (a four percentage-points lower for /sn/). Therefore, no strong claim can be made about the homorganic cluster /sn/ being easier to produce than the heterorganic /sm/, although results are tending in the right direction according to the theory.

Table 10 : /s/-nasal vs. /s/-liquid clusters and homorganic advantage of /s/-nasal clusters

	/sm/	/sn/	/sm, sn/	/sl/
N° prod's	156	154	310	156
N° epen	104	97	201	92
Rate epen	**67%**	**63%**	**65%**	**59%**

Figure 10 : /s/-nasal vs. /s/-liquid clusters and homorganic advantage of /s/-nasal clusters

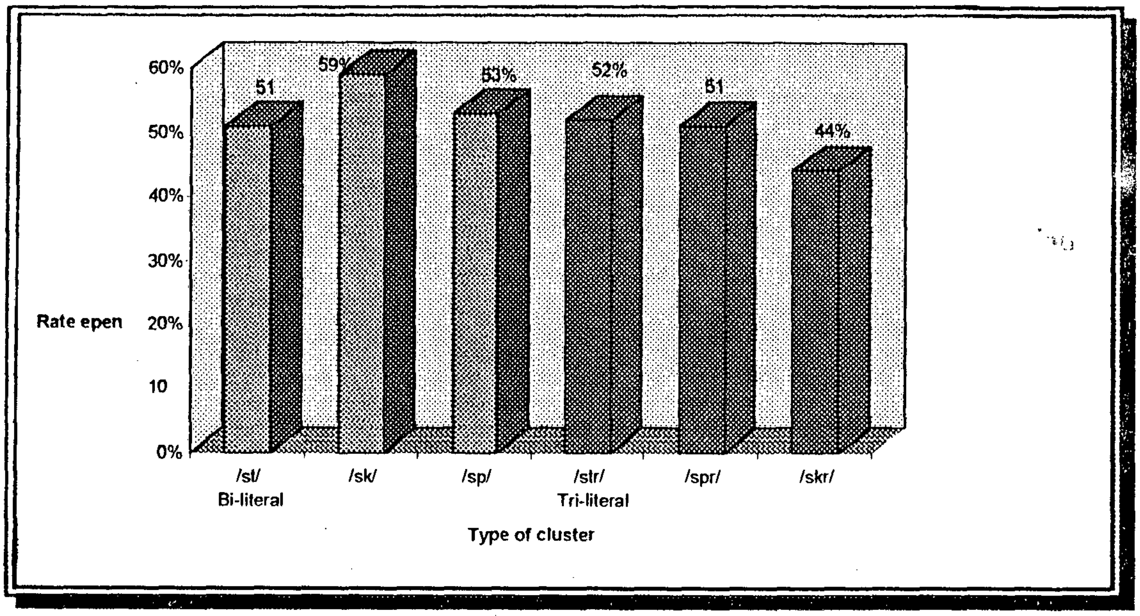


Homorganic advantage was also investigated in regard to clusters in violation of the universal strength hierarchy. Table 11 and Figure 11 display the results concerning bi-literal and tri-literal clusters in violation. Within the bi-literal group, /st/ produced the lowest rate of epenthesis (51%), followed by /sp/, 53%, and by /sk/, 59%. Again, as for the /s/-nasal clusters, there was very little difference in the total rate of epenthesis between the homorganic cluster and the total rate for the heterorganic clusters. The homorganic cluster was only two percentage-points lower than the heterorganic /sp/ and eight percentage-points lower than /sk/. Within the tri-literal group of clusters, there was also very little difference between the total rate of epenthesis for the homorganic cluster /stɹ/ (52%), and the total rates for the heterorganic /spɹ/ (51%) and /skɹ/ (44%). The homorganic structure was only one percentage-point higher than the heterorganic /spr/, and eight percentage-points higher than /skɹ/. As we can see, the results concerning homorganic advantage are probably not statistically significant, because of the small difference in the percentages obtained. Thus, we can only say that for the /s/-nasal clusters and for the bi-literal clusters in violation results seemed to tend in the expected direction according to the theory. In regard to the tri-literal clusters, results were not in the expected direction.

Table 11 : Homorganic advantage of bi-literal and tri-literal clusters in violation

	Bi-literal			Tri-literal		
	/st/	/sk/	/sp/	/str/	/spr/	/skr/
Nº prod's	154	156	153	155	154	156
Nº epen	79	92	81	81	78	69
Rate epen	**51%**	**59%**	**53%**	**52%**	**51%**	**44%**

Figure 11 : Homorganic advantage of bi-literal and tri-literal clusters in violation



4.3.3- Voicing assimilation of /s/-sonorant clusters

Because of a possible link to the unexpected results concerning clusters not in violation of the SSC, it was considered important to investigate the possible relationship between the voicing assimilation of /s/ and the rate of epenthesis. Tables 12 and 13 and Figures 12 and 13 show the results concerning the voicing assimilation of /s/-nasal and /s/-liquid clusters and the rates of epenthesis related to these structures. As we can see, in 59% of the clusters /sm/ and /sn/, the /s/ was voiced by the subjects, and, out of these, 82% were pronounced with epenthesis. A much lower rate of epenthesis (40%) was obtained in the productions without the voicing clusters. In this case, in 55% of the structures the /s/ was voiced by the subjects, and, out of this number, 73% caused epenthesis. Only 41% of the /s/-liquid clusters produced without the voicing of /s/ caused epenthesis. These results show that the voicing assimilation of these structures is apparently related to the high rates of epenthesis obtained for /s/-nasal and /s/-liquid clusters, but a statistical analysis would be necessary here in order to present more reliable results.

Table 12 : The voicing assimilation of /s/-nasal and /s/-liquid clusters and their corresponding rates of epenthesis

	/s/-nasal	/s/-liquid
N° prod's	310	156
N° + vd	183	86
Rate + vd	**59%**	**55%**

Figure 12 : The voicing assimilation of /s/-nasal and /s/-liquid clusters and their corresponding rates of epenthesis

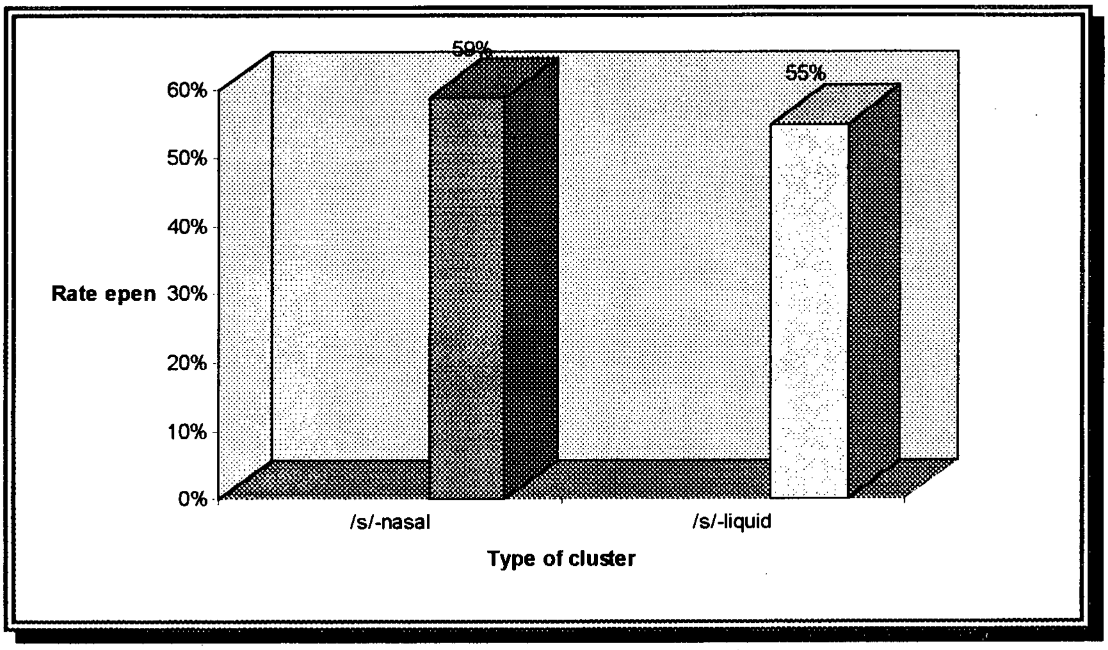
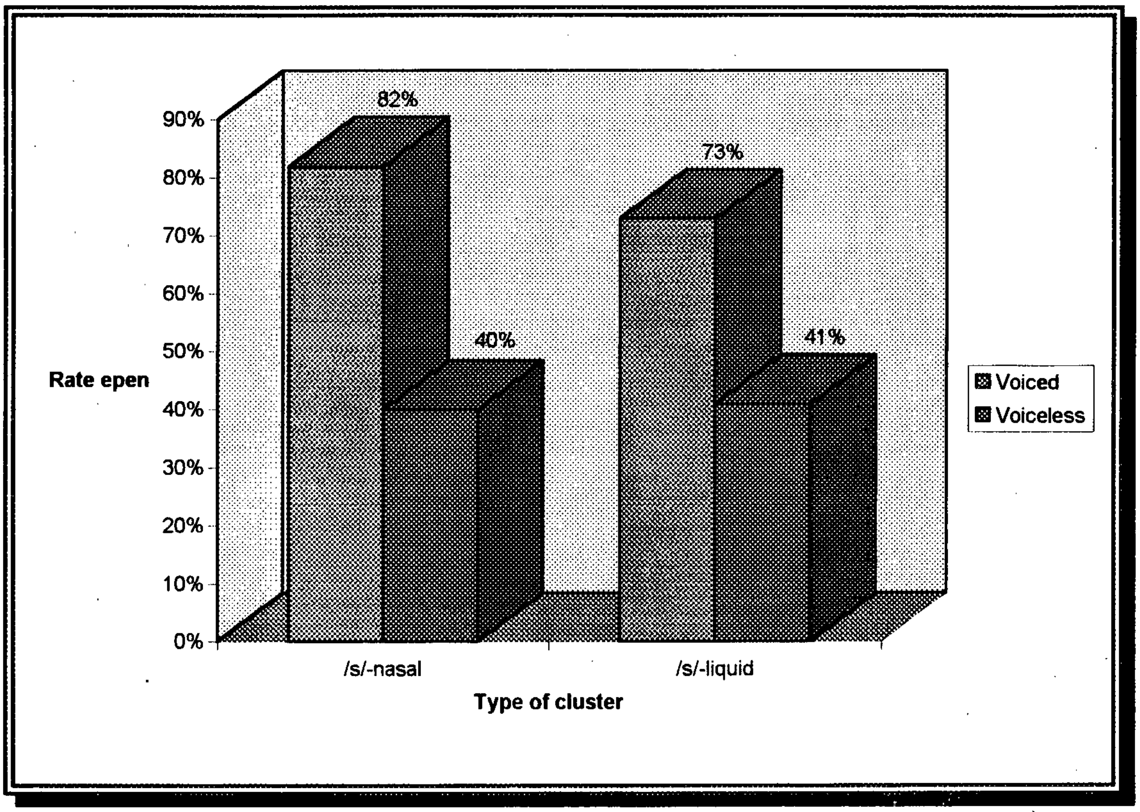


Table 13 : Rate of epenthesis by voicing

	/s/-nasal	/s/-liquid
N° [+vd]	183	86
N° epen	150	63
Rate epen	**82%**	**73%**
N° [-vd]	127	70
N° epen	51	29
Rate epen	**40%**	**41%**

Figure 13 : Rate of epenthesis by voicing



4.3.4- Discussion of clusters in violation vs. clusters not in violation

Both individual and group results concerning hypothesis 2 have shown that strength relationships within the syllable did not have the expected effect on the difficulty these learners found in handling initial clusters of two and three segments. In fact, /s/-nasal and /s/-liquid clusters actually caused more epenthesis than /s/-stop clusters, which violate the Syllable Structure Condition. As previously mentioned, a statistical test would be necessary for the results concerning /s/-nasal and /s/-liquid clusters.

A particular characteristic of Brazilian EFL learners was observed in the output of these subjects : the voicing assimilation of the segment /s/ in /s/-nasal and /s/-liquid clusters. Based on my own teaching experience, I have noticed that these clusters are usually troublesome to Brazilians, first, because they tend to voice this fricative, and, second, because the voicing assimilation of this fricative seems to be somehow linked with the placement of an epenthetic vowel. The voicing assimilation of /s/ can be attributed to L1 influence, since this sibilant is always voiced in Portuguese when preceding nasals or liquids, although in Portuguese they are always in separate syllables. The words *eslavo* /ez.la.vu/, *asma* /az.ma/, *desligar* /dez.li.gaχ/, *Oslo* /oz.lu/ illustrate this phenomenon. The results of this study seem to indicate that the voicing assimilation of /s/ somehow facilitates epenthesis, but this fact needs to be further investigated. The effect of voicing was not one of the original hypotheses and the test was not set up to test this hypothesis. A statistical analysis was not carried out. However, since the differences in the percentage were great, it does not appear quite likely that inappropriate voicing assimilation was related to the rate of epenthesis.

A possible explanation for this relationship is that voiced consonants are more marked than voiceless consonants, and therefore, are expected to cause more epenthesis. Silva (forthcoming) found that final voiced consonants caused more epenthesis than final voiceless consonants. Thus, the voicing assimilation of /s/ in /s/-nasal and /s/-liquid clusters may explain the fact that these structures were more frequently modified than the bi-literal and tri-literal /s/-stop clusters, since the stops found in /s/-stop clusters are all voiceless and cannot cause voicing assimilation. In fact, results obtained from the analysis of both these structures showed that the /s/ in the /s/-sonorant clusters was frequently voiced by the learners, and that epenthesis occurred at a much greater rate when /s/ was voiced.

The voicing assimilation of /s/ and its effect on the results obtained can be related to one of Greenberg's (1965 :23) generalisations : that voiceless obstruents are said to dominate over voiced obstruents in both clusters of obstruent + obstruent and clusters of obstruent + sonant. In other words, voiced obstruents are more marked than voiceless obstruents in these clusters. Although Greenberg is clearly referring to relationships within obstruent-obstruent pairs and within obstruent-sonant pairs, it is quite possible that across-cluster-markedness relationships concerning voicing assimilation exist besides. Thus, the voicing of /s/ in initial in initial /s/-nasal and /s/-liquid clusters may make these clusters (voiced obstruent + sonant) more marked than the bi-literal and tri-literal clusters in violation of the Syllable Structure Condition (voiceless obstruent + obstruent), and, thus, be the explanation for /s/-nasal and /s/-liquid clusters causing more epenthesis than /s/-stop clusters. Perhaps length of cluster and strength relations within the syllable play only a secondary role in facilitating epenthesis, while the markedness of segments which constitute a given cluster seems to be the most influential factor.

One more aspect to be mentioned in regard to /s/-nasal clusters and /s/-liquid clusters is that the difference in the rates of epenthesis between these structures was probably not statistically significant, since the total rate of epenthesis obtained for /s/-nasal clusters was only nine percentage-points higher than the total rate of epenthesis for /s/-nasal clusters. Thus, this result and the results concerning homorganic advantage of /sm/ over /sn/, although probably not statistically significant, are at least in the same direction of the findings of Carlisle (1988, in Carlisle, 1994 :235), who investigated the frequency of epenthesis before the onsets /sm, sn, sl/ in controlled environments. His hypothesis was based on another of Greenberg's (1965 :27) language universals, which states that a language which has obstruent-nasal onsets will also have obstruent-liquid onsets. Thus, according to this universal, obstruent-nasal onsets are more marked than obstruent-liquid onsets. The results obtained by Carlisle (ibid) showed that the /sm/ cluster caused the highest frequency of epenthesis followed by /sn/, and then by /sl/. The fact that /sm/ caused a higher frequency of epenthesis than /sn/ led him to try to draw a parallel between his results and those of Greenberg (ibid :29), who found that a coda of a nasal + homorganic obstruent was less marked than a coda of a nasal + heterorganic obstruent. Thus, Carlisle's explanation for the /sn/ cluster being easier than /sm/ cluster was that in the former the segments are homorganic and, therefore, more easily articulated, whereas in the latter they are heterorganic. The results of the present study lean in the direction of homorganic advantage for /s/-nasal clusters, and also for the bi-literal /s/-stop clusters. If this advantage really does exist, however, it disappears with the influence of the additional segment in the tri-literal /s/-stop clusters. A statistical analysis would be necessary in order to make a stronger claim in relation to the homorganic advantage obtained for these clusters.

Markedness relationships related to voicing, as discussed above, associated with strength relationships within the syllable, may help us clarify the results obtained for hypothesis 2. As commented by Carlisle (1991 :91), the difference in sonority between the first and the second member of an onset may influence the rate of epenthesis, since this rate tends to increase as the difference in degree of sonority between the two segments decreases. If we consider that nasals are less sonorant than liquids, which implies a smaller difference in degree of strength between nasals and the fricative /s/ than between liquids and /s/, we can then understand why the rate of epenthesis before /sm/ and /sn/ onsets was higher than before /sl/.

Another explanation for liquids being easier than nasals in regard to these clusters is the fact that Portuguese allows /l/ in the second position within the syllable after bilabials and velar stops (e.g. *pluma* /plu.ma/- "plume", *globo* /glo.bu/- "globe") whereas /m/ and /n/ are never found in this position, regardless of the consonant in first position.

Overall, the analysis concerning strength relationships within the syllable yielded both expected results and results which were unexpected but explainable through markedness theory. On the one hand, results obtained for /s/-nasal clusters versus /s/-liquid clusters were expected according to the theory of markedness and to the Syllable Structure Condition, although a statistical analysis would be necessary here in order to make a stronger claim. On the other hand, results concerning initial /s/-clusters in violation of the Syllable Structure Condition versus initial /s/-clusters not in violation appeared, at first, contrary to both hypothesis two and the theory of markedness. However, after verifying that /s/-nasal and /s/-liquid clusters become more marked than /s/-stop clusters due to the voicing assimilation of /s/ (Greenberg, 1965 :23), we can, then, say that these results went only against hypothesis two, but not against the theory of markedness.

In addition to markedness, the exceptionality of /s/ can also help explain the results obtained in this study. Hooper (1976 :218) points out this exceptionality, which makes /s/ behave differently in different languages. In English and Icelandic, for instance, it is considered a very strong consonant and can occur before and after obstruents in syllable final position in English. In Spanish, on the other hand, */s/* is considered a rather weak consonant in terms of its distribution, since */s/*-stop clusters cannot be found in this language. The */s/* in Portuguese is also considered to be a weak consonant, due to the fact that it becomes voiced in voiced environments. In

Icelandic, on the other hand, where /s/ is regarded as a strong consonant, it never voices in voiced environments (Istre, 1981 :191). The fact that learners found /s/-stop clusters easier than /s/-nasal and /s/-liquid clusters, in spite of their violation of the Syllable Structure Condition, may be somehow linked with the exceptionality of this segment.

Tropf (1987) also found the sonority factor to be relevant for the choice of certain variants in the production of onsets of the form /ʃC(C)/, but only investigated clusters which were in conformity with the canonical syllable structure. So, although her results are consistent with the results obtained here for /s/-nasal in relation to /s/-liquid clusters, they cannot be directly related to those obtained in this study for clusters in violation of the Syllable Structure Condition, where the sonority relationship between the first and the second segment of onsets by itself did not prove to be the most important variable constraint in facilitating epenthesis.

One more possible explanation for the results showing a greater rate of epenthesis before clusters not in violation of the SSC is related to frequency of exposure. There are eight different types of /s/-stop clusters as opposed to four types of /s/-sonorant clusters, giving learners a greater exposure to the former.

Summing up the discussion, the results concerning the comparison of /s/-nasal clusters to /s/-liquid clusters, although possibly not statistically significant, tended toward conformity with both the Markedness Differential Hypothesis (MDH) (Eckman, 1987a) and The Structural Conformity Hypothesis (SCH) (Eckman, Moravicsik, & Wirth, 1989, in Eckman 1991). In relation to the MDH, /s/-nasal clusters, as expected, caused somewhat more epenthesis than /s/-liquid clusters, since the former type of cluster is more marked than the latter (Greenberg, 1965 :27). Also, within the class of nasals, /sm/ was expected to cause more epenthesis than /sn/, since the segments in this particular cluster are heterorganic whereas in /sn/ they are homorganic (Carlisle, 1994 :235). In relation to the SCH, results of /s/-nasal vs. /s/-liquid clusters also supported this hypothesis, since /s/-nasal clusters caused somewhat more epenthesis than /s/-liquid clusters, and, the heterorganic cluster /sm/ caused somewhat more epenthesis than the homorganic cluster /sn/. These results showed that the universals that hold for the primary language (English) also held for the subjects' interlanguages, since the more marked type of clusters in English (/s/-nasal clusters and heterorganic clusters) produced the highest rates of epenthesis in the subjects interlanguages. These results, though, need to be further investigated due to the lack of a statistical analysis.

Results concerning clusters in violation of the Syllable Structure Condition vs. clusters not in violation appear to contradict the MDH and the SCH if the only variable taken into consideration were the sonority relationship between the first and the second member of these onsets. In this case, according to the MDH, /s/-clusters in violation were expected to cause more epenthesis than /s/-clusters not in violation, since they do not exist in the native language (Portuguese) and are also more marked in the target language (English). In regard to the SCH, /s/-clusters in violation of the

Syllable Structure Condition are not expected to exist in the interlanguages of the subjects without the prior existence of clusters not in violation. However, if we consider the fact that the first member of /s/-nasal and /s/-liquid clusters was mostly pronounced as /z/ by the subjects, and that it led to the formation of a more marked type of cluster (voiced obstruent + sonant) in opposition to a less marked type

(voiceless obstruent + obstruent), results, then, were in accordance with both the MDH and the SCH, since the more marked-type of cluster caused more epenthesis than the less marked type.

The issue of environment is the topic to be discussed in the next section.

4.4- The consonantal strength hierarchy across syllables

Hypothesis 3 was based on Hooper's (1976:220) principle of strength relations across syllables, which was further reformulated by Murray & Venneman (1983:520) into the Syllable Contact Law, which says, "the tendency for a syllabic structure A$B to change, where A and B are marginal segments and *a* and *b* are the Consonantal Strength values of A and B respectively, increases with the value of *a* minus *b*." In other words, the more the consonantal strength of A exceeds that of B, the greater the syllable structure violation will be, and the more likely some remedial measures will be employed in order to improve syllable contact. Applying this law for diachronic change in primary language to interlanguage phonology, it was predicted that due to the effect of strength relations across syllables learners would have greater difficulty in producing initial /s/ clusters preceded by segments of greater or equal strength value than those preceded by segments of lesser strength value.

To test this prediction, eight categories of environment were elaborated according to the degree of strength of segments. The strength value for each of these categories was calculated based on the consonantal strength hierarchy below proposed by Hooper (1976 :206). Notice that affricates are not represented in this scale, but were given value 7 since Hooper (ibid) believes that they should be placed at the very end. Vowels are not represented either, since it is a consonantal strength scale, but were given the lowest strength value (0) due to the fact that they always occupy the peak of the syllable.

glides	liquids	nasals	voiced continuants	voiceless continuants voiced stops	voiceless stops
1	2	3	4	5	6

In order to establish the difference in strength between the environment and /s/, the segment which initiated all clusters, the strength value of /s/, which is (5), was subtracted from the strength value of the environment which preceded the cluster. For instance, either of the affricates /tʃ, dʒ/ minus the voiceless fricative /s/ gives a strength value of (+2), since 7-5= +2. Below are the syllable contact numbers obtained by subtracting /s/ from the environment .

- Affricates /tʃ, dʒ/ : value (+2)
- Voiceless stops /p, t, k / : value (+1)
- Voiceless continuants and voiced stops /b, d, g, s, f, θ, ʃ/ : value (0)
- Voiced continuants /z, v, ʒ, ð/ : value (-1)
- Nasals /m, n, ŋ/ : value (-2)
- Liquids /ɹ, l/ : value (-3)
- Vowels /i, u, oʊ, aɪ, aʊ, ɔɪ/ : value (-5)

Besides the syllable contact numbers mentioned above, the null environment was also considered. It occurred either when subjects paused between the word which supplied the environment and the word with the /s/ cluster or when the word with the /s/-cluster initiated a sentence. Glides would have been difficult to place in the position of environment, and were, therefore, not included in the analysis. Vowels which were nasalized due to L1 interference were assigned the same strength value as those not nasalized. It is important to mention that although the test was designed with the same number of sentences for each environment, some of the environments occurred more often than others because of substitution. For instance, final /l/ was often substituted by /ʊ/ or /u/ due to L1 interference, since this liquid is never realised as such at the end of the syllable in Portuguese.

In the results of hypothesis 3, as for hypotheses 1 and 2, epenthesis is expressed in percentages. These percentages were calculated by dividing the number of occurrences of epenthesis in a given environment by the number of sentences which contained that environment. The rates of epenthesis for each environment will be given first for each individual and then for the whole group. Two complementary analyses will be carried out for the whole group : one comparing environments of lesser strength to environments of equal or greater strength and to null context, and the other comparing environments in terms of whether they were vowels, consonants or simply null.

4.4.1- Analysis of the syllable contact numbers

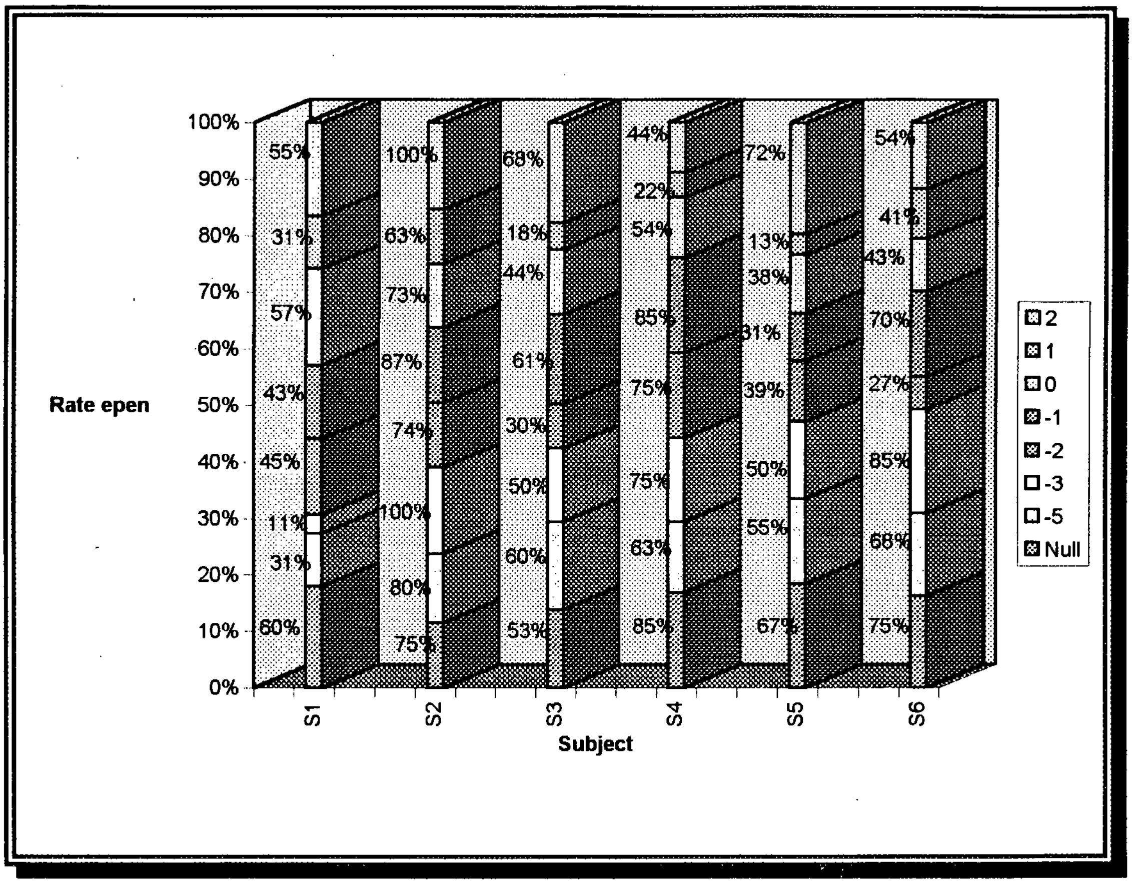
The results displayed in Table 14 and Figure 14 show the rates of epenthesis of all subjects individually for the different syllable contact numbers. For subject 1, the highest rate of epenthesis (60%) was caused by null context, followed by 57% for the syllable contact number [0], 55% for [+2], 45% for [-2], 43% for [-1], 31% for both [-5] and [+1], and 11% for [-3]. For subject 2, the highest rate of epenthesis (100%) was obtained for the syllable contact numbers [+2] and [-3], followed by 87% for [-

1], 80% for [-5], 75% for null context, 74% for the syllable contact number [-2], 73% for [0], and 63% for [+1]. For subject 3, the highest frequency of epenthesis (68%) was caused by the syllable contact number [+2] , followed by 61% for [-1], 60% for [-5], 53% for null context, 50% for the syllable contact number [-3], 44% for [0], and, finally, 18% for [+1]. For subject 4, the frequencies of epenthesis were as follow : 85% for null context and for the syllable contact number [-1], 75% for both [-3] and [-2], 63% for [-5], 54% for [0], 44% for [+2], and 22% for [+1]. In regard to subject 5, a rate of epenthesis of 72% was obtained for the syllable contact number [+2], followed by 67% for null context, then 55% for the syllable contact number [-5], then 50% for [-3], 39% for [-2], 38% for [0], 31% for [-1], and finally, 13% for [+1]. The rates of epenthesis of subject 6 were as follow : 85% for the syllable contact number [-3], 75% for null context, 70% for the syllable contact number [-1], 68% for [-5], 54% for [+2], 43% for [0], 41% for [+1], and 27% for [-2].

Table 14 : Individual rates of epen. for the different syllable contact numbers

		Null	-5	-3	-2	-1	0	+1	+2
	N° prod	87	61	9	22	7	60	26	9
S1	N° epen	52	19	1	10	3	34	8	5
	Rate epen	**60%**	**31%**	**11%**	**45%**	**43%**	57%	**31%**	**55%**
	N° prod	147	30	4	19	16	37	19	12
S2	N° epen	110	24	4	14	14	27	12	12
	Rate epen	75%	**80%**	**100%**	74%	**87%**	73%	**63%**	**100%**
	N° prod	45	52	8	23	23	66	39	25
S3	N° epen	24	31	4	7	14	29	7	17
	Rate epen	**53%**	**60%**	**50%**	**30%**	**61%**	**44%**	**18%**	**68%**
	N° prod	111	46	4	16	13	46	23	18
S4	N° epen	94	29	3	12	11	25	5	8
	Rate epen	**85%**	**63%**	75%	75%	**85%**	**54%**	**22%**	**44%**
	N° prod	30	60	12	23	16	81	30	25
S5	N° epen	20	33	6	9	5	31	4	18
	Rate epen	**67%**	**55%**	**50%**	**39%**	**31%**	**38%**	**13%**	**72%**
	N° prod	68	54	13	22	20	74	27	13
S6	N° epen	51	37	11	6	14	32	11	7
	Rate epen	75%	**68%**	**85%**	27%	70%	**43%**	**41%**	**54%**

Figure 14 : Individual rates of epenthesis for the different syllable contact numbers



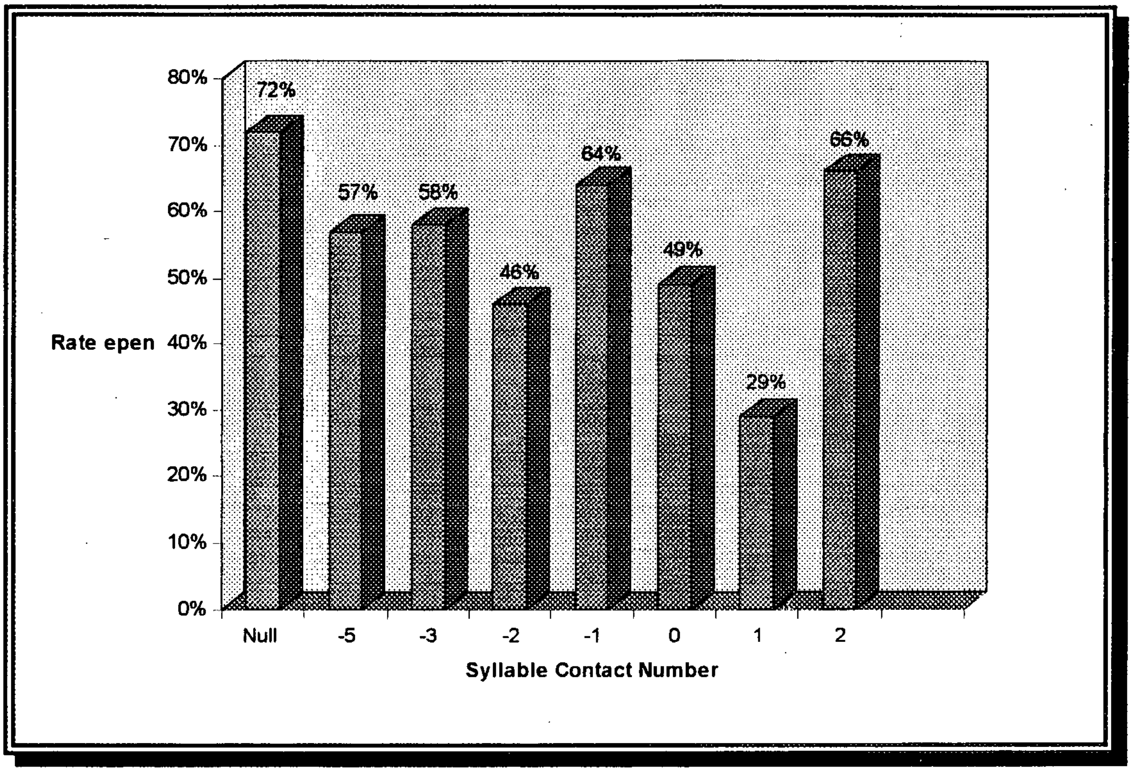
Group results were important for statistical reasons because of the fact that the number of sentences within each category was small. General tendencies could be masked in the report of the individual results. The results concerning the frequencies of epenthesis obtained for the whole group of subjects for the different syllable contact numbers show that the highest rates come from the positive end of the scale- 66% for

(+2), and then from the middle of the scale- 64% for (-1), and then from the negative end- 57% for (-5). The lowest rate- 29% for (+1)- is next to the highest at the positive end of the scale. It is obvious that there is no sequence according to the syllable contact numbers (Table 15 and Figure 15).

Table 15 : Group rates of epenthesis for the different syllable contact numbers

	Null	-5	-3	-2	-1	0	+1	+2
N° prod's	488	303	50	125	95	364	164	102
N° epen	351	173	29	58	61	178	47	67
Rate epen	**72%**	**57%**	**58%**	**46%**	**64%**	**49%**	**29%**	**66%**

Figure 15 : Group rates of epenthesis for the different syllable contact number

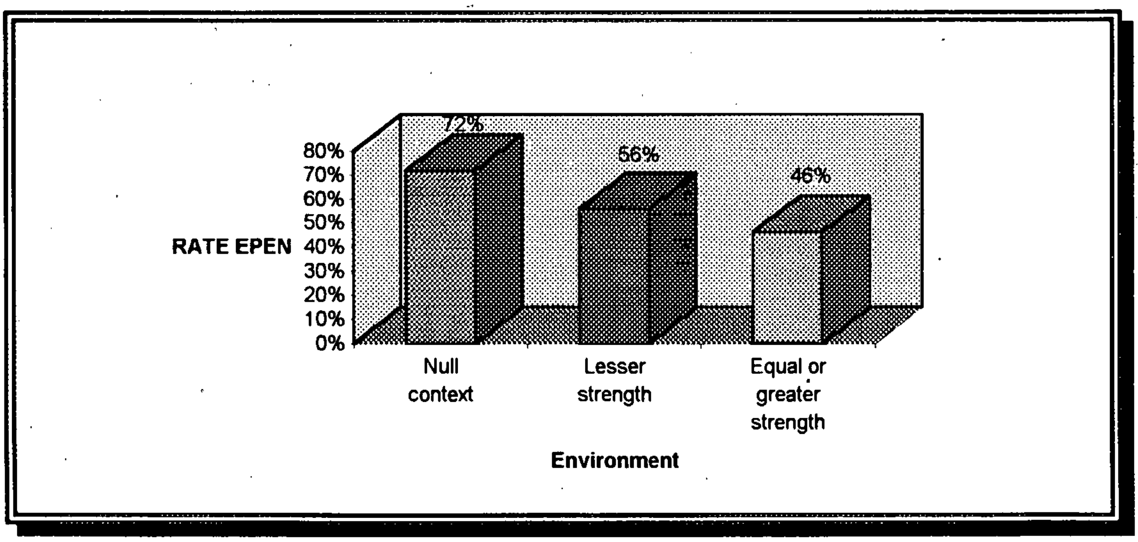


Environments were also analysed according to whether they were null, environments of lesser strength ([-5], [-3], [-2], [-1]), and environments of equal or greater strength ([0] , [+1], [+2]). Table 16 and Figure 16 show that the frequency of epenthesis was considerably higher after the null context (72%) than after the other two. As to the difference between environments of greater or lesser strength, contrary to expectations, more epenthesis was produced after segments of lesser strength (56%) than those of greater strength (46%), making it impossible to support hypothesis 3, based on Murray and Vennemann's Syllable Contact Law.

Table 16 : Rates of epenthesis for null context, environments of lesser strength and environments of equal or greater strength

	Null	Lesser strength	Equal/greater strength
N° prod's	488	573	630
N° epen	351	321	292
Rate epen	**72%**	**56%**	**46%**

Figure 16 : Rates of epenthesis for null context, environments of lesser strength and environments of equal or greater strength

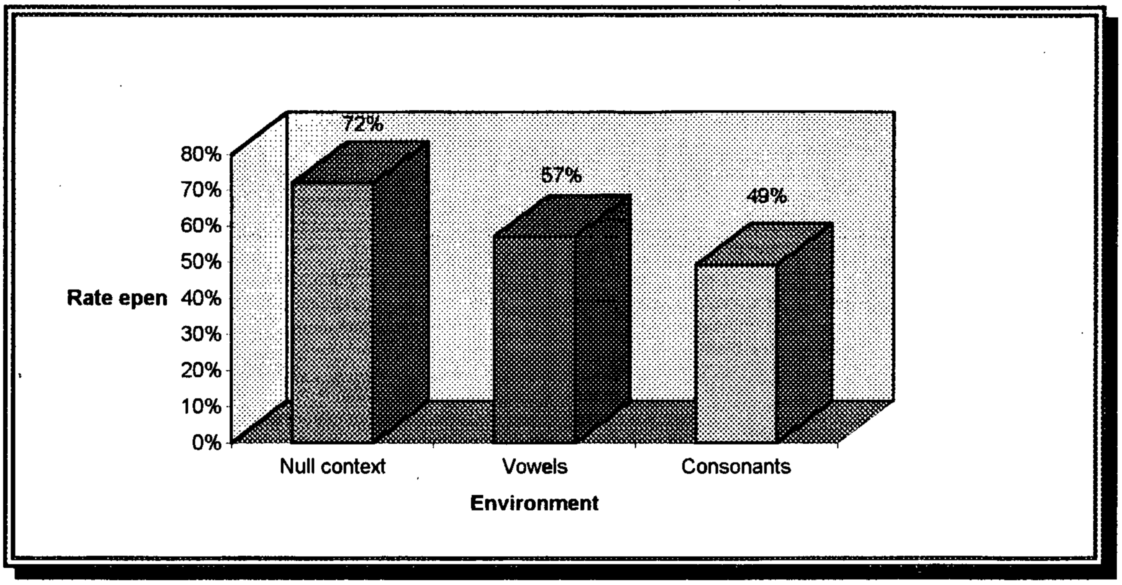


An analysis was also conducted in which environments were divided into vowels, consonants or simply null. Results displayed on Table 17 and Figure 17 show that the highest rate of epenthesis occurred after the null context (72%), followed by vowels (57%) and finally, by consonants (49%). The total rate of epenthesis obtained for the null context was fifteen percentage-points higher than that obtained for vowels, and twenty-three percentage-points higher than that obtained for consonants. There was very little difference between the total rate of epenthesis for vowels and the total rate for consonants, the former actually being eight percentage-points higher. Although results concerning vowels and consonants showed a slight tendency to be contrary to the expectations, a statistical analysis would be necessary here in order to say that vowels caused more epenthesis than consonants.

Table 17 : Rates of epenthesis for null context, vowels and consonants

	Null context	**Vowels**	**Consonants**
N° prod's	488	303	900
N° epen	351	173	440
Rate epen	**72%**	**57%**	**49%**

Figure 17 : Rates of epenthesis for null context, vowels and consonants

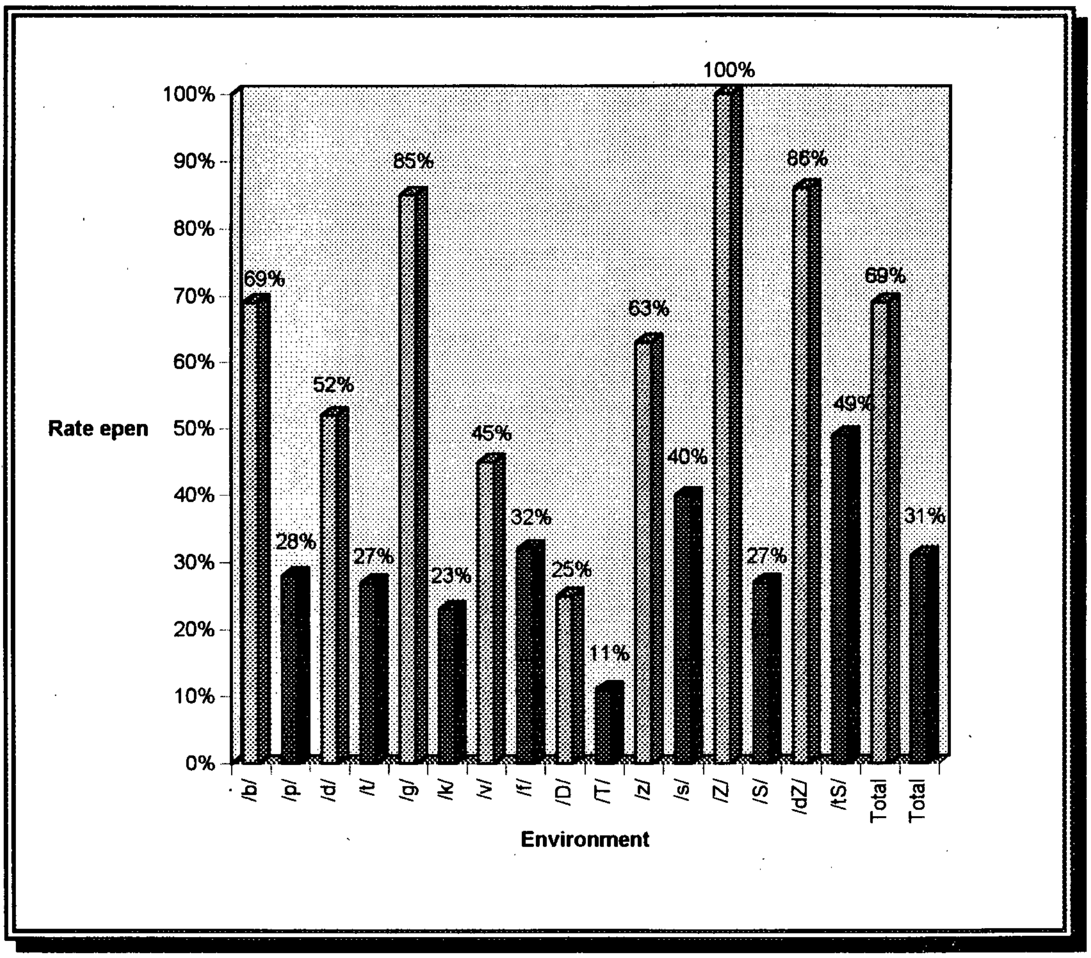


An analysis comparing voiced/voiceless obstruent pairs in the context was conducted in order to verify if these subgroups of consonants could be acting as variable constraints. The rates of epenthesis for the voiced stops were 69% for /b/, 52% for /d/, and 85% for /g/. In regard to the voiceless stops, the rates were 28% for /p/, 27% for /t/, and 23% for /k/. The rates of epenthesis for the voiced fricatives were 45% for /v/, 25% for /ð/, 63% for /z/, and 100% for /ʒ/. Voiceless fricatives yielded the following rates of epenthesis : 32% for /f/, 11% for /θ/, 40% for /s/, and 27% for /ʃ/. The rates of epenthesis for the affricates were 86% for the voiced /dʒ/ and 49% for the voiceless /tʃ/. Thus, the results show that, in every case, the rate for the voiced member of the pair was much greater than the rate for the voiceless member, and in half of the pairs the rate for the voiced member was more than twice as great. Collapsing these results, the average rate of epenthesis for voiced obstruents was (69%), compared to less than half- 31%- for voiceless obstruents. It appears clear that voicing assimilation in the environment is a very important variable (Table 18 and Figure 18).

Table 18 : Rates of epenthesis for voiced/voiceless obstruent pairs in the context

Voiced Obstruents									
	/b/	/d/	/g/	/v/	/ð/	/z/	/ʒ/	/dʒ/	Total
N° prod's	49	73	66	22	4	54	14	56	338
N° epen	34	38	56	10	1	34	14	48	235
Rate epen	**69%**	**52%**	**85%**	**45%**	**25%**	**63%**	**100%**	**86%**	**69%**
Voiceless Obstruents									
	/p/	/t/	/k/	/f/	/θ/	/s/	/ʃ/	/tʃ/	Total
N° prod's	46	62	57	87	27	35	29	49	392
N° epen	13	17	13	28	3	14	8	24	120
Rate epen	**28%**	**27%**	**23%**	**32%**	**11%**	**40%**	**27%**	**49%**	**31%**

Figure 18 : Rates of epenthesis for voiced/voiceless obstruent pairs in the context (Dark bar: voiceless / Light bar: voiced)



4.4.2- Discussion of the different environments

In the individual analysis, only results of subject 1 supported the hypothesis based on Murray and Venneman's (1983 :520) Syllable Contact Law, since this subject produced more epenthesis after environments of equal or greater strength

(49%) than after environments of lesser strength (33%), although the highest rate of epenthesis (60%) was obtained for null context. The results of the remaining subjects (2, 3, 4, 5, and 6) contradicted the Syllable Contact Law in the sense that environments of lesser strength caused somewhat more epenthesis than environments of equal or greater strength. Three out of these subjects (4, 5, and 6) produced more epenthesis after null context than any other type of environment. The tendency showed by the results which were contrary to the SCL would have to be further investigated by carrying out a statistical analysis

Results for the whole group demonstrate that there was little difference between the total rate of epenthesis for environments of lesser strength (56%) and the total rate for environments of equal or greater strength (46%). The former actually being ten percentage-points higher than the latter. The null context, which caused the highest frequency of epenthesis (72%), was sixteen percentage-points higher than environments of lesser strength, and twenty-six percentage-points higher than environments of equal or greater strength. Thus, although it cannot be said from these data that results contradict the hypothesis based on Murray and Vennemam's Syllable Contact Law, since no statistical analysis was conducted they certainly do not support it.. No relation was found between the syllable contact numbers and the way the frequency of epenthesis increased or decreased. In other words, the frequency of epenthesis did not increase gradually from the syllable contact numbers of lesser strength to those of equal or greater strength. Rather, no consistency was found in regard to these numbers. Thus, these results show that strength relations across the syllable by themselves did not seem to influence the rate of epenthesis produced by the subjects.

The null environment was the only type of environment which expressed a consistently high rate of epenthesis in all the analyses conducted. Only in the individual analysis of subjects 2 and 3 this environment did not cause the highest rate of epenthesis. The reason why the null context induced epenthesis to such a high degree may have to do with the fact that when words are said in the stream of speech some instantiations of epenthetic vowel may be deleted, and may, therefore, surface much less often in the speech of learners than when they occur before a word initiating a sentence or before a word which is preceded by pause. In Tarone's study (1987a) of epenthesis after codas of single consonants, results regarding null context also yielded the highest rate of epenthesis (50%) of all environments considered.

Carlisle (1991 :85) considered vowels and consonants to be the only environmental constraints which influenced the rate of epenthesis, since no significant result was obtained for the subgroups of consonants *sonorant vs. obstruents* and *voiced vs. voiceless obstruents*. The results of this study concerning vowels and consonants as environments did not corroborate those of Carlisle (1991, 1994), who found the frequency of epenthesis to be higher after word-final consonants than after word-final vowels. Tarone (1987a) also found a higher frequency of epenthesis before word-initial consonants than word-initial vowels. In the present study, though, vowels induced epenthesis (57%) more frequently than consonants (49%), although this difference was not statistically confirmed. The subgroups voiced/voiceless obstruent pairs seem to have acted as environmental constraints, since the rate of epenthesis for the voiced obstruents was 69% while that for the voiceless obstruents was 31%. Again, the issue of voicing assimilation seems to have played a crucial role in inducing epenthesis. In the results of the previous section it was suggested that the voicing of the fricative /s/ in initial /s/-clusters caused high rates of epenthesis produced by the subjects, since the voicing assimilation of this fricative led /s/-nasal and /s/-liquid clusters to become more marked than s-stop clusters. In this section, results show that voiced obstruents caused the second highest frequency of epenthesis (69%), followed by 57% obtained for vowels and 31% for voiceless obstruents. The highest rate of epenthesis, though, was that obtained for null environment (72%). The difference between these total rates of epenthesis would have to be confirmed by a statistical analysis in order to make stronger claims concerning the degree of difficulty of these environments. A statistical test would be interesting specially for comparing voiced obstruents to vowels and null context to voiced obstruents, since the difference between these environments was rather small in terms of percentage-point.

Carlisle (1991 :90) states that both the degree of sonority of the preceding environment as well as the sonority relationships among the members of initial /s/ clusters may affect the frequency in which epenthesis occurs. In the present study none of these constraints seems to have played a major role in affecting the rate of epenthesis. Instead, markedness relationships in terms of voicing assimilation between members of the initial /s/ clusters acted as a more powerful constraint in inducing epenthesis than length of cluster or strength relations within and across syllables.

Thus, a constraint different from those observed in previous studies could be proposed to influence the rate in which epenthesis occurs in second language acquisition.

The large range of percentages obtained for the different syllable contact numbers seems to indicate that there is something in the environment affecting difficulty. For instance, the high rate of epenthesis for the null context may be related to the fact that speakers were not assisted by rhythm. Also, some syllable contact numbers (+2, 0, -1) involve segments which require assimilation (/tʃ, dʒ, ʃ, z, ʒ/) a process not usually present in the speech of these learners. As already discussed, the results of this study contradicted those obtained by Carlisle (1991) and Tarone (1987a), whose subjects were non-native speakers of English living in English-speaking countries. In the present study, none of the subjects was fluent in English or had ever spent any time abroad. These aspects may have to do with the difference in the results obtained from previous research, since when there is a lack of fluency, it may make no difference whether a word ends in a vowel or a consonant. In this study learners frequently could not make the assimilation between words.

All in all, there is some evidence that environment was relevant, but not in the direction of previous research (the vowel vs. consonant constraints proposed by Carlisle, 1991) or in terms of the predictions made based on the syllable contact numbers. Silva's (forthcoming) results were in the direction predicted by the same theory, but his study dealt with final singleton consonants, while the present study dealt with initial /s/ clusters, which in themselves are exceptional.

The results of this study show that although languages share many universal properties, some of the individual features of the native language may sometimes play a more important role in the process of acquisition than any of the universal characteristics of languages. This is the case of the voicing assimilation of the fricative /s/ before nasals and liquids in different syllables in Portuguese. This particular characteristic of Portuguese seemed to have influenced the rate of epenthesis to a higher degree than strength relations within and across syllables, aspects of the syllable which are more universal.

4.5-Summary of Overall Results

The first hypothesis predicted that learners would have more difficulty in producing initial three-segment clusters than two-segment ones. The results of the two analyses carried out in order to verify whether the length of the cluster influenced the rate of epenthesis were as follows :

- when comparing /sC/ clusters vs. /sCC/ clusters independent of cluster components, results show that there was very little difference between the total rate of epenthesis for /sC/ structures and the total rate for /sCC/ structures. A statistical analysis would be necessary in order to confirm that the /sC/ structures caused more epenthesis than the /sCC/ structures.

- when comparing clusters grouped by their second component, results show that /sCC/ clusters caused somewhat more epenthesis than /sC/ for two groups of clusters analysed, while in the third group of clusters /sC/ structures were more difficult to produce than /sCC/. Because of the small difference between the total rates of epenthesis for the /sC/ and for the /sCC/ clusters, it cannot be said from these data that the tri-literal structures caused more difficulty.

Thus, the results concerning the first hypothesis showed that cluster length alone did not determine the rate of epenthesis, since, in general, /sC/ clusters caused somewhat more epenthesis than /sCC/ clusters. This would have to be further investigated in future research in the field.

The second hypothesis predicted that clusters in violation of the sonority hierarchy principle /sp, st, sk, spɹ, stɹ, spl, skw/ would cause more epenthesis than clusters not in violation /sl, sm, sn/. Results demonstrated that clusters which are not in violation actually caused somewhat more epenthesis than clusters which are in violation, therefore, showing that strength relations within the syllable did not act as a crucial factor in causing epenthesis. In spite of the great difference between the rates of epenthesis obtained for the /s/-sonorant clusters in relation to the /s/-stop clusters, a statistical test would be necessary in order to confirm that the former causes more epenthesis than the latter.

The third hypothesis predicted that strength relations across the syllable would affect the difficulty learners would find in producing initial /s/ clusters. Results showed that strength relations across the syllable did not act as a crucial factor in causing epenthesis, since there was very little difference between the total rate of epenthesis for environments of lesser strength and the total rate for environments of equal or greater strength. Also, there was no tendency for epenthesis to increase or decrease with the degree of difference in strength across syllables.

Environment was found to be important, not in terms of the difference in strength between A $ B, but in terms of the degree of markedness regarding voicing assimilation. Markedness relationships of voicing assimilation were found to be important not only in the environment, but also with the clusters themselves. Thus, the voicing assimilation of /s/ in clusters not in violation (/s/-nasal and /s/-liquid) made them become more marked than /s/-clusters in violation (/s/-stop), and, consequently, more difficult to be produced. In this study, markedness relationships of voicing assimilation seem to have predominated over strength relationships within and across the syllable.

It is important to point out that a statistical analysis would be necessary in this study only to confirm the unexpected results obtained for each of the hypotheses. That is to say, for showing that : a) bi-literal clusters cause more epenthesis than tri-literal clusters ; b) clusters not in violation cause more epenthesis than clusters in violation ; c) environments of lesser strength cause more epenthesis than environments of equal or greater strength. In regard to the original hypotheses, it was possible to answer them even without a statistical test, since all results tended in the opposite direction.

Chapter 5- Conclusion

5.1- Limitations of the Research

The results of this study would have been more reliable if the following aspects were improved :

a) statistical analysis- a statistical test would be necessary in order to confirm the unexpected results obtained for the hypotheses as well as to confirm the results concerning the voicing assimilation of /s/. It would not be necessary, though, in order to answer the original hypotheses ;

b) a larger number of subjects ;

c) various sociolinguistic contexts- different sociolinguistic contexts could have been used besides list-reading. The resulting pronunciation would have been less accurate in free speech than in word-list reading, but the patterns found would most likely have been the same. The use of various sociolinguistic and phonological contexts can be illustrated by Beebe's (1988) study. She, the first SLA researcher to follow Labov (Dickerson, 1974), tested 10 subjects over 9 months in 3 different speech "styles" : free speech, dialogue reading and word-list reading. She also included different phonological contexts. For all the subjects the list-reading produced the most accurate pronunciation and the free speech the least accurate. They were also consistent in reacting to the phonological contexts- the same contexts elicited more or less accurate pronunciation for all subjects. The easier the sociolinguistic context (speech style) and the phonological context, the more accurate the variable produced, but the patterns were the same.

d) one more rater in order to have interrater reliability.

The ideal way to conduct this research would have been by improving all the limitations just mentioned, but it was not possible due to the limited scope of this research (Master's thesis). Thus, I would suggest that all these aspects were taken into consideration in a group research in the field.

5.2- Theoretical Implications

In this section, some suggestions will be made concerning the theories used in this study in relation to the results obtained. According to Anderson (1987 :283), longer clusters are more marked than shorter clusters, and therefore, more difficult to be acquired. If this statement is to be applied on a universal basis, /sC/ clusters should have been easier than /sCC/ clusters. However, results showed that, at least for this particular group of learners, shorter clusters caused more epenthesis than longer clusters, thus, casting doubt on the degree to which SL production is constrained by UG. Perhaps we should be more cautious and say that the extent to which learners have access to these principles and parameters is directly related to the interaction between their native language and the target language. This seems to be a plausible explanation of why results did not support the influence of UG in terms of cluster length, but did support the influence of UG in regard to markedness relationships in terms of voicing, both in the environment and within the cluster itself.

Yóung-Scholten (1994) investigated one of the principles of sonority, the sonority sequencing generalisation, based on the production of initial clusters by Arabic learners in a study conducted by Broselow (1987). She concluded that phonological principles of UG are accessible to second language learners, since the subjects who took part in that research were sensitive to the violations of the sonority sequencing generalisation in some of the initial /sC/ clusters. In the present study, however, clusters not in violation of the Syllable Structure Conditioning caused more epenthesis than clusters in violation. Again, results were contrary to predictions made by UG, at least from the perspective of strength relations.

Hooper's (1976) theory of universal and language-specific syllable structure served as the basis for this research. In her theory she proposes a universal condition on preferred syllable structure which determines, among other aspects of the syllable, that the degree of strength of the consonantal segments which comprise a syllable should decrease from syllable-initial position towards the nucleus. Hooper also proposes that a syllable-initial C be stronger than the immediately preceding syllable-final C, a principle which was further reformulated by Murray & Venneman (1983 :520) and served as the basis for the Syllable Contact Law. According to the Syllable Contact Law, the more the consonantal strength of A exceeds that of B, the greater the syllable structure violation will be, and the more likely some remedial measures will be employed in order to improve syllable contact. If we analyse the results of this research in relation to the theory on which it was based, we can see that strength relations within and across the syllable did not have much effect on the production of initial /s/-clusters, since clusters in violation of the Syllable Structure Conditioning caused less epenthesis than clusters not in violation, the only exception being the comparison between nasals and the lateral, and environments of equal or greater strength caused less epenthesis than environments of lesser strength. Thus, there is very little support in the results of this study for the relevance of strength relations within or across the syllable to second language acquisition. Rather, the results concerning the tendency to voice the sibilant in voiced environments indicate that native-language transfer has taken preference over UG. It can be said, then, that results of this study have not demonstrated any link between second language acquisition of /s/-clusters and diachronic language change, the perspective from which the syllable was investigated by Murray & Venneman.

5.3- Pedagogical Implications

The results of several studies (Patkowski, 1994 ; Carlisle, 1994 ; Yavas, 1994) conducted in the field of second language phonological acquisition have provided important information for the teaching of pronunciation. The findings of such studies certainly enrich the instruction of pronunciation, since learners can have access to material and activities suitable to their levels and presented based on a hierarchy of difficulty. The grading of the teaching material implies presenting less complex structures first, followed by more complex structures. One of the greatest benefits provided by these findings is, in my opinion, the interaction between what takes place in research and what teachers actually do in class, since for many years researchers worked basically on their own, making no further use of the results obtained from their studies. Thus, the application of these findings to the teaching of pronunciation works like a bridge connecting two separate worlds.

The role of the teacher in the teaching of pronunciation should be that of someone who makes use of the latest findings in the field and adapts them to the learners' reality. In other words, not all teaching suggestions made apply necessarily to all learners of different L1 backgrounds. In fact, specific characteristics of the native language should be considered carefully. To illustrate this fact, the present study resulted in a different hierarchy of difficulty than that obtained by Carlisle (1994), although both studies dealt with initial /s/-clusters. This difference may be related to the fact that in this study the subjects' native language was Portuguese while in the study conducted by Carlisle the subjects' native language was Spanish.

Carlisle (1994) suggests that less marked structures be presented to learners before more marked structures. Based upon his results, two-member onsets should be presented before three-member onsets, /sl/ cluster before /sm/ and /sn/ clusters, /sm, sn, sl/ before /st, sk, sp/, and vocalic environment before consonantal environments.

Results of the present study indicate that when teaching the /s/-nasal and /s/-liquid clusters, the voiceless quality of /s/ should be stressed, since the rate of epenthesis increases dramatically with the voicing of /s/ in these structures. Another suggestion is that the environments in which the /s/-clusters appear should be practiced in the following sequence :

- Voiceless contexts
- Vowels
- Voiced contexts

The null context should be the last environment to be presented to learners. Learners should also be taught how to link words in order to avoid pauses, which helped increase the rate of epenthesis. Again, it is important to point out that these teaching points may be specific to native speakers of Brazilian Portuguese whose language differs in many respects from other languages already investigated.

5.4- Future Research

Besides the improvement of all the limitations mentioned above, many aspects of the present study could be changed in order to obtain more comprehensive and reliable results concerning the acquisition of initial /s/-clusters by Brazilian EFL learners. For instance, the difference between natural acquisition and classroom learning could also be investigated. Subjects would then be selected according to these two categories. One more change that could be made in relation to the present research is to have subjects divided into Spanish and Portuguese speakers. This would provide findings more specific to each of these languages, since most of the previous studies on /s/-clusters dealt basically with Spanish speakers.

Concerning the corpus, my suggestion is that environments should be better controlled in order to collect a balanced amount of each of the contexts. Substitutions of environments occurred very frequently for different reasons. For instance, /l/ was rarely produced as a lateral, but usually as the vowel /u/ due to native language interference. The segment /ʒ/ was frequently substituted by /dʒ/ due to spelling interference. The phoneme /ð/ was often replaced by /d/ also because of native language interference. Thus, a better way of ensuring the production of these contexts could be developed in future research.

More essential than any of the suggestions made above is that researchers in the field of second language acquisition take a greater interest in the area of phonology and, consequently, help enlighten this so neglected area of second language teaching.

Appendices

Appendix A- Corpus

1) **sp Clusters**

/i/- He speaks with the girls all the time.

/eɪ/- They spoilt everything.

/u/- How do you spell your name?

/oʊ/- No spitting on the floor.

/p/- That map specially attracted me.

/t/- Do not speed up, please.

/k/- The black spades are in the big box.

/s/- His father is a famous speech therapist.

/ʃ/- Your rush spoilt everything.

/f/- People's life span in Brazil is not very long.

/tʃ/- I don't like such spoilt children.

/θ/- The twentieth Spanish person in the list is Carlos.

/b/- The whole mob spoke to the minister.

/d/- A mad sponsor decided to pay for the conference.

/g/- The big spatula is for the icing of the cake.

/z/- You should always specify what you want.

/ʒ/- She bought a beige spaniel.

/v/- Lots of spectators were standing by the gate.

/ð/- Children love playing with spades.

/dʒ/- We don't give the judge special privileges.

/m/- There are some special effects in that film.

/n/- This has been done specially for you.

/ŋ/- They sang spectacular songs.

/r/- The beggar spelt his name.

/l/- Several species of mammal are in danger of extinction.

null- Spaghetti is my favourite dish.

2) st Clusters

/eɪ/- You may stay here.

/u/- Those guys are too stubborn.

/oʊ/- No standing near the door. .

/aɪ/- My staff is better trained.

/p/- I hope steelworkers are not on strike.

/t/- Don't get stuck there.

/k/- I do not like stale bread.

/s/- Hamley's is a famous store in London.

/ʃ/- Don't brush stallions in this area.

/f/- Jeff steals all the time.

/θ/- The cloth stains cannot be removed.

/tʃ/- That is such still water.

/b/- They rob students out in the park.

/d/- You should stand up for your rights.

/g/- The big stapler is better.

/z/- She was stabbed by her husband.

/ʒ/- The rouge stuck on the clown's face.

/v/- It's all a matter of style.

/ð/- Clean the cut with sterilised cotton.

/dʒ/- The judge stood by the window.

/m/- I'm starving.

/n/- Mix all the ingredients and then stir the sauce.

/ŋ/- You can see shooting stars at night.

/r/- Peter stares at me every day.

/l/- All staple diets are regular and basic.

null- Students are not allowed in the hall.

3) sk Clusters

/u/- If you do skateboarding you're prone to having bad knees.

/oʊ/- You should go skiing.

/aɪ/- That guy skin-dives every weekend.

/aʊ/- The cow skipped across the pasture.

/p/- I hope skiving does not become common practice here.

/t/- The cupboard was hanging a bit skew.

/k/- The book skips over adult life.

/s/- Famous skinheads were present at the meeting.

/ʃ/- Josh skidded into the ditch.

/f/- This section is a brief sketch of the school's history.

/θ/- Both skiers got hurt.

/tʃ/- Which ski lift are you taking?

/b/- Bob skimps on his warm-up exercises all the time.

/d/- Some fish passed skimming along the bottom of the sea.

/g/- Big skiffs are not allowed in this river.

/z/- She is skeptical about it.

/ʒ/- Beige skirtings were fitted on that house.

/v/- He has a nice pair of skis.

/ð/- They acted with skill and conviction.

/dʒ/- She was wearing a huge skirt.

/m/- Sam skinned his knee.

/n/- A human skeleton consists of many bones.

/ŋ/- Long skeins of geese were flying over the rooftops.

/r/- Mark likes roller-skating.

/l/- Paul skewered bits of meat on the branches.

null- Sketchpads are useful for drawing on.

4) sw Clusters

/oʊ/- A few years ago swearwords were rarely heard.

/aɪ/- Thai sweets are delicious.

/aʊ/- You must now swear on the Bible.

/oɪ/- The boy swept the floor yesterday.

/p/- Stop swanking, please.

/t/- The showers brought swarms of insects to the place.

/k/- Turtle-neck sweaters are beautiful.

/s/- This swampy area should be cleared.

/ʃ/- Josh swapped his old car for a new one.

/f/- Think of your wife sweating over the stove.

/θ/- Both swans belong to the local zoo.

/tʃ/- Which sweater should I wear?

/b/- Bob swatted mosquitoes all night long.

/d/- David swore he would never tell anyone.

/g/- Big swastikas were drawn on the wall.

/z/- These swimmers were the winners.

/ʒ/- Beige sweatbands were worn by the athletes.

/v/- These plants grow by the edges of swamps.

/ð/- You can find many people with swarthy complexions.

/dʒ/- She worked at a huge switchboard.

/m/- Jim swaggered back to his place.

/n/- Wrap the baby in swaddling clothes.

/ŋ/- Don't take a long swallow of this whiskey!

/r/- Peter swam out into the sea.

/l/- Michael swabbed the floor this morning.

null- Sweets are bad for your teeth.

5) sm Clusters.

/i/- They always see smugglers crossing the border.

/oʊ/- So smokers are not allowed here?

/aʊ/- The bow smashed into the dock.

/oɪ/- She gave me a coy smile.

/p/- This soup smells good.

/t/- I've got small pox.

/k/- You look smart tonight.

/s/- London is famous for its smog.

/ʃ/- Josh smirked and left the room.

/f/- My wife smokes heavily.

/θ/- They both smashed up the car.

/tʃ/- Each smithy should be cleared today.

/b/- Bob smiled at me.

/d/- His dad smacked him on the bottom.

/g/- Big smelters are used in this factory.

/z/- She said his smile was beautiful.

/ʒ/- She wore a beautiful beige smock.

/v/- They were accused of smash-and-grab robbery.

/ð/- They used to fight with small arms.

/dʒ/- The wallpaper had huge smudges all over it.

/m/- I've got some small change.

/n/- The local cinema has been smartened up.

/ŋ/- They're always making small talk.

/r/- They are smartly dressed.

/l/- Bill smashed through the plate-glass wall.

null- Smallholdings are very common in England.

6) sn Clusters

/i/- She snores every single night.

/eɪ/- They snatched the paper from the man's hand.

/aʊ/- How snobbish can she be?

/oɪ/- I enjoy snuggling close to him.

/p/- Stop snivelling right now!

/t/- Look at the information and make it snappy.

/s/ They ate delicious snacks.

/k/- Jack snared me on purpose.

/ʃ/- Josh sneered at the idea.

/f/- His wife sniggered at him.

/θ/- They both snicked their fingers with the knife.

/tʃ/- Which sniper shot at her?

/b/ Bob sneaked up behind me.

/d/- The lid snapped shut.

/g/- There are many big snails around here.

/z/- I'm tired of these snappish pupils.

/ʒ/- She likes her beige sneakers.

/v/- I would have snapped up a chance like that.

/ð/- You have trouble with sneezing, don't you?

/dʒ/- The hotel has a huge snack bar.

/m/- Children like the game ' snakes and ladder'.

/n/- Ian snagged his trousers on a bramble.

/ŋ/- The swamp is full of long snakes.

/r/- These drugs cure snakebites.

/l/- Beautiful snapdragons were planted in the garden.

null- Snake charmers are very popular in India.

7) sl Clusters

/i/- Paul uses many slang words.

/eɪ/- They sleep long hours every day.

/u/- Sue slapped him across the face.

/oɪ/- The little boy sliced the bread.

/p/- Wake up sleepyhead!

/t/- Security has got a bit slack.

/k/- Jack slung the book across the room.

/s/- She fell into a dreamless sleep.

/ʃ/- Josh slandered her behind her back.

/f/- There was a great rough slab in front of the house.

/θ/- They both slept on the couch.

/tʃ/- There was too much slapstick in the comedy.

/b/- Bob slunk away to his room.

/d/- Ted sloshed water all over the room.

/g/- She was given a big sledgehammer.

/z/- Mark is always slagging off his friends.

/ʒ/- She has a beautiful beige sleeping bag.

/v/- She is fond of slap-up meals.

/ð/- The baby's eyes were clogged with sleep.

/dʒ/- There is a huge slammer in this town.

/m/- Tom slowed down at the intersection.

/n/- Jack's face has been slashed with broken glass.

/ŋ/- My shirt has long sleeves.

/r/- Peter slammed the door.

/l/- All sleepers are taken at the moment.

null- Slackers are not well paid in this company.

8) spr Clusters

/i/- We sprayed a little perfume over ourselves.

/u/- Did you spread the news around?

/eɪ/- They sprawled out on the bed last night.

/oʊ/- That old man is so spry, it's unbelievable!

/p/- I hope sprouts will come out.

/t/- They ate meat spring-rolls.

/k/- Jack sprained his ankle.

/s/- This sprinkler is not working properly.

/ʃ/- They are having fresh spring-onions.

/f/- Jeff spread out the newspaper.

/θ/- Both spring-rolls are spicy.

/tʃ/- Each spring we go to the country side.

/b/- Bob spring-cleaned the house last weekend.

/d/- The door of the safe had sprung open.

/g/- Meg sprinted to her car.

/z/- He was sprung from prison.

/ʒ/- It was a beige springboard made of wood.

/v/- They bought a couple of springy mattresses.

/ð/- She was caught with springboks in the trunk of her car.

/dʒ/- The village sprawled all over the mountain.

/m/- Jim sprinkled the pie with sugar.

/n/- Paris is beautiful in springtime.

/ŋ/- He went on a drinking spree.

/r/- Hair spray is very bad for the ozone layer.

/l/- Small sprats are found in the sea.

null- Sprayers should wear special clothes.

9) spl Clusters

/i/- He splashed the water.

/eɪ/- The motorway splits this community in half.

/u/- They do splendid clay work.

/oʊ/- Peter is so splenetic sometimes.

/p/- We need to stop splinter groups from being formed.

/t/- She wrote splendid detective novels.

/k/- Jack splurged on an expensive car.

/s/- The police splashed through the shallow water.

/ʃ/- Don't rush splenetic boy!

/f/- This is a rough splintery surface.

/θ/- Both splendiferous films were selected for the festival.

/tʃ/- Which split peas do you want?

/b/- Little Kathy's bib split.

/d/- There were loud splashes coming from the bathroom.

/g/- I've got a big splinter in my foot.

/z/- Food was splattered all over the kitchen wall.

/ʒ/- She wore a beige splint on one leg.

/v/- He did that in a burst of spleen.

/ð/-He pressed the mattress with splayed fingers.

/dʒ/- It's a huge split level house.

/m/- She was caring for him splendidly.

/n/- Brian spliced the film together.

/ŋ/- That was an exciting splashdown.

/r/- Peter splashed out and bought a new car.

/l/ He heard an occasional splatter of snow on the window.

null- Splats were heard in the laundry area.

10) str Clusters

/eɪ/- Don't say strange things.

/u/- They acted too strangely.

/oʊ/- You should go straight ahead.

/aɪ/- My strategy is to avoid the enemy.

/p/- There was a sponge and a bar of soap strewed on the floor.

/t/- Eight streets have been closed.

/k/- She told the joke straight-faced.

/s/- Loose strands of wire can be dangerous.

/ʃ/- Have you been to the Turkish Straits?

/f/- His wife strongly influenced his choice.

/θ/- Her bags had cloth straps.

/tʃ/- How much stretching has she done?

/b/- Bob struggled to finish his paper.

/d/- I went to bed straightaway.

/g/- The big streetlamp was out.

/z/- These strawberries are delicious.

/ʒ/- The rouge strangely disappeared.

/v/- She has a lot of strength.

/ð/- There are hills abound with streams and waterfalls.

/dʒ/- The village straggles down the hillside.

/m/- Relations between our families became strained.

/n/- Brendon strode along the river.

/ŋ/- Betty's hair is being straightened at the hairdresser's.

/r/- This has always been their struggle.

/l/- He is a tall strapping boy.

null- Strict upbringing won't do her any good.

11) skw Clusters

/u/- He's chosen the blue square.

/oʊ/- No squads will be located at the border.

/aɪ/- That guy squandered his savings last weekend.

/oɪ/- You don't seem to enjoy squalid flats.

/p/- Stop squelching, Peter!

/t/- They eat squash at every meal.

/k/- They look squarely at social problems.

/s/- That was a delicious square meal.

/ʃ/- Josh squatted down under the tree.

/f/- Jeff squealed on Paul.

/θ/- Both squashy tomatoes were used in the salad.

/tʃ/- I like peach squash.

/b/- Bob squeezed the packs.

/d/- It was an area of a hundred square miles.

/g/- He gave her hand a big squeeze.

/z/- She always squabbles over little details.

/ʒ/- His shirt had beige squares.

/v/- There are people living in conditions of squalor.

/ð/- I saw her with squirrels around her feet.

/dʒ/- Village squatters were evicted this morning.

/m/- It would have made him squeamish to look at it.

/n/- The town square was well-kept.

/ŋ/- There was a strong squall over the bay yesterday.

/r/- There was a car squashed between two lorries on the motorway.

/l/- Several squad cars were sent to the area.

null- Square deals were given to them.

12) skr Clusters

/oʊ/- Only low scrub can survive on that land.

/aɪ/- I scrabbled weakly at the sanded floor.

/aʊ/- You don't know how scrupulous he is.

/oɪ/- The oldest boy scribbled all over the floor.

/p/- I hope screenwriters will appear soon.

/t/- They offer a somewhat scrappy education.

/k/- He does not like scrambled eggs.

/s/- The police scrawled on a piece of paper.

/ʃ/ Josh scrambled up the bank.

/f/- Jeff scraped through his exams last semester.

/θ/- If we both scrape up enough money we can open a bar.

/tʃ/- There is no policy concerning such screening.

/b/- Rob screwed up his eyes as he faced the sun.

/d/- They both should scram.

/g/- Meg scratched the boy's back.

/z/- I held his scraggy wrist.

/ʒ/- It was written on a beige scroll.

/v/- It was made of scraps of old clothes.

/ð/- The programme started off with scripted dialogue on tape.

/dʒ/- It was a huge scrapbook.

/m/- Sam screamed in terror.

/n/- All nuts have been scraped.

/ŋ/- He bought a long screwdriver.

/r/- You have to make your way over screes of stones.

/l/- People like small screens.

null- Scruffy children can be found in the street.

Appendix B- Transcriptions

Subjects 1 and 2

1) sp Clusters

	subject 1	subject 2
/i/- He speaks	[hispiks]	[hispiks]
/eɪ/- They spoilt	[deɪspɔɪlt]	[deɪ + spɔɪlt]
/u/- you spell	[juispɛw]	[jəispɛ̠w]
/oʊ/- No spitting	[now + + əspa̠ɪtiŋ]	[deɪspi̠tɪn]
/p/- map specially	[mapəspɛ̠ʃilɪ]	[mɛp + ispɛ̠ʃialɪ]
/t/- not speed	[nɔtspid]	[nɔtspid]
/k/- black spades	[blɛkispe̠ɪds]	[blækispeɪdz]
/s/- famous speech	[fe̠ɪməuspitʃ]	[fa̠məus + ispi̠tʃ]
/ʃ/- rush spoilt	[hʌʃspɔ̠ju]	[ɹʌʃəspɔɪlt]
/f/- life span	[laɪf + əspæ̠n]	[laɪfspæn]
/tʃ/- such spoilt	[sʌtʃispɔ̠ɪlt]	[sutʃəspɔ̠lit]
/θ/- twentieth Spanish	[twɛ̠ntɪ + əspɛ̠niʃ]	[twɛ̠ntieθ + spæ̠niʃ]
/b/- mob spoke	[mɔb + spowk]	[mobspowk]
/d/- mad sponsor	[mɛd + əspɔ̠nsoɹ]	[mɛdispɔ̠nsoɹ]

/g/- big spatula	[bigspatəla]	[bigi + əspatula]
/z/- always specify	[auweɪz + ispesifaɪ]	[alweɪz + əspesifaɪ]
/ʒ/- beige spaniel	[beɪdʒ + speɪnjəw]	[beɪdʒispɛnjəl]
/v/- of spectators	[ɔf + +spekteɪtoɹs]	[of + spɛktatoɹz]
/ð/- with spades	[wispeɪs]	[wɪdəzpeɪdz]
/dʒ/- judge special	[dʒʌdʒə + əspɛʃaw]	[ʒudʒispɛʃiaw]
/m/- some special	[sʌməspɛʃaw]	[somispɛʃial]
/n/- done specially	[dʌnəspɛʃialɪ]	[dʌnəspɛʃialɪ]
/ŋ/- sang spetacular	[seŋəspetakjuləɹ]	[sɛŋispɛtekjulaɹ]
/r/- beggar spelt	[bigarspɛlt]	[bəgaɹ + spɛwt]
/l/- Several species	[sɛveɹauspɛs]	[sɛvɛɹaw + + spisiz]
null- Spaghetti	[ispagɛtɪ]	[spagɛt]

2) st Clusters

/eɪ/- may stay	[meɪistei]	[meɪisteɪ]
/u/- too stubborn	[tu + stubɔɹn]	[tu + əstubɔɹn]
/oʊ/- No standing	[nowstɛndɪn]	[nowistɛndiŋ]
/aɪ/- My staff	[maɪistaf]	[maɪstæf]
/p/- hope steelworkers	[howpistiw]	[howp + əstilwoɹkeɹz]

/t/- get stuck	[gɛt + stuk]	[gɛtis $ tuk]
/k/- like stale	[laɪksteju]	[laikstale]
/s/- famous store	[feɪmowz + stɔɹ]	[famowzəstɔɹ]
/ʃ/- brush stallions	[bɹʌʃ + + əsteɪlionz]	[bɹuʃstalionz]
/f/- Jeff steals	[dʒɛfəstiwz]	[dʒɛf - əstɛwz]
/θ/- cloth stains	[klaus + əsteɪnz]	[klɔθ + isteɪnz]
/tʃ/- such still	[sʌtʃ + istiw]	[sʌtʃ + stʃiw]
/b/- rob students	[ɹɔbstjudənts]	[hɔb + studənts]
/d/- should stand	[ʃudstend]	[ʃudstænd]
/g/- big stapler	[bigistapləɹ]	[bigistapleɹ]
/z/- was stabbed	[wɔz + + teɪkbəd]	[wɔz+ istæbed]
/ʒ/- rouge stuck	[hugəstuk]	[hudʒistuki]
/v/- of style	[ɔfstaju]	[ɔfstaɪl]
/ð/- with sterilized	[wis + əsteɹɪlaɪzəd]	[wiθ + + istaɪɹelized]
/dʒ/- judge stood	[dʒʌgədstud]	[ʒudʒə + əstud]
/m/- I'm starving	[aɪmstaɹvɪn]	[aɪmistaɹvin]
/n/- then stir	[den + stʃiɹ]	[den - istɹi]
/ŋ/- shooting stars	[ʃutɪŋistaɹz]	[ʃətɪŋstaɹz]
/r/- Peter stares	[pitəɹstaɹs]	[pireɹ - əstɛɹz]

/l/- All staple	[ɔusteɪpow]	[auəstaple]
null- Students	[istjudənts]	[stjudənts]

3) sk Clusters

/u/- do skateboarding	[duəskeɪtbɔɹdiŋ]	[du + əskeɪtbɔɹdin]
/oʊ/- go skiing	[go + əskaɪŋ]	[gu+ + əskin]
/aɪ/- guy skin	[gaɪiskindaɪvz]	[gəɪ - iskin]
/aʊ/- cow skipped	[kauiskipəd]	[kau - iskiped]
/p/- hope skiving	[howp + skaɪvin]	[howpskiviŋ]
/t/- bit skew	[bət + + iskju]	[bitskju]
/k/- book skips	[buk + + əskaɪps]	[buk + skips]
/s/- Famous skinheads	[feɪmowskinhɛdz]	[femow + iskinhɛdz]
/ʃ/- Josh skidded	[dʒɔskaɪdəd]	[ʒɔʃ + iskided]
/f/- brief sketch	[bɹif + əskɛtʃ]	[bɹifiskɛtʃi]
/θ/- Both skiers	[bɔs $ kaɪəɹz]	[bəuθ + əskaɪəɹz]
/tʃ/- Which ski	[witʃskaɪ]	[witʃəs + + $ ki]
/b/- Bob skimps	[bɔbəs + + k̄ips]	[bɔb + isk̄ips]
/d/- passed skimming	[pasədskimin]	[pɛsed + + skimiŋ]
/g/- Big skiffs	[bigiskis]	[bɪgiskifs]

/z/- is skeptical	[iz + sk̲iptɪkaʊ]	[iz - skɛ̲ptikaʊ]
/ʒ/- Beige skirtings	[beɪg + + əsk̲iɹtiŋz]	[beɪʒ + əsk̲ɪɹtiŋz]
/v/- of skis	[əsk̲is]	[ofəsk̲is]
/ð/- with skill	[wiðisk̲iw]	[wɪθ + isk̲iwz]
/dʒ/- huge skirt	[hjug + skiɹt]	[hjudʒisk̲iɹt]
/m/- Sam skinned	[sʌm + isk̲in]	[sam + sk̲ined]
/n/- human skeleton	[ju̲mənskelɛ̲ton]	[hju̲məniskele̲ton]
/ŋ/- Long skeins	[lo̲ŋoŋskɪns]	[ləʊgəsk̲inz]
/r/- roller-skating	[ho̲leɹske̲ɪtin]	[ɹəu̲leɹiske̲ɪtin]
/l/- Paul skewered	[pow + + əskjuəɹ]	[pow + + isk̲iweɹɛd]
null- Sketchpads	[skɛ̲tʃpɔdz]	[skɛ̲tʃpɛdz]

4) sw Clusters

/oʊ/- ago swear	[a̲gow + swi̲ɹwoɹd]	[əgo̲w + + swɛ̲ɹwoɹdz]
/aɪ/- Thai sweets	[taɪswits]	[θaɪ + swits]
/aʊ/- now swear	[naʊswɛɹ]	[naʊ + + swɛɹ]
/oɪ/- boy swept	[bɔɪswep]	[bɔɪ + swɛp]
/p/- Stop swanking	[stɔpswʌ̲ŋkin]	[stɔp + + swa̲nkin]
/t/- brought swarms	[bɹɔtswaɹm]	[bɹəugθ + + swɔɹmz]

/k/- neck sweaters	[nɛk + + switəɹz]	[nɛki - swɛrəɹz]
/s/- This swampy	[diswẽpɪ]	[diswẽpɪ]
/ʃ/- Josh swapped	[dʒɔs + swɛpəd]	[ʒɔʃə - ispɛʃialɪ]
/f/- wife sweating	[waɪf + + switiŋ]	*[5]
/θ/- Both swans	[bɔs + swʌ̃]	[bəuθ + swowz]
/tʃ/- Which sweater	[witʃ + swɪtəɹ]	[witʃə - swɛreɹ]
/b/- Bob swatted	[bɔbsweɪtəd]	[bɔb - swɔted]
/d/- David swore	[deɪvidswoɹ]	[deɪvɪdswoɹ]
/g/- Big swastikas	[bigswɔwstikəs]	[bigi + + swɔstikaz]
/z/- These swimmers	[dis + swiməɹz]	[dizswimeɹz]
/ʒ/- Beige sweatbands	[bɹigswitbɛndz]	[beɪdʒ + swɛtbændz]
/v/- of swamps	[ɔfswamps]	[ɔfswæmps]
/ð/- with swarthy	[witə + + swɔɹtɪ]	[wɪθ - swɔɹtɪ]
/dz/ huge switchboard	[hʌgswitʃibɔɹd]	[hjudʒ + + suitʃibɔɹd]
/m/- Jim swaggered	[dʒĩsweɪdʒəɹ]	[dʒim + izwɔɹgɛd]
/n/- in swaddling	[i + + swɛdlin]	[in + + sʃwɔdlɪŋ]
/ŋ/- long swallow	[loŋswɔlow]	[loŋswalow]
/r/- Peter swam	[pitəɹswʌm]	[pirəɹ - swæm]
/l/- Michael swabbed	[maɪkəusweɪbəd]	[maɪkəu - swɔbed]

[5] -- Sentence not read by the subject.

null- Sweets	[swits]	[swits]

5) sm Clusters.

/i/- see smugglers	[si + əsmʌ̱gləɹz]	[si + əsmʌ̱gleɹz]
/oʊ/- So smokers	[sowzmə̱ʊ̱kəɹz]	[sowizmə̱ʊ̱keɹz]
/aʊ/- bow smashed	[bow + əzmɛ̱ʃəd]	[baʊ + izma̱ʃed]
/oɪ/- coy smile	[kɔɪizma̱ju]	[kɔɪizma̱ɪl]
/p/- soup smells	[sowpsmɛwz]	[sowp^{h} + + izmɛwz]
/t/- got small	[gɒtsmaw]	[gɒtismɔ̱w]
/k/- look smart	[luksmaɹ]	[luk^{h}isma̱ɹt]
/s/- its smog	[itsmow]	[itsizmɔ̱g]
/ʃ/- Josh smirked	[ʒɔsmi̱ɹkəd]	[ʒɔʃ + izmi̱ɹked]
/f/- wife smokes	[waɪfsmowks]	[waɪf + izmo̱wk]
/θ/- both smashed	[bɔsmɛ̱ʃəd]	[bɒθ + izmɛ̱ʃed]
/tʃ/- Each smithy	[itʃ + smʌ̱tʃi]	[itʃizmi̱θ]
/b/- Bob smiled	[bɔbizma̱ɪ̱lowd]	[bɔbizma̱i̱led]
/d/- dad smacked	[dɛdismæ̱kəd]	[dɛd + izma̱ked]
/g/- Big smelters	[bigizmɛ̱ltəɹz]	[bigizmɛw̱teɹz]
/z/- his smile	[hɪzmaju]	[hizizma̱ɪl]
/ʒ/- beige smock.	[beɪgizmo̱wk]	[beɪʒizmɔ̱k]

/v/- of smash	[ɔfsmɛʃ]	[ɔfizmɛtʃ]
/ð/- with small	[wid + əsmow]	[wiθ - izmɔw]
/dʒ/- huge smudges	[hʌg + əsmʌdʒəz]	[hʊdʒ + izmutʃeɹz]
/m/- some small	[sʌmsmɔw]	[sumizmɔw]
/n/- been smartened	[binzmaɹtɪnəd]	[bin + izmaɹtenəd]
/ŋ/- making small	[meɪkiŋismɔw]	[meɪkiŋɪzmɔw]
/r/- are smartly	[aɹsmaɹtlɪ]	[aɹizmaɹtlɪ]
/l/- Bill smashed	[biwizmɛʃəd]	[biw + izmɛʃed]
null- Smallholdings	[smɔwhowdĩ]	[əsmɔwhowdiŋz]

6) sn Clusters

/i/- She snores	[ʃisnɔɹz]	[ʃi + iznɔɹz]
/eɪ/- They snatched	[deɪznɛtʃəd]	[deɪ + iznɛtʃɛd]
/aʊ/- How snobbish	[haʊsnobiʃ]	[haʊiznobiʃ]
/oɪ/- enjoy snuggling	[endʒɔɪ + əsnʌglin]	[enʒɔɪ + iznɪgliŋ]
/p/- Stop snivelling	[stɔpsnaɪvliŋ]	[stɔpisniveliŋ]
/t/- it snappy	[itisnɛpɪ]	[itisnɛpɪ]
/s/ delicious snacks	[dəliʃowzsnæks]	[deliʃiowsəzneɪks]

/k/- Jack snared	[dʒɛksnɛɹəd]	[dʒæk^h + iznaɹed]
/ʃ/- Josh sneered	[dʒɔsniɹəd]	[ʒɔʃ + iznidəɹəd]
/f/- wife sniggered	[waɪf + + signəɹ]	[waɪf + iznigeɹəd]
/θ/- both snicked	[bɔs + snikəd]	[boθ + izniked]
/tʃ/- Which sniper	[wtʃi + iznaɪpəɹ]	[witʃiznipeɹ]
/b/ Bob sneaked	[bɔbisnikəd]	*[6]
/d/- lid snapped	[lidisnɛpəd]	[lid + iznɛped]
/g/- big snails	[big + əsnejuz]	*[7]
/z/- these snappish	[dis + + əsnɛpiʃ]	[diz + + iznæpiʃ]
/ʒ/- beige sneakers	[beɪgisnikəɹz]	[beɪʒ + izneɪkeɹz]
/v/- have snapped	[hɛvsnɛpəd]	[hɛvəznæped]
/ð/- with sneezing	[witisniʒiŋ]	[wið + + izniʒĩ]
/dʒ/- huge snack	[hʌg + snɛk]	[hjudʒizneɪkbaɹ]
/m/- game snakes	[geɪm + əsneɪks]	[geɪmi + + izneɪks]
/n/- Ian snagged	[ɪʌ̃ + əsneɪdʒɪd]	[ɪã + iznæged]
/ŋ/- long snakes	[loŋəsneɪks]	[loŋizneɪks]
/r/- cure snakebite	[kjuɹzneɪkbaɪts]	[kuɹ + izneɪkbits]
/l/- Beautiful snapdragons	[bjurifuəsnɛpdɹagonz]	[bjurfuliznæpdɹagonz]
null- Snake	[sneɪk]	[isneɪk]

[6] -- Sentence omitted from the corpus.
[7] -- Sentence omitted from the corpus.

/ð/- with sleep	[widslip]	[wɪθslip]
/dʒ/- huge slammer	[hʊgəsleɪməɹ]	[hjudʒ + izlameɹ]
/m/- Tom slowed	[tõ + əsloʊəd]	[tõ + izloʊed]
/n/- been slashed	[bĩ + əslɛʃəd]	[binizlæʃed]
/ŋ/- long sleeves	[loŋslivz]	[loŋizlivz]
/r/- Peter slammed	[pitəɹisleɪməd]	[piɾəɹ + izlɛmed]
/l/- All sleepers	[awslipəɹz]	[awizlipeɹz]
null- Slackers	[slɛkəɹz]	[əzlækeɹz]

8) spr Clusters

/i/- We sprayed	[wispɹeɪəd]	[wizpɹaɪd]
/u/- you spread	[juspɹɛd]	[juispɹɛd]
/eɪ/- They sprawled	[deɪspɹɔləd]	[ðeɪ + + spɹɔled]
/oʊ/- so spry	[sowspɹaɪ]	[sowispɹaɪ]
/p/- hope sprouts	[howpspɹowts]	[howpispɹuts]
/t/- meat spring	[mit + əspɹiŋ]	[mɛt + + əspɹɪŋ]
/k/- Jack sprained	[dʒɛkspɹeɪnəd]	[dʒɛkispɹeɪnɛd]
/s/- This sprinkler	[dispɹinklɹəɹ]	[θizpɹiŋkləɹ]
/ʃ/- fresh spring	[fɹɛʃ + əspɹiŋs]	[fɹɛʃispɹiŋ]

7) sl Clusters

/i/- many slang	[menɪ + əsleŋz]	[menɪizglend]
/eɪ/- They sleep	[deɪslip]	[deɪizlip]
/u/- Sue slapped	[suəslapəd]	[sju + izlaped]
/oɪ/- boy sliced	[bɔɪəslisəd]	[bɔɪ + slised]
/p/- up sleepyhead	[ap + slɪphɛd]	[ʌp + izliphɛd]
/t/- bit slack	[big + + əslɛk]	[bitslæk]
/k/- Jack slung	[dʒɛkslʌŋ]	[dʒeki + izlʌŋ]
/s/- dreamless sleep	[dɹimləslip]	[dɹemləsizlip]
/ʃ/- Josh slandered	[ʒɔslendəɹəd]	[ʒɔʃ + izlɛndeɹɛd]
/f/- rough slab	[haugizlæb]	[hug + izlæb]
/θ/- both slept	[bɔs + əslɛp]	[boθ - izlɛp]
/tʃ/- much slapstick	[mʌtʃislɛpstik]	[mʌtʃ + izlæpstik]
/b/- Bob slunk	[bɔbslʌnk]	[bɔb + izluk]
/d/- Ted sloshed	[tɛdəslɔʃəd]	[tɛd + islɔʃed]
/g/- big sledgehammer	[bigizlɛdʒi + hʌməɹ]	[bigi + izlɛdʒhameɹ]
/z/- always slagging	[auweɪz + əslɛgĩ]	[alweɪz + izlægĩ]
/ʒ/- beige sleeping	[bigislipĩ]	[beɪʒezlipə̃]
/v/- of slap	[onzlɛp]	[ɔfizlɛp]

/f/- Jeff spread	[dʒɛfspɹed]	[dʒɛf+ spɹɛd]
/θ/- Both spring	[bɔs + əspɹiŋs]	[bowθ + + əspɹiŋ]
/tʃ/- Each spring	[itʃspɹiŋ]	[itʃispɹĩ]
/b/- Bob spring	[bɔbspɹĩklinəd]	[bɔb + spɹiŋ]
/d/- had sprung	[hɛdspɹʌŋ]	[hɛdspɹuŋ]
/g/- Meg sprinted	[mɛgspɹintəd]	[mɛgi + ispɹinted]
/z/- was sprung	[wɔspɹʌŋ]	[wazispɹoŋ]
/ʒ/- beige springboard	[bliŋspɹiŋbɔɹd]	[bidʒi - spɹiŋbɔɹd]
/v/- of springy	[ɔfspɹiŋi]	[ɔf + spɹiŋɪ]
/ð/- with springboks	[widəspɹinbɔks]	[wid + ispɹiŋbuks]
/dʒ/- village sprawled	[viladʒi + spɹowləd]	*[8]
/m/- Jim sprinkled	[dʒĩəspɹinkləd]	[dʒɪm + ispɹinkled]
/n/- in springtime	[inəspɹiŋtaɪm]	[in + ispɹiŋitaɪm]
/ŋ/- drinking spree	[dɹiŋkɪŋspɹi]	[dɹinkĩ + əspɹi]
/r/- Hair spray	[hɛɹspɹeɪ]	[hɛɹispɹeɪ]
/l/- Small sprats	[smowspɹɛts]	[izmowizpɹæts]
null- Sprayers	[əspɹeɪəɹz]	[spɹeɪɹz]

[8] -- Sentence omitted from the corpus.

9) spl Clusters

/i/- He splashed	[hisplɛʃəd]	[hizplaʃed]
/eɪ/- motorway splits	[mɔtoɹweɪisplɛɪts]	[mɔtoɹweɪ + əsplits]
/u/- do splendid	[dusplɛndɪd]	[du + splendɪd]
/oʊ/- so splenetic	[sow + əsplenətɪk]	[soisplenɛtɪk]
/p/- Stop splinter	[stɒpsplinteɹ]	[stɔp + ispɹiŋz]
/t/- wrote splendid	[wɹowtəsplendɪd]	[wɹowt + isplendɪ]
/k/- Jack splurged	[dʒɛksplʌɹdʒəd]	[dʒɛkəsplugəɹɛd]
/s/- police splashed	[pəlisisplɛʃɪs]	[pɔlɪs + isplɛʃəθ]
/ʃ/- rush splenetic	[hʌʃisplenɪk]	[ɹʌʃ + + əsplenetic]
/f/- rough splintery	[ɹɔgsplintəɹɪ]	[hug + splinteɹɪ]
/θ/- Both splendiferous	[bɔsplendifəɹowz]	[bəuθ+isplendifeɹowz]
/tʃ/- Which split	[witʃisplit]	[witʃəsplits]
/b/- bib split	[bibisplit]	[bibisplit]
/d/- loud splashes	[lawdəsplɛʃad]	[lowdisplɛʃɪz]
/g/- big splinter	[bigisplintəɹ]	*[9]
/z/- was splattered	[wɔz + əslaptɹəd]	[wazizplɛtɹed]
/ʒ/- beige splint	[bigisplint]	[beɪʒizplint]

[9] -- Sentence omitted from the corpus.

/v/- of spleen	[ɔfispl̠i]	[ɔfispl̠i]
/ð/- with splayed	[wis + əspl̠eɪəd]	[wiθ + + ispl̠eɪəd]
/dʒ/- huge split	[hʌgəspl̠ɪt]	[hjudʒispl̠it]
/m/- him splendidly	[his + əspl̠endɪdlɪ]	[hĩ +əspl̠endɪdlɪ]
/n/- Brian spliced	[bɹaɪnspl̠aisəd]	[bɹa̠ɪən + + ispla̠ɪsed]
/ŋ/- exciting splashdown	[eksa̠ɪtɪŋispl̠ɛʃdon]	[eksa̠ɪtəŋəspl̠ɛʃdʒon]
/r/- Peter splashed	[p̠itəɹspl̠ɛʃəd]	[p̠irəɹ + ispl̠ɛʃed]
/l/ occasional splatter	[oka̠ʒənəw + əspl̠eitəɹ]	[okɛ̠ʃowispl̠ɛreɹ]
null- Splats	[əspl̠ɛts]	[splɛts]

10) str Clusters

/eɪ/- say strange	[seɪgstɹɛ̠ɪʒi]	[seɪəstɹe̠ndʒ]
/u/- too strangely	[tustɹe̠ndʒlɪ]	[tʃu + istɹe̠ndʒəlɪ]
/oʊ/- go straight	[gowstɹe̠ɪʒahɛd]	[gow + + stɹaɪt]
/aɪ/- My strategy	[maɪstɹatɛ̠ʒɪ]	[maɪistɹatɛ̠ʒɪ]
/p/- soap strewed	[sowpstɹu̠əd]	[swɔp + əstɹɛ̠wəd]
/t/- Eight streets	[eɪtistɹ̠its]	[eɪtʰistɹ̠its]
/k/- joke straight	[dʒowkstɹe̠ɪʒəd]	[istɹa̠ɪt]
/s/- Loose strands	[lustɹendz]	[luzistɹɛ̠nds]
/ʃ/- Turkish Straits	[tʌ̠ɹkiʃtɹeɪt]	[tʌ̠ɹkiʃistɹe̠ɪz+ +stɹeɪts]

/f/- wife strongly	[waɪfəstɹoŋlɪ]	[waɪfstɹoŋled]
/θ/- cloth straps	[klowsəstɹɛps]	[kɔθ + istɹæps]
/tʃ/- much stretching	[mʌtʃstɹɛtʃiŋ]	[mʌtʃəistɹɛtʃiŋ]
/b/- Bob struggled	[bɔbəstɹʌgləd]	[bɔb + istɹuglɛd]
/d/- bed straightaway	[bɛdstɹeɪɾaweɪ]	[bɛd + stɹaɪtaweɪ]
/g/- big streetlamp	[bigi + istɹilʌmp]	[bigi + istɹitʃilɛmp]
/z/- These strawberries	[distɹobɛɹɪz]	[diziztɹobɛɹɪz]
/ʒ/- rouge strangely	[hjugəstɹendʒlɪ]	[huʒ - stɹendʒəlɪ]
/v/- of strength	[ɔfistɹendʒə]	[əfstɹent]
/ð/- with streams	[wistɹimz]	[wiθtɹimz]
/dʒ/- village straggles	[viladʒə + əstɹaglez]	[viladʒ + istɹɛgowz]
/m/- became strained	[bikeɪmistɹeɪnɛd]	[bicamistɹeɪned]
/n/- Brendon strode	[brendõstɹowd]	[bɹendõ + əstɹowd]
/ŋ/- being straightened	[biŋistɹeɪʒitɪnəd]	[biŋ + + istɹaɪtenəd]
/r/- their struggle	[deɹstɹʌgow]	[dizistɹʌgow]
/l/- tall strapping	[tɔl + stɹɛpiŋ]	[tawəstɹɛpiŋ]
null- Strict	[stɹikti]	[stɹikt]

11) skw Clusters

/u/- blue square	[bluskwɛɹ]	[bluiskwɛ̱ɹ]
/oʊ/- No squads	[nowskwɛds]	[noiskwɛ̱ds]
/aɪ/- guy squandered	[gaɪiskwe̱ndəɹəd]	[gəɪ + skwa̱ndeɹəd]
/oɪ/- enjoy squalid	[endʒɔ̱ɪ̱əskwa̱lid]	[endʒɔ̱ɪ̱ + + iskwa̱lid]
/p/- Stop squelching	[stɔpskwɛ̱ltʃin]	[stɔpiskaʊ̱ʃin]
/t/- eat squash	[itskwɛʃ]	[eɪtskwɛʃ]
/k/- look squarely	[lukskwɛ̱ɹlɪ]	[luk^h + + iskwɛ̱ɹlɪ]
/s/- delicious square	[dəli̱ʃəs + əskwɛ̱ɹ]	[deli̱ʃiowziskwɛ̱ɹ]
/ʃ/- Josh squattted	[ʒɔske̱ɪ̱tɪd]	[ʒɔʃ + əskwɛ̱tedawn]
/f/- Jeff squealed	[dʒɛfiskwi̱lɪd]	[dʒef + iskwa̱led]
/θ/- squashy tomatoes	[bɔskwɛ̱ʃɪ]	[bəʊθ + + iskwɛ̱ʃɪ]
/tʃ/- peach squash	[pitʃskwɛʃ]	[pitʃiskwɛ̱ʃ]
/b/- Bob squeezed	[bɔbiskwi̱zəd]	[bɔb + skwi̱zed]
/d/- hundred square	[hʌ̱ndɹəd + + əskwɛ̱ɹ]	[hʌ̱ndɹediskwa̱ɹ̱z]
/g/- big squeeze	[bigiskwi̱z]	[bigiskwi̱z]
/z/- always squabbles	[a̱ʊ̱wɪzskwe̱ɪ̱blow]	[a̱lweɪz + əskɛ̱bowz]
/ʒ/- beige squares	[blɪ + skwɛɹz]	[beɪʒizkwɛ̱ɹəz]
/v/- of squalor	[ɔf + + skwɛ̱loɹ]	[ɔfəskwa̱loɹ]
/ð/- with squirrels	[wiskwa̱ɹ̱owz]	[wiθ + iskwi̱ɹəls]

/dʒ/- Village squatters	[vi̱ladʒiskwɛ̱təɹz]	[vi̱ladʒ + iskwa̱ɹteɹ]
/m/- him squeamish	[himskwi̱mi∫]	[hĩ + əskwɛ̱mi∫]
/n/- town square	[tawnskwɛɹ]	[tawiskwɛ̱ɹ]
/ŋ/- strong squall	[stɹoŋpskwɛwz]	[stɹoŋəskwa̱w]
/r/- car squashed	[kaɹ + əskwɛ̱ʃɪd]	[kaɹ + iskwɛ̱ʃed]
/l/- Several squad	[sɛ̱vəɹawəskwɛ̱d]	[sɛ̱veɹawiskwɛ̱d]
null- Square	[əskwɛ̱ɹ]	[skwɛɹ]

12) skr Clusters

/oʊ/- low scrub	[lowskɹʌb]	[low + + əskɹʌ̱b]
/aɪ/- I scrabbled	[aɪskɹe̱ɪbow]	[aɪskɹɛ̱bled]
/aʊ/- how scrupulous	[haw + əskɹu̱pulowz]	[hawɪskɹu̱pulowz]
/oɪ/- boy scribbled	[bɔɪskɹi̱bləd]	[bɔɪ + skɹɛ̱bled]
/p/- hope screenwriters	[howpəskɹinwɹa̱ɪtəɹz]	[hop + skɹizwɹi̱taɹz]
/t/- somewhat scrappy	[sʌ̱mwɔt + skɹɛpt]	[so̱mewɒtiskɹæ̱p]
/k/- like scrambled	[laɪkskɹɛ̱mbow]	[laɪkskɹa̱mblɛd]
/s/- police scrawled	[pɔ̱lisiskɹɔ̱wled]	[poli̱sɪ + əskɹɔ̱led]
/ʃ/ Josh scrambled	[ʒɔskɹe̱mblowd]	[ʒɔʃ + iskɹa̱mbled]
/f/- Jeff scraped	[dʒɛfiskɹe̱ɪpɪd]	[dʒɛf + iskɹa̱ped]

/θ/- both scrape	[bɔsəskɹe̱ɪpə]	[boθ + iskɹɛ̱p]
/tʃ/- such screening	[sʌtʃəskɹ̱iniŋ]	[sʌtʃ + + skɹ̱inĩ]
/b/- Rob screwed	[hɔbiskɹju̱əd]	[ɹɔ̱bə + + skɹɛ̱wed]
/d/- should scram	[ʃu + skɹɛm]	[ʃudskɹæm]
/g/- Meg scratched	[mɛgs $ kɹɛ̱tʃɪd]	[mɛg + skɹɛ̱tʃɛd]
/z/- his scraggy	[hɪskɹɛ̱gɪ]	[his + + kɹɛ̱dʒi]
/ʒ/- beige scroll	[big + skɹow]	[beɪʒiskɹo̱w]
/v/- of scraps	[əfskæps]	[ɔfiskɹæ̱ps]
/ð/- with scripted	[widəskɹ̱ipəd]	[wiθ + iskɹ̱iptɛd]
/dʒ/- huge scrapbook	[hjug + skɹɛ̱pbʊk]	[hjudʒiskɹɛ̱pbuk]
/m/- Sam screamed	[sɛ̃ski̱məd]	[sæm + əskɹe̱məd]
/n/-been scraped	[bĩskɹe̱ɪpɪd]	[binskɹa̱ped]
/ŋ/- long screwdriver	[lõ + skɹu̱dɹaɪvəɹ]	[loŋ + skɹu̱dɹaɪvəɹ]
/r/- over screes	[ow̱vəɹskɹiz]	[o̱vəɹ + skɹis]
/l/- small screens	[smɔwskɹinz]	[laɪkizmɔ̱w]
null- Scruffy	[sḳɹʌ̱fɪ]	[skɹu̱fɪ]

Subjects 3 and 4

1) sp Clusters

	Subject 3	Subject 4
/i/- He speaks	[hiispiks]	[hispiks]
/eɪ/- They spoilt	[deɪspɔɪlt]	[deɪispɔɪlət]
/u/- you spell	[juispɛl]	[juspɛw]
/oʊ/- No spitting	[nowispaɪtɪŋ]	*[10]
/p/- map specially	[mɛpspɛʃəlɪ]	[mɛp + spɛʃɪəlɪ]
/t/- not speed	[nɔtspiɾ]	*[11]
/k/-black spades	[blɛkspeɪds]	[blɛkspeɪdz]
/s/- famous speech	[feɪmows + ispitʃ]	[feɪmuzispitʃ]
/ʃ/- rush spoilt	*[12]	[ɹʌʃ + əspɔɪlt]
/f/- life span	[laɪfspɛn]	[laɪfspɛn]
/tʃ/- such spoilt	[sʌtʃispɔɪlt]	[sʌtʃspɔɪlt]
/θ/- twentieth Spanish	[twɛtɪspɛnɪʃ]	[twentɪspænɪʃ]
/b/- mob spoke	[mɔbəspowk]	[mɔb + əspowk]

[10] -- Sentence omitted from the corpus.
[11] -- Sentence omitted from the corpus.
[12] -- Sentence not read by the subject.

/d/- mad sponsor	[mɛdspo̱nsor]	[mædəspo̱nsoɹ]
/g/- big spatula	[bigəspɛ̱tulə]	[bigəspa̱tula]
/z/- always specify	[ɔ̱wɪzəspe̱sɪfaɪ]	[a̱uwɪz + əspe̱sɪfaɪ]
/ʒ/- beige spaniel	[beɪdʒispeɪ̱njəl]	[beɪdʒəspɛ̱njow]
/v/- of spectators	[əvspekte̱ɪtəɹz]	[əfspɛ̱kteɪtoɹz]
/ð/- with spades	[widspeɪdz]	[wifspeɪdz]
/dʒ/-judge special	[dʒʌdʒispɛ̱ʃəl]	[dʒʌdʒəspɛ̱ʃəl]
/m/- some special	[sʌmspɛ̱ʃəl]	[sʌməspɛ̱ʃow]
/n/- done specially	[dʌnspɛ̱ʃəlɪ]	[dõəspɛ̱ʃəlɪ]
/ŋ/- sang spectacular	[seŋspetɛ̱kuləɹ]	[sɛŋ + əspeta̱kulaɹ]
/r/- beggar spelt	[bi̱gaɹspɛlt]	[bɛ̱gaɹ + spɛwt]
/l/- Several species	[sɛ̱vəɹəwəspɛ̱sɪs]	[sɛ̱vəɹowəspɛ̱sɪs]
null- Spaghetti	[spəgɛ̱ɾɪ]	[əspagɛ̱ɾɪ]

2) st Clusters

/eɪ/- may stay	[meɪiste̱ɪ]	[meɪsteɪ]
/u/- too stubborn	[tustʌ̱pbɔɹn]	[tʃuəstʌ̱bəɹn]
/oʊ/- No standing	[nowiste̱ndɪŋ]	[nowəstɛ̱ndĩ]
/aɪ/- My staff	[maɪstɛf]	[maɪstaf]

/p/- hope steelworkers	[howpstiwwoɹks]_	[howpstiwwoɹkəɹz]
/t/- get stuck	[gɛtstʌk]	[gɛt + stʌk]
/k/- like stale	[laiksteɪl]	[laɪksteɪbow]
/s/- famous store	[feɪmowstɔɹ]	[feɪmows + əstɔɹ]
/ʃ/- brush stallions	[bɹʌʃstɛljənz]	[bɹʌʃ + əstalɪõz]
/f/- Jeff steals	[dʒɛfstiwz]	[dʒɛfstiwz]
/θ/- cloth stains	[klɔdəsteɪnz]	[klowsəsteɪnz]
/tʃ/- such still	[sʌtʃəstiw]	[sʌtʃ + stiw]
/b/- rob students	[ɹɔbistjudənts]	[ɹɔb + əstjudənts]
/d/- should stand	[ʃudəsten]	[ʃudstɛnd]
/g/- big stapler	[bigstɛpləɹ]	*[13]
/z/- was stabbed	[wɔz + əstɛpɪd]	[wazəstɛbɪd]
/ʒ/- rouge stuck	[ɹowdʒstʌk]	[ɹuʒ + əstʌk]
/v/- of style	[əvəstaɪl]	[əfstaɪl]
/ð/- with sterilized	[widəsteɹɪlaɪzd]	[wif + əstɛɹɪlaɪzɪd]
/dʒ/- judge stood	[dʒʌdʒistud]	[dʒʌdʒəstud]
/m/- I'm starving	[aɪməstaɹvɪŋ]	[aɪmstaɹvĩ]
/n/- then stir	[denstiɹ]	[dɛn + stiɹ]
/ŋ/- shooting stars	[ʃuriŋ + əstaɹz]	[ʃutiŋəstaɹz]

[13] -- Sentence omitted from the corpus.

/r/- Peter stares	[pirəɹ + əstɛɹz]	[pitəɹ + stɛɹz]
/l/- All staple	[awəstɛpow]	[awəstɛpow]
null- Students	[studənts]	[əstjudənts]

3) sk Clusters

/u/- do skateboarding	[duiskeɪrɪbɔɹdɪŋ]	[du + əskeɪtbɔɹdĩ]
/oʊ/- go skiing	[gowiskiŋ]	[gowiskaɪn]
/aɪ/- guy skin	[gaɪiskĩ]	[gaɪ + iskin]
/aʊ/- cow skipped	[kaw + skipɪd]	[kaw + skipɪd]
/p/- hope skiving	[howpskiviŋ]	[howpskaɪvĩ]
/t/- bit skew	[bitiskju]	[bitskju]
/k/- book skips	[bukskips]	[bukskips]
/s/- Famous skinheads	[feɪmowziskinhɛds]	[feɪmows + iskihɛds]
/ʃ/- Josh skidded	[dʒɔʃskidɪd]	[dʒɔʃ + + əskaɪdɪd]
/f/- brief sketch	[bɹifskɛtʃ]	[bɹifis + + kɛtʃ]
/θ/- Both skiers	[bɔtskiəɹz]	[bowf + skaɪɹz]
/tʃ/- Which ski	[witʃiski]	[witʃskaɪ]
/b/- Bob skimps	[bɔbskimps]	[bɔbiskimps]
/d/- passed skimming	[pɛsɪdəskimiŋ]	[pɛsidskimĩ]

/g/- Big skiffs	[bigiskifs]	[bigəskɪfs]
/z/- is skeptical	[ɪzskɛptɪkaw]	[izəskɛptɪkaw]
/ʒ/- Beige skirtings	[beɪdʒəskiɹtiŋz]	[beɪʒə + əskaɹtĩz]
/v/- of skis	[ɔfskis]	[əfskis]
/ð/- with skill	[widskiw]	[wɪθskiw]
/dʒ/- huge skirt	[hʌgskiɹt]	[hjudʒi + əskɛɹt]
/m/- Sam skinned	[sæmskinɪd]	[sam + əskinɪd]
/n/- human skeleton	[hjumənskəlɛtən]	[juman + əskəlɛton]
/ŋ/- Long skeins	[lɔŋskaɪnz]	[loŋəskinz]
/r/- roller-skating	[ɹowləɹskeɪtɪŋ]	[ɹoləɹskeɪtĩ]
/l/- Paul skewered	[powskjuɹɛd]	[pow + iskjuɹɪd]
null- Sketchpads	[skɛtʃpɛdz]	[əskɛtʃpɛds]

4) sw Clusters

/oʊ/- ago swearwords	[əgowswiɹwɜɹdz]	[agəw + swɛɹwoɹdz]
/aɪ/- Thai sweets	[taɪswits]	[tai + swits]
/aʊ/- now swear	[nawswɛɹ]	[nawswɛɹ]
/oɪ/- boy swept	[bɔɪswɛpt]	[bɔɪ + swɛpt]
/p/- Stop swanking	[stɔpswankĩ]	[stɔpswankĩ]

/t/- brought swarms	[bɹawtswɔɹmz]	[bɹɔwt + swaɹmz]
/k/- neck sweaters	[nɛkswɛ̲rəɹz]	[nɛk + + swɛ̲təɹz]
/s/- This swampy	[dis + swɛ̲mpɪ]	[diswamp]
/ʃ/- Josh swapped	[dʒɔʃ + swɔ̲pɪd]	[dʒɔʃ + swa̲pɪd]
/f/- wife sweating	[waɪfswi̲tiŋ]	[waɪfswi̲fi]
/θ/- Both swans	[bɔtswamz]	[bowθ + swanz]
/tʃ/- Which sweater	[witʃswi̲təɹ]	[witʃswi̲təɹ]
/b/- Bob swatted	[bɔbswɔ̲rɪd]	[bɔbswa̲tɪd]
/d/- David swore	[de̲ɪvɪdswɔɹ]	[de̲ɪvɪdswɔɹ]
/g/- Big swastikas	[bigswɔ̲stikəz]	[bigəswa̲stɪkas]
/z/- These swimmers	[dis + swi̲məɹz]	[diz + swi̲məɹz]
/ʒ/- Beige sweatbands	[be̲ɪʒi + swi̲tbendz]	[be̲ɪdʒə + swi̲tbendz]
/v/- of swamps	[əvswɛmps]	[əfswamps]
/ð/- with swarthy	[wɪdswɔ̲ɹtɪ]	[wɪðswa̲ɹtɪ]
/dʒ/- huge switchboard	[hʌg + swi̲tʃibɔɹd]	[hju̲dʒi + swi̲tʃbɔɹd]
/m/- Jim swaggered	[dʒim + swɔ̲gəɹɪd]	[dʒim + swa̲gəɹɪd]
/n/- in swaddling	[inswɔ̲dlɪŋ]	[inswa̲dlɪ]
/ŋ/- long swallow	[lɔŋ + swɛ̲low]	[loŋswa̲low]
/r/- Peter swam	[pi̲təɹ + swam]	[pi̲teɹswam]
/l/- Michael swabbed	[ma̲ɪkowswɔ̲bɪd]	[ma̲ɪkowsɔ̲bɪd]

null- Sweets	[swits]	[swits]

5) sm Clusters.

/i/- see smugglers	[siəsmʌgləɹz]	[si + izmʌgləɹz]
/oʊ/- So smokers	[sowəsməʊkəɹz]	[sowizməʊkəɹ]
/aʊ/- bow smashed	[bow + smɛʃɪd]	[bowəsmɛʃɪd]
/oɪ/- coy smile	[kɔɪzmaɪl]	[kɔɪ + izmaɪl]
/p/- soup smells	[sʌp + izmɛlz]	[sowpzmɛwz]
/t/- got small	[gɔtsmɔl]	[gɔtsmɔl]
/k/- look smart	[luksmaɹt]	[lukəzmaɹt]
/s/- its smog	[ɪtsmɔg]	[its + izmug]
/ʃ/- Josh smirked	[dʒɔʃ + smɪɹkɪd]	[dʒɔʃ + izmaɹkɪd]
/f/- wife smokes	[waɪfsmowks]	[waɪfsmowks]
/θ/- both smashed	[bɔtsmɛʃɪr]	[bow + izmɛʃɪd]
/tʃ/- Each smithy	[itʃsmit]	[itʃə + izmit]
/b/- Bob smiled	[bɔbsmaɪl]	[bɔbəzmaɪlɪd]
/d/-dad smacked	[dɛdizmɛkɪd]	[dɛd + izmɛkid]
/g/- Big smelters	[bigizmɛwtəɹz]	[bigəsmɛltəɹz]
/z/- his smile	[hizizmaɪw]	[hizmaɪl]

/ʒ/- beige smock	[beɪdʒsmowk]	[beɪʒizmuk]
/v/- of smash	[əvəzmɛʃ]	[ɔf + izmɛʃə]
/ð/- with small	[widəsmɔw]	[wɪfsmɔw]
/dʒ/- huge smudges	[hʌdʒizmʌdʒiz]	[hjudʒə + + əzmuds]
/m/- some small	[sʌmsmɛl]	[sʌməzmaw]
/n/- been smartened	[binzmaɹtənɪd]	[bĩ + izmaɹtənɪd]
/ŋ/- making small	[meɪkɪŋzmɔl]	[meɪkĩ + izmɔw]
/r/- are smartly	[aɹəsmaɹtlɪ]	[aɹ + izmaɹtlɪ]
/l/- Bill smashed	[biwəsmɛʃɪd]	[biwizmɛʃɪd]
null- Smallholdings	[smowhowdɪŋs]	[izmawhowdĩz]

6) sn Clusters

/i/- She snores	[ʃiiznɔɹz]	[ʃiznɔɹz]
/eɪ/- They snatched	[deɪznɛtʃɪd]	[deɪznɛtʃɪd]
/aʊ/- How snobbish	[hawəsnɔbɪʃ]	[hawiznɔbiʃ]
/oɪ/- enjoy snuggling	[endʒɔɪiznʌglɪŋ]	[endʒɔɪ + + iznʌgĩɪ]
/p/- Stop snivelling	[stɔpsnivəlɪŋ]	[əstɔpsnaɪvlɪŋ]
/t/- it snappy	[meɪkəsnɛpɪ]	[itsnɛpɪ]
/s/ delicious snacks	[deliʃiows + əsnɛks]	[delisiowsiznæks]

/k/- Jack snared	[dʒɛksnɛ̱ɹɪd]	[dʒɛks $ nɛ̱ɹɪd]
/ʃ/- Josh sneered	[dʒɔʃ + izni̱ɹɪd]	[dʒɔʃ + izni̱ɹɪd]
/f/- wife sniggered	[waɪfsni̱gəɹd]	[wa̱ɪfə + izni̱gəɹɪd]
/θ/- both snicked	[bɔtsni̱kɪd]	[bowθ + izni̱kɪd]
/tʃ/- Which sniper	[switisni̱pəɹ]	[witʃizni̱pəɹ]
/b/ Bob sneaked	[bɔbiznɛ̱kɪr]	[bɔbzni̱kɪd]
/d/- lid snapped	[lidsnɛ̱pɪd]	[lidəznɛ̱pɪd]
/g/- big snails	[bigəsne̱ɪlz]	[bigəzne̱ɪwz]
/z/- these snappish	[dizəznɛ̱pɪʃ]	[dizəznɛ̱piʃ]
/ʒ/- beige sneakers	[beɪdʒizni̱keɹz]	[beɪdʒsni̱kəɹz]
/v/- have snapped	[hɛvəznɛ̱pɪd]	
/ð/- with sneezing	[widsni̱zɪŋ]	[wiθsni̱zĩ]
/dʒ/- huge snack	[hʌg + sneɪk]	[hju̱dʒə + əzna̱k]
/m/- game snakes	[geɪmisne̱ɪks]	[ge̱ɪməs + əzne̱ɪks]
/n/- Ian snagged	[a̱ɪənsnɛg]	[jən + əznɛ̱gɪd]
/ŋ/- long snakes	[loŋsneɪks]	[loŋəzne̱ɪks]
/r/- cure snakebites	[kʌɹ + izne̱ɪkbaɪts]	[kjuɹ + izne̱ɪk + baɪts]
/l/- Beautiful snapdragons	[bju̱rɪfowəznɛ̱pdɹɛgənz]	[bju̱ɹɪfowəznɛ̱pdɹɛgõz]
null- Snake	[sneɪk]	[sneɪk]

7) sl Clusters

/i/- many slang	[me̱nɪzleŋ]	[me̱nɪzleŋ]
/eɪ/- They sleep	[deɪzli̱pɪd]	[deɪizli̱p]
/u/- Sue slapped	[suəzlɛ̱pɪd]	[su + + əzlɛ̱pɪd]
/oɪ/- boy sliced	[bɔɪizla̱ɪsɪd]	[bɔɪzla̱ɪsɪd]
/p/- up sleepyhead	[ʌpisli̱phɛd]	[ʌp + izli̱phɛd]
/t/- bit slack	[bitslɛk]	[bitslɛk]
/k/- Jack slung	[dʒɛkslʌŋ]	[dʒɛkzlʌŋ]
/s/- dreamless sleep	[dɹimləs + isli̱p]	[dɹimlɛs + əzli̱p]
/ʃ/- Josh slandered	[dʒɔʃslɛ̱ndəɹɪd]	[ʒɔʃ + əsla̱ndəɹɪd]
/f/- rough slab	[ɹɔk + əslɛ̱b]	[ɹudʒ + əzlɛ̱b]
/θ/- both slept	[bɔtslɛpt]	[bows + əzli̱pt]
/tʃ/-much slapstick	[mʌtʃslɛ̱pstik]	[mʌtʃəspla̱tək]
/b/- Bob slunk	[bɔbslʌŋk]	[bɔbəzla̱ŋk]
/d/- Ted sloshed	[tɛdəzlɔ̱ʃɪd]	[tɛdzlɔ̱ʃɪd]
/g/- big sledgehammer	[bigislɛ̱dʒihʌ̱məɹ]	[bigəzlɛ̱dəgə++hʌ̱məɹ]
/z/-always slagging	[ɔ̱lwɪzlɛgɪŋ]	[a̱weɪz + izlæ̱gɪŋ]
/ʒ/- beige sleeping	[beɪdʒsli̱pin]	[beɪdʒ + əzli̱pɪn]
/v/- of slap	[əfslɛp]	[onzlɛp]

/ð/- with sleep	[widslip]	[wɪð + əslip]
/dʒ/- huge slammer	[hʌdʒizleməɹ]	[hjudʒəslaməɹ]
/m/- Tom slowed	[tɔm + slowəd]	[tõ + əzlowəd]
/n/- been slashed	[binislɛʃɪd]	[binzlɛʃɪd]
/ŋ/- long sleeves	[lɔŋslivz]	[loŋzlivz]
/r/- Peter slammed	[pirəɹslɛmɪd]	[piteɹizlæmɛd]
/l/- All sleepers	[ɔwəslipəɹz]	[awəzlipəɹ]
null- Slackers	[sleɪkəɹz]	[əzlakəɹz]

8) spr Clusters

/i/- We sprayed	[wispɹeɪəd]	[wispɹeɪəd]
/u/- you spread	[juispɹid]	[juəspɹɛd]
/eɪ/- They sprawled	[deispɹɔlɛd]	[deɪpɹawlɪd]
/oʊ/- so spry	[sowispɹaɪ]	[sowəspɹaɪ]
/p/- hope sprouts	[howpspɹawts]	[howpəspɹawts]
/t/- meat spring	[mitspɹiŋ]	[mit + əspɹiŋ]
/k/- Jack sprained	[dʒɛkispɹeɪnɪd]	[dʒɛkd + əspɹeɪnɪd]
/s/- This sprinkler	[dispɹinkləɹ]	[dizispinkləɹ]
/ʃ/- fresh spring	[fɹɛʃəspɹiŋ]	[fɹɛʃ + ispɹiŋə]

/f/- Jeff spread	[dʒɛfspɹid]	[dʒɛf + əspɹɛd]
/θ/- Both spring	[bɔtspɹiŋ]	[bowθ + əspɹiŋ]
/tʃ/- Each spring	[itʃspɹiŋ]	[itʃəspɹiŋki]
/b/- Bob spring	[bɔbspɹiŋ]	[bɔb + əspɹiŋ]
/d/- had sprung	[hɛdəspɹʌŋ]	[hɛdəspɹʌŋɪd]
/g/- Meg sprinted	[mɛgspɹintɪd]	[mɛg + spɹintɪd]
/z/- was sprung	[wɔzispɹuŋ]	[wɔzispɹʌŋ]
/ʒ/- beige springboard	[beɪdʒispɹiŋbɔɹd]	[beɪdʒə + əspɹinbɔɹd]
/v/- of springy	[əvspɹiŋɪ]	[ɔfspɹiŋɪ]
/ð/- with springboks	[wɪdspɹiŋbɔks]	[wɪð + əspɹinbɔks]
/dʒ/- village sprawled	[viladʒispɹɔlɪr]	[viladʒspɹawlɪd]
/m/- Jim sprinkled	[dʒim + əspɹiŋklɪd]	[dʒĩ + əspɹinklɛd]
/n/- in springtime	[ĩ + ispɹiŋtaɪm]	[ɪnispɹiŋtaɪm]
/ŋ/- drinking spree	[dɹiŋkiŋispɹi]	[dɹiŋkĩ + spɹi]
/r/- Hair spray	[hɛɹ + ispɹeɪ]	[hɛɹ + əspɹeɪ]
/l/- Small sprats	[smɔwspɹɛts]	[izmɔwispɹats]
null- Sprayers	[spɹeɪɹz]	[əspɹeɪəɹz]

9) spl Clusters

/i/- He splashed	[hisplaʃɪd]	[hisplɛʃɪd]
/eɪ/- motorway splits	[mɔrəɹweɪsplits]	[mɔrəɹweɪəsplits]
/u/- do splendid	[duəsplendɪd]	[duəsplɛdɪd]
/oʊ/- so splenetic	[sowəsplenɪk]	[sowəsplɛnətk]
/p/- stop splinter	[istɔpisplintəɹ]	[stɔpəsplintəɹ]
/t/- wrote splendid	[wɹowtsplɛndɪd]	[wɹowtsplendɪd]
/k/- Jack splurged	[dʒɛksplʌgɹɪd]	[dʒæk + əsplugəɹd]
/s/- police splashed	[pɔlɪsəsplɛʃɪd]	[polɪsəsplɛʃɪd]
/ʃ/- rush splenetic	[ɹʌʃisplenɛtik]	[ɹʌʃəsplənɛtɪk]
/f/- rough splintery	[ɹagəsplintəɹɪ]	[ɹudəsplintəɹɪ]
/θ/- Both splendiferous	[bɔt + əsplendɪfəɹəz]	[bowθ+əsplendɪfəɹowz]
/tʃ/- Which split	[witʃspit]	[witʃsplit]
/b/- bib split	[bib + isplit]	[bibəsplit]
/d/-loud splashes	[lawd + splɛʃɪz]	[lawdəsplɛʃɪz]
/g/- big splinter	[bigisplintəɹ]	[big + splintəɹ]
/z/- was splattered	[wɔzəsplɛtəɹɪd]	[wazəsplatəɹɛd]
/ʒ/- beige splint	[beɪdʒisplint]	[beɪdʒsplint]
/v/- of spleen	[ɔvsplin]	[ɔfəsplin]

/ð/- with splayed	[wɪdəspleɪəd]	[wɪf + əspleɪəd]
/dʒ/- huge split	[hʌʒisplit]	[hjudʒsplit]
/m/- him splendidly	[him + əsplendɪdlɪ]	[hĩ + əsplendlɪ]
/n/- Brian spliced	[bɹaɪən + isplaɪsɪd]	[bɹaɪənəsplaɪsɪd]
/ŋ/-exciting splashdown	[əksaɪtiŋ + əsplɛʃdawn]	[ɪksaɪfi + əsplɛʃdawn]
/r/- Peter splashed	[pitəɹsplɛʃɪr]	[piteɹ + əsplɛʃɪd]
/l/ - occasional splatter -	[əkeɪʒənawispleɪtəɹ]	[okaʒonawəsplatəɹ]
null- Splats	[əsplɛts]	[splɛts]

10) str Clusters

/eɪ/-say strange	[seɪstɹendʒ]	[seɪstɹeɪndʒ]
/u/- too strangely	[tuəstɹeŋlɪ]	[tuəstɹeɪndʒəlɪ]
/oʊ/- go straight	[gowistɹeɪr]	[gowəstɹeɪt]
/aɪ/- My strategy	[maɪstɹɛtəʒɪ]	[maɪstɹɛtədʒɪ]
/p/- soap strewed	[sowpəstɹuəd]	[sopistjuəɹd]
/t/- Eight streets	[eɪtstɹits]	[eɪtstɹits]
/k/- joke straight	[dʒowkstɹeɪt]	[dʒowʊkstɹeɪt]
/s/- Loose strands	[luz + əstɹendz]	[luzəstɹɛndz]
/ʃ/- Turkish Straits	[tuɹkɪʃstɹeɪts]	[tʌɹkɪʃ + əstɹeɪts]

/f/- wife strongly	[waɪfstɹɔŋlɪ]	[waɪfstɹoŋlɪ]
/θ/-cloth straps	*[14]	[klowθ + stɹɛps]
/tʃ/- much stretching	[mʌtʃəstɹitʃiŋ]	[mʌtʃstɹɛtʃĩ]
/b/- Bob struggled	[bɔbistɹʌglɪd]	[bɔbəstɹʌgow]
/d/-bed straightaway	[bɛdstɹeɪtweɪ]	[bɛd + əstɹeit + aweɪ]
/g/- big streetlamp	[bigəstɹiplɛmp]	[bigəstɹilɛmpə]
/z/- These strawberries	[ðizəstɹombɛɹɪz]	[diztɹɔbəɹɪz]
/ʒ/- rouge strangely	[ɹowdʒistɹeŋlɪ]	[ɹudʒəstɹeɪndʒəlɪ]
/v/- of strength	[əvstɹiŋ]	[ɔfstɹeɪnts]
/ð/- with streams	[widstɹimz]	[wɪð + stɹimz]
/dʒ/- village straggles	[vɪlədəstɹɛgowz]	[viladzistɹagowz]
/m/- became strained	[bikeɪmistɹeɪnɪd]	[bikeɪmistɹeɪnɪd]
/n/- Brendon strode	[bɹendowəstɹowd]	[bɹendõ + əstɹowd]
/ŋ/- being straightened	[baɪn + əstɹeɪtənɪd]	[binistɹeɪtənɪd]
/r/- their struggle	[deɪɹəstɹʌgow]	[deɪɹəstɹʌgow]
/l/-tall strapping	[tɔwstɹɛpɪŋ]	[tawəstɹɛpĩ]
null- Strict	[əstɹikt]	[əstɹitʃ]

[14] -- Sentence omitted from the corpus.

11) skw Clusters

/u/- blue square	[bluəskwɛɹ]	[bluəskwɛɹ]
/ou/- No squads	[nowəskwɛds]	[nowəskwɛds]
/aɪ/- guy squandered	[gaɪiskwandəɹɪ]	[gaɪ + skwʌndəɹɪd]
/oɪ/- enjoy squalid	[endʒɔɪ + əskwɛd]	[endʒɔɪ + əskwælɪd]
/p/- Stop squelching	[stɔpskwɛlʃɪŋ]	[stɔpskwɛwtʃi]
/t/- eat squash	[itskwɔʃ]	[itskwɛʃ]
/k/- look squarely	[lukskwɛɹəlɪ]	[lukskwɛɹlɪ]
/s/- delicious square	[delɪʃəskwɛɹ]	[dəliʃuz + iskwɛɹ]
/ʃ/- Josh squatted	[dʒɔʃi + əskwɔɾɪd]	[dʒɔʃ + uskwatɪd]
/f/- Jeff squealed	[dʒɛfiskwilɪd]	[dʒɛfskwilɪd]
/θ/- Both squashy	[bɔtskwɛʃɪ]	[bowθ + əskwɛʃɪ]
/tʃ/- peach squash	[pitʃəskwɛʃ]	[pitʃə + əskwɛʃ]
/b/- Bob squeezed	[bɔbskwizɪd]	[bɔbiskwizɪd]
/d/- hundred square	[hʌndɹɪdskwɛɹ]	[χʌndɹɪdskɛɹ]
/g/- big squeeze	[bigiskwiz]	[bigəskwiz]
/z/- always squabbles	[ɔlweɪzəskwɛbowz]	[waweɪz + iskwabow]
/ʒ/- beige squares	[beɪdʒiskwɛɹz]	[beɪdʒskwɛɹz]
/v/- of squalor	[əvəskwɛləɹ]	[ɔfskwaloɹ]

/ð/- with squirrels	[wɪd + əskwiɹowz]	[wɪfis + kwaɹowz]
/dʒ/- Village squatters	[vilɪds $ kwɔtəɹz]	[viladʒ + əskwatəɹz]
/m/- him squeamish	[him + skwimiʃ]	[hĩ + iskwimiʃ]
/n/-town square	[tawnskwɛɹ]	[tawnəskwɛɹ]
/ŋ/- strong squall	[əstɹɔŋəskwaw]	[əstɹoŋəskwɔl]
/r/- car squashed	[kaɹəskwɔʃɪd]	[kaɹəskwɛʃɪd]
/l/- Several squad	[sɛvəɹawskwɛd]	[sɛveɹawəskwɛd]
null- Square	[skwɔɹ]	[əskwɛɹ]

12) skr Clusters

/oʊ/- low scrub	[lɔn + skɹʌb]	[lowəskɹub]
/aɪ/- I scrabbled	[aɪskɹɛbəl]	[aɪskɹæbowd]
/aʊ/- how scrupulous	[hawəskɹupəlowz]	[hawəskɹɛpəlowz]
/oɪ/- boy scribbled	[bɔɪəskɹɪbow]	[bɔɪskɹiblɪd]
/p/- hope screenwriters	[howpskɹinwɹaɪtəɹz]	[howpi+əskɹinwɹaɪtəɹz]
/t/- somewhat scrappy	[sʌməwɔtskɹeɪpɪ]	[swimwɔtəskɹɛnpə]
/k/- like scrambled	[laɪkskɹɛmbow]	[laɪkskɹʌmbəd]
/s/- police scrawled	[pɔlɪsi + əskɹowlɪd]	[polisə + skɹɔlɪd]
/ʃ/ Josh scrambled	[dʒɔʃ + əskɹɛmbow]	[dʒɔʃ + əskɹɛmbəd]

/f/- Jeff scraped	[dʒɛfəskɹɛ̠pɪd]	[dʒɛfskɹɛ̠pɪd]
/θ/- both scrape	[bɔdskɹ̠ɪpər]	[bowθ + əskɹɛ̠p]
/tʃ/- such screening	[sʌtʃskɹ̠iñ]	[sʌtʃskɹ̠iñ]
/b/- Rob screwed	[ɹɔbiskɹu̠əd]	[ɹɔbəskɹu̠owd]
/d/- should scram	[ʃud + skɹɪm]	[ʃudəskɹʌ̠m]
/g/- Meg scratched	[mɛgsəskɹɛ̠tʃɪd]	[mɛgəskɹɛ̠tʃ]
/z/- his scraggy	[hizskɹɛ̠gɪ]	[hɪzəskɹɛ̠dʒɪ]
/ʒ/- beige scroll	[beɪdʒiskɹu̠]	[beɪʒəskɹu̠]
/v/- of scraps	[əvskɹɛps]	[ɔfskɹɛps]
/ð/- with scripted	[widəskɹ̠iɪd]	[wisəskɹ̠iptɪd]
/dʒ/- huge scrapbook	[hʌdʒiskɹɛ̠pbuk]	[hjud + əskɹɛ̠pbuk]
/m/- Sam screamed	[səmskɹ̠imɪd]	[sʌm + əskɹ̠imɪd]
/n/- been scraped	[binəskɹɛ̠pɪd]	[bin + əskɹɛ̠pɪd]
/ŋ/-long screwdriver	[lɔŋskɹu̠dɹaɪvəɹ]	[loŋəskɹu̠dɹaɪveɹ]
/r/-over screes	[owvəɹiskɹiz]	[o̠vəɹ + əskɹ̠iz]
/l/- small screens	[smɔ̊wskɹimz]	[smɔwəskɹ̠inz]
null- Scruffy	[əskɹʌ̠fɪ]	[əskɹʌ̠f]

Subjects 5 and 6

1) sp Clusters

/i/- He speaks	[hispiks]	[hiispi̱ks]
/eɪ/- They spoilt	[deɪsplɔɪlt]	[deɪspɔɪlt]
/u/- you spell	[juspɛw]	[juspɛl]
/oʊ/- No spitting	[nowəspi̱tiŋ]	[nɔtspi̱ti]
/p/- map specially	[mɛp + əspɛ̱ʃɪəlɪ]	[mæp + əspɛ̱ʃəlɪ]
/t/- not speed	[nɒtspir]	[dontspɪd]
/k/-black spades	[blekspeɪdz]	[blækispe̱ɪdz]
/s/- famous speech	[fe̱ɪmowspitʃ]	[fe̱ɪmowz + ispi̱tʃ]
/ʃ/- rush spoilt	[ɹʌʃ + + əksplɔ̱ɪt]	[hʌʃispɔ̱ɪl]
/f/- life span	[laɪf + spɛn]	[laɪfspæn]
/tʃ/- such spoilt	[sʌtʃəsplɔ̱ɪd]	[sʌʃspɔɪld]
/θ/- twentieth Spanish	[twɛ̱nɪəθspɛ̱nɪʃ]	[twe̱ntɪθspæ̱nɪʃ]
/b/- mob spoke	[mɔb + + spowk]	[mɔbispo̱wk]
/d/- mad sponsor	[mɛdəspo̱nsəɹ]	[mɛdspʌ̱nsəɹ]
/g/- big spatula	[bigəspɛ̱tjulə]	[bigispatu̱la]
/z/- always specify	[ɔ̱weɪzəspe̱sɪfaɪ]	[a̱weɪz + ispe̱sɪfaɪ]

/ʒ/- beige spaniel	[bidʒispɛnjəl]	[beɪdʒ + əspɛnɪɛl]
/v/- of spectators	[əfspɛkteɪtəɹz]	[əfspɛkteɪtorz]
/ð/- with spades	[wɪθspeɪdz]	[wɪðspeɪdz]
/dʒ/-judge special	[dʒʌdʒəspɛʃə]	[dʒudʒispɛʃəl]
/m/- some special	[sʌməspɛʃəl]	[sʌmspɛʃowz]
/n/- done specially	[dʌnəspɛʃəlɪ]	[dʌnispɛʃjəlɪ]
/ŋ/- sang spectacular	[seŋ + + spektɛkjuləɹ]	[saŋspɛktulaɹ]
/r/- beggar spelt	[bɛgəɹəspɛlt]	[bɪgəɹispɛlt]
/l/- Several species	[sɛvəɹawəspiʃɪz]	[sɛvəɹələspɛsɪz]
null- Spaghetti	[əspəgɛɾɪ]	[spagɛtɪ]

2) st Clusters

/eɪ/- may stay	[meɪisteɪ]	[meɪistei]
/u/- too stubborn	[tustɛboɹn]	[tʃuistubəɹn]
/oʊ/- No standing	[nowstendĩ]	[nowistendɪŋ]
/aɪ/- My staff	[maɪstaf]	[maɪstɛf]
/p/- hope steelworkers	[howpstiuwwɜɹkəɹz]	[həupistʃiwwɜɹkəɹz]
/t/- get stuck	[gɛtstʌk]	[gɛtstuk]
/k/- like stale	[laɪksteɪl]	[laɪksteɪl]

/s/- famous store	[fe̱ɪmowzəstɔ̱ɹ]	[feɪtstɔɹ]
/ʃ/- brush stallions	[bɹʌʃstɛ̱ljənz]	[bɹʌʃstæ̱lɪõz]
/f/- Jeff steals	[dʒɛfstʃiwz]	[dʒɛfstiwz]
/θ/- cloth stains	[klɔθsteɪnz]	[klowθsteɪnz]
/tʃ/- such still	*[15]	[sʌtʃisti̱w]
/b/- rob students	[ɹɔbəstju̱dənts]	[ɹɔbistju̱dənts]
/d/- should stand	[kudəste̱nd]	[ʃudiste̱nd]
/g/- big stapler	[bɪgiste̱ɪplow]	[bɪgistɛ̱pləɹ]
/z/- was stabbed	[wəztɛb]	[wɔzistɛ̱bɪd]
/ʒ/- rouge stuck	[ɹowdəstu̱k]	[ɹuʒistu̱k]
/v/- of style	[əvstaɪl]	[əvstaɪl]
/ð/- with sterilized	[widstəɹɪla̱ɪzd]	[wɪθsteɹɪla̱ɪzəd]
/dʒ/- judge stood	[dʒʌdʒəstu̱d]	[dʒʌdʒ + istu̱d]
/m/- I'm starving	[aɪmsta̱ɹvɪŋ]	[aɪmista̱ɹvɪŋ]
/n/- then stir	[denəsti̱ɹ]	[denistʃ̱iɹ]
/ŋ/- shooting stars	[ʃu̱tɪŋstaɹ]	[ʃu̱tiŋstaɹz]
/r/- Peter stares	[pi̱təɹstɛɹz]	[pi̱teɹstɛɹz]
/l/- All staple	[ɔwste̱ɪpow]	[awiste̱ɪbow]
null- Students	[əstju̱dənts]	[stju̱dənts]

[15] -- Sentence cancelled due to the erroneous inclusion of the indefinite article 'a' between the target words.

3) sk Clusters

/u/- do skateboarding	[duəskeɪtbɒɹdɪŋ]	[duiskeɪtbɔɹdɪŋ]
/oʊ/- go skiing	[gowskin]	[gowiskin]
/aɪ/- guy skin	[gaɪəskin]	[gaɪ + iskin]
/aʊ/- cow skipped	[kaw + skipt]	[kawiskipəd]
/p/- hope skiving	[howp + + əskeɪvɪŋ]	[howp + iskiviŋ]
/t/- bit skew	[bitəʃkju]	[bitiskju]
/k/- book skips	[bukəskips]	[bukskips]
/s/- Famous skinheads	[feɪmowzəskinhɛdz]	[feɪmowz + iskinhɛdz]
/ʃ/- Josh skidded	[dʒɔʃ + iskidəd]	[dʒɒʃ + iskidɪd]
/f/- brief sketch	[bɹifiskɛtʃ]	[bɹifskɛtʃ]
/θ/- Both skiers	[bowθəskaɪɹz]	[bowfskaɪəɹz]
/tʃ/- Which ski	[witʃkaɪ]	[witʃiski]
/b/- Bob skimps	[bɔbiskimps]	[bɔbiskimps]
/d/- passed skimming	[pɛsəskimĩ]	[pɛsədskimiŋ]
/g/- Big skiffs	[bɪgskifs]	[bigiskifs]
/z/- is skeptical	[ɪzskɛptɪkəl]	[z + skɛtipow]
/ʒ/- Beige skirtings	[bidʒiskɹɹtɪŋz]	[beɪdʒiskiɹtiŋz]
/v/- of skis	[əvskis]	[əvskis]

/ð/- with skill	[wɪθskiw]	[wiθəskju]
/dʒ/- huge skirt	[hjudʒiskɹɪt]	[hjuʒ + iskɜɹt]
/m/- Sam skinned	[sɛməskind]	[samskinɪd]
/n/- human skeleton	[hjumənəskɛlɪtən]	[jumən + iskelɛkton]
/ŋ/- Long skeins	[loŋskaɪnz]	[loŋiskinz]
/r/- roller-skating	[holəɹskeɪtɪŋ]	[holəɹiskeɪtiŋ]
/l/- Paul skewered	[pəʊəskjuɹəd]	[pəʊiskjuɹɪd]
null- Sketchpads	[skɛtʃpɛdz]	[skɛtʃpɛdz]

4) sw Clusters

/oʊ/- ago swearwords	[agow + swɛɹwɜɹdz]	[əgow + swaɹwɜɹdz]
/aɪ/- Thai sweets	[taɪswits]	[deɪswits]
/aʊ/- now swear	[nawswɛɹ]	[naw + sweɹ]
/oɪ/- boy swept	[bɔɪswɛpt]	[bɔɪswɛpt]
/p/- Stop swanking	[əstɔpswankĩ]	[istɔpswankĩ]
/t/- brought swarms	[bɹɒtswaɹmz]	[bɹɔtswaɹmz]
/k/- neck sweaters	[nɛkswɛtəɹz]	[nɛkswɛteɹz]
/s/- This swampy	[tɪswampɪ]	[diswɛmpɪ]
/ʃ/- Josh swapped	[dʒɔʃswapɪd]	[dʒɔʃ + swɔpɪd]

/f/- wife sweating	[waɪf + swɛfi]	[waɪfswɛfi]
/θ/- Both swans	[bowθswɛnz]	[bowθswanz]
/tʃ/- Which sweater	[hwitʃswɛrəɹ]	[witʃswɛteɹ]
/b/- Bob swatted	[bɔbswatɪd]	[bɔbsweted]
/d/- David swore	[deɪvɪdswɔɹ]	[deɪvɪdswɔɹ]
/g/- Big swastikas	[bigswastʃikəs]	[bigi + wəstikəz]
/z/- These swimmers	[dɪs + swiməɹz]	[diswɪməɹz]
/ʒ/- Beige sweatbands	[bidʒswɛtbændz]	[beɪdʒ + switbendz]
/v/- of swamps	[əvswãps]	[ɔvswɛmps]
/ð/- with swarthy	[wis + θwɔɹtɪ]	[wifə + swartɪ]
/dʒ/- huge switchboard	[hjudʒiswitʃibɔɹd]	[hjuʒi + switʃibɔɹd]
/m/- Jim swaggered	[dʒimswɛgəɹd]	[ʒ̃iswɛgɪɹd]
/n/- in swaddling	[ɪnswɔdlɪŋ]	[in + swɛdl̃i]
/ŋ/- long swallow	[lɒŋswalow]	[loŋswalow]
/r/- Peter swam	[pitəɹswam]	[nɛveɹswam]
/l/- Michael swabbed	[maɪkəswabɪd]	[maɪkowswɛbɪd]
null- Sweets	[swits]	[swits]

5) sm Clusters.

/i/- see smugglers	[siəzmʌgləɹz]	[sizmʌgləɹz]
/oʊ/- So smokers	[sowəzmowkəɹz]	[sʌmzmowkəɹ]
/aʊ/- bow smashed	[bowəzmɛʃɪd]	[bowizmɛʃɪd]
/oɪ/- coy smile	[kɔɪzmaɪi]	[kɔɪzmaɪl]
/p/- soup smells	[sowpsmɛwz]	[sowp + izmɛwz]
/t/- got small	[gɔtsmaw]	[gɔtsmɔw]
/k/- look smart	[luksmaɹt]	[lukismaɹ]
/s/- its smog	[ɪtsmɔg]	[ɪtsmɔg]
/ʃ/- Josh smirked	[dʒɔʃsmɜɹkɪd]	[dʒɔʃ + izmɪɹkɪd]
/f/- wife smokes	[waɪfsmowks]	[waɪfismowks]
/θ/- both smashed	[bowθmɛʃd]	[bowfizmɛʃɪd]
/tʃ/- Each smithy	[itʃəsmɪðɪ]	[itʃizmitɪ]
/b/- Bob smiled	[bɔbəzmaɪld]	[bɔbizmaɪowd
/d/-dad smacked	[dɛd + əzmɛkəd]	[dɛdizmɛkɪd]
/g/- Big smelters	[bigizmɛwtəɹz]	[bigizmɛwtəɹz]
/z/- his smile	[hizmaɪl]	[hizizmaɪl]
/ʒ/- beige smock	[bidʒiŋəsmɔk]	[beɪdʒi + izmɔk]
/v/- of smash	[əfsmɛʃ]	[ɔvismɔw]

/ð/- with small	[wɪθmɔw]	[wifismɔw]
/dʒ/- huge smudges	[hjudʒəzmʌdʒɪz]	[hjudʒizmʌg]
/m/- some small	[sʌmismɔl]	[sʌmizmɔw]
/n/- been smartened	[bin + izmaɹtənd]	[bin + izmaɹted]
/ŋ/- making small	[meɪkiŋəzmɔw]	[meɪkĩizmɔw]
/r/- are smartly	[aɹəzmaɹtlɪ]	[aɹizmaɹtlɪ]
/l/- Bill smashed	[biwəsmɛʃ]	[biwizmɛʃɪd]
null- Smallholdings	[smawhowdɪŋ]	[izmawhowdɪŋz]

6) sn Clusters

/i/- She snores	[ʃiznɔɹz]	[ʃiznɔɹz]
/eɪ/- They snatched	[deɪznɛtʃɪd]	[deɪznɛtʃɪd]
/aʊ/- How snobbish	[hawznɔbiʃ]	[hawiznɔbiʃ]
/oɪ/- enjoy snuggling	[endʒɔɪəznʌglɪŋ]	[endʒɔɪiznʌglĩ]
/p/- Stop snivelling	[stɔpsnivlĩ]	[istɔpsnivlĩ]
/t/- it snappy	[ɪtsnɛpɪ]	[diznɛp]
/s/ delicious snacks	[dəlɪʃuəsnɛks]	[deliʃowəznæks]
/k/- Jack snared	[dʒɛksnɛɹd]	[dʒɛkiznɛɹɪd]
/ʃ/- Josh sneered	[dʒɔʃsniɹd]	[dʒɔsniɹd]

/f/- wife sniggered	[waɪf + əsnigəɹd]	[waɪfiznigəɹd]
/θ/- both snicked	[bowθsnikɪd]	[bowfsnikɪd]
/tʃ/- Which sniper	[hwɪtʃsnaɪpəɹ]	[witʃsnaɪpeɹ]
/b/ Bob sneaked	[bɔbiznikɪd]	[bɔb + iznigər]
/d/- lid snapped	[lidəznɛpɪd]	[lidə + iznɛpɪd]
/g/- big snails	[bigizneɪlz]	[bigizneɪowz]
/z/- these snappish	[diznɛpiʃ]	[dis + iznɛpɪʃ]
/ʒ/- beige sneakers	[bidʒi + + əznikəɹz]	[beɪʒisnikəɹz]
/v/- have snapped	[hɛvəznɛpɪd]	[hɛvəznɛpə]
/ð/- with sneezing	[wiðniʒi]	[wɪfznizi]
/dʒ/- huge snack	[hjudʒəznɛk]	[hjudʒ + znɛk]
/m/- game snakes	[geɪməsneɪks]	[geɪmiznɛkəz]
/n/- Ian snagged	[iən + əznɛg]	[janznɛgɪd]
/ŋ/- long snakes	[lɔŋzneɪks]	[loŋzneɪks]
/r/- cure snakebites	[kjuɹ + izneɪkbaɪts]	[kjuɹizneɪkbaɪts]
/l/- Beautiful snapdragons	[bjurɪfuləsnɛpdɹægənz]	[bjurɪfowiznɛpdɹɛgənz]
null- Snake	[əsneɪk]	[izneɪki]

7) sl Clusters

/i/- many slang	[mʌ̲nɪizlɛ̲ŋ]	[mɛ̲nɪzleŋ]
/eɪ/- They sleep	[deɪzlip]	[deɪizli̲p]
/u/- Sue slapped	[suəzlɛ̲pəd]	[suizlɛ̲pɪd]
/oɪ/- boy sliced	[bɔɪislaɪ̲sɪd]	[bɔɪizla̲ɪ̲sɪd]
/p/- up sleepyhead	[ʌpsli̲phɛd]	[ʌp + izli̲phɛd]
/t/- bit slack	[bitslɛk]	[bit + izlɛ̲k]
/k/- Jack slung	[dʒɛkslʌŋ]	[dʒɛkizlʌ̲ŋ]
/s/- dreamless sleep	[dɹ̲imlɛslip]	[dr̲imlɛs + əzlɪ̲p]
/ʃ/- Josh slandered	[dʒɔʃsla̲ndəɹd]	[dʒɔʃla̲ndəɹɪd]
/f/- rough slab	[ɹʌfəslæ̲b]	[hukzlɛb]
/θ/- both slept	[bowθslɛpt]	[bowf + izlɛ̲pt]
/tʃ/-much slapstick	[mʌʃslɛ̲pstɪk]	[mʌ̲tʃi + əzlɛ̲pstik]
/b/- Bob slunk	[bɔbəzlu̲ŋk]	[bɔbizlʌ̲̃k]
/d/- Ted sloshed	[tɛdəslɔ̲ʃɪd]	[tɛdəslɔ̲ʃɪd]
/g/- big sledgehammer	[bigəzlɛ̲dʒhæməɹ]	[big + izlɛ̲dʒihʌməɹ]
/z/-always slagging	[ɔ̲wwɪzlɛ̲gɪŋ]	[ɔ̲lweɪzlɛ̲gĩ]
/ʒ/- beige sleeping	[bidʒizli̲pĭ]	[beɪdʒ + əsli̲pĩ]
/v/- of slap	[onzlɛp]	[ɔfəzla̲p]

/ð/- with sleep	[wɪθlips]	[wɪθslip]
/dʒ/- huge slammer	[hjudslɛŋəɹ]	[hjuʒzlɛməɹ]
/m/- Tom slowed	[tõslow]	[tõ + izlowəd]
/n/- been slashed	[binəzlɛʃəd]	[bɪnzlɛʃɪd]
/ŋ/- long sleeves	[lɒŋslivz]	[loŋzlivz]
/r/- Peter slammed	[pitərəzlæmd]	[pitəɹizlɛmɪd]
/l/- All sleepers	[ɔwzlipəɹz]	[awizlipəɹz]
null- Slackers	[slɛkəɹz]	[izlɛkəɹz]

8) spr Clusters

/i/- We sprayed	[wispɹeɪd]	[ʃispɹeɪəd]
/u/- you spread	[juəspɹɛd]	[juspɹɛd]
/eɪ/- They sprawled	[deɪspɹowd]	[deɪspɹɔled]
/oʊ/- so spry	[sowəspɹɪ]	[sowispɹaɪ]
/p/- hope sprouts	[howpspɹawts]	[howpspɹawts]
/t/- meat spring	[mit + əspɹɪŋ]	[mit + ispɹiŋ]
/k/- Jack sprained	[dʒɛkspɹeɪnd]	[dʒɛkispɹeɪnɪd]
/s/- This sprinkler	[dispɹikləɹ]	[diz + ispɹikləɹ]
/ʃ/- fresh spring	- cancelled -	[fɹɛʃspɹɪŋ]

/f/- Jeff spread	[dʒɛfspɹɛd]	[dʒɛfspɹɛd]
/θ/- Both spring	[bowθ + əspɹ̱ɪŋ]	[bowθspɹɪŋ]
/tʃ/- Each spring	[itʃspɹɪŋ]	[itʃspɹiŋ]
/b/- Bob spring	[bɔb + + spɹɪŋ]	[bɔbispɹ̱ĩ]
/d/- had sprung	[hɛdspɹʌŋ]	[hɛdispɹʌ̱ŋ]
/g/- Meg sprinted	[mɛgəspɹ̱intɪd]	[mɛgspɹ̱intɪd]
/z/- was sprung	[wəzpɹʌŋ]	[wɔzispɹʌ̱ŋ]
/ʒ/- beige springboard	[bidʒəspɹ̱iŋbɔɹd]	[beiʒispɹ̱iŋbɔɹd]
/v/- of springy	[əfspɹ̱iŋɪŋ]	[ɔfspɹ̱iŋɪ]
/ð/- with springboks	[wɪðspɹ̱iŋbuks]	[wifsəspɹ̱inbuks]
/dʒ/- village sprawled	[v̱iladʒispɹɔ̱ld]	[v̱ilɪʒi + ispɹɔ̱lɪd]
/m/- Jim sprinkled	[dʒiməspɹ̱inklow]	[dʒ̃iispɹ̱iklow]
/n/- in springtime	[ɪnspɹ̱ɪŋtaɪm]	[ɪnspɹ̱iŋtaɪm]
/ŋ/- drinking spree	[dw̱inkĩspɹ̱i]	[dɹ̱iŋkĩ + ispɹ̱i]
/r/- Hair spray	[hɛɹspɹeɪ]	[hɛɹispɹe̱ɪ]
/l/- Small sprats	[smowəspɹɛ̱ts]	[izmɔ̱wispɹɛ̱ts]
null- Sprayers	[spɹe̱ɪəɹz]	[spɹe̱ɪəɹz]

9) spl Clusters

/i/- He splashed	[hiəsplɛʃt]	[hisplɛʃɪd]
/eɪ/- motorway splits	[motoɹweɪisplits]	[motoɹweɪsplɪt]
/u/- do splendid	[duəsplendɪd]	[duisplɛndɪd]
/oʊ/- so splenetic	[sowəsplənɛtɪk]	[sowisplenɛtik]
/p/- stop splinter	[stɔpsplintəɹ]	[istɔpəsplinər]
/t/- wrote splendid	[wɹowtsplendɪd]	[wɹowtsplendɪd]
/k/- Jack splurged	[dʒɛksplʌɹdʒə]	[dʒɛgəsplʌɹgəɹ]
/s/- police splashed	[polisəsplɛʃt]	[polɪsisplɛʃɪd]
/ʃ/- rush splenetic	[ɹʌʃsplenətɪk]	[ɹʌʃ + əsplɛnɪtk]
/f/- rough splintery	[ɹʌfsplintəɹɪ]	[ɹowgəsplentəɹɪ]
/θ/- Both splendiferous	[bowθəsplendɪfəɹows]	[bowf + əsplendɪfəɹəz]
/tʃ/- Which split	[hwɪtʃsplit]	[witʃsplɪt]
/b/- bib split	[bibəspit]	[bit + isplit]
/d/-loud splashes	[lawdəsplɛʃɪz]	[lɔwd + isplɛʃɪz]
/g/- big splinter	[bigəsplintəɹ]	[big + isplintəɹ]
/z/- was splattered	[wəzplɛtəɹd]	[wazisplɛtəɹ]
/ʒ/- beige splint	[beɪdʒəsplint]	[beɪʒisplint]
/v/- of spleen	[əfəsplin]	[əfspleɪn]

/ð/- with splayed	[wɪθ + əsple̲ɪd]	[wɪfsple̲ɪəd]
/dʒ/- huge split	[hjudsplit]	[hjuʒ + split]
/m/- him splendidly	[himsple̲ndɪdlɪ]	[hĩ + spɹe̲ndeɪdlɪ]
/n/- Brian spliced	[bɹa̲ɪənsplaɪs]	[bɹa̲ɪn + ispla̲ɪsɪd]
/ŋ/-exciting splashdown	[ɪksa̲ɪtĩsplɛ̲ʃdawn]	[əksa̲ɪɾĩ + isplɛ̲ʃdawn]
/r/- Peter splashed	[pi̲təɹsplɛ̲ʃɪd]	[pi̲tərisplɛ̲ʃɪd]
/l/ - occasional splatter	[əke̲ɪʒənawsplɛ̲təɹ]	[əke̲ɪʒənələsplɛ̲təɹ]
null- Splats	[əsplɛ̲ts]	[isplɛ̲ts]

10) str Clusters

eɪ/-say strange	[seɪəstɹe̲ŋ]	[seɪistɹe̲nʒɪ]
/u/- too strangely	[tuəstɹe̲ndʒlɪ]	[tʃuəstɹe̲ŋlɪ]
/oʊ/- go straight	[gowstɹeɪt]	[gowistɹe̲ɪd]
/aɪ/- My strategy	[maɪəstɹa̲tədʒɪ]	[maɪstrɛ̲təʒɪ]
/p/- soap strewed	[sowpəstɹu̲əd]	[sup + istrju̲əd]
/t/- Eight streets	[eɪtstwits]	[eɪtistɹ̲its]
/k/- joke straight	[dʒowkstɹeɪt]	[dʒowkstɹeɪt]
/s/- Loose strands	[luzəstɹe̲ndz]	[luzistɹe̲ndz]
/ʃ/- Turkish Straits	[tʌ̲ɹkɪʃstɹeɪts]	[tʌ̲ɹkɪʃ + stɹeɪts]
/f/- wife strongly	[waɪfstɹo̲ŋlɪ]	[waɪfstɹo̲ŋlɪ]

/θ/-cloth straps	[klɔstɹɛps]	[klowð + stɹɛps]
/tʃ/- much stretching	[mʌtʃstɹɛ̱tʃɪ]	[mʌtʃitɹɛ̱tʃɪ].
/b/- Bob struggled	[bɔbəstɹʌ̱glowd]	[bɔbstʌ̱gowd]
/d/- bed straightaway	[bɛdstɹe̱ɪtawei]	[bɛdstɹe̱ɪtaweɪ]
/g/- big streetlamp	[bigstwi̱tlɛmp]	[bigəstɹ̱itlɛmp]
/z/- These strawberries	[dizəstɹɔ̱bɛɹɪz]	[diz + istrɔ̱beɹɪs]
/ʒ/- rouge strangely	[howd + + θstɹɛ̱ndʒəlɪ]	[ɹuʒ + stra̱ŋĩ]
/v/- of strength	[əfsθɹeɪnθ]	[əvistɹe̱ɪndʒ]
/ð/- with streams	[wɪθtɹimz]	[wɪθstɹimz]
/dʒ/- village straggles	[vɪ̱ladʒəstɹɛ̱gowz]	[vi̱ladʒistɹɛ̱glɪz]
/m/- became strained	[bike̱ɪmistɹe̱ɪnd]	[bika̱mstɹe̱ɪnɪd]
/n/- Brendon strode	[bɹe̱ndõstɹowd]	[bɹe̱ndənstɹowd]
/ŋ/- being straightened	[biŋstɹe̱ɪtən]	[bĩ + istɹe̱ɪtɪd]
/r/- their struggle	[dɛɹstɹʌ̱gow]	[deɪɹstɹʌ̱gə]
/l/-tall strapping	[tawstɹɛ̱pɪŋ]	[tɔwistɹɛ̱pĩ]
null- Strict	[stɹɪkt]	[stri̱ktɪd]

11) skw Clusters

/u/- blue square	[bluəskwɛɹ]	[bluiskwɛɹ]
/oʊ/- No squads	[nowskɛdz]	[nowiskwɛd]
/aɪ/- guy squandered	[gaiəskwandəɹd]	[gaɪ + iskwandəɹɪd]
/oɪ/- enjoy squalid	[əndʒɔɪəskwɛlɪd]	[əndʒɔɪiskwɛlɪd]
/p/- Stop squelching	[stɔpskwɛltʃɪŋ]	[stɔp + iskɛlʃi]
/t/- eat squash	[itəskwɛʃ]	[itiskwɛʃi]
/k/- look squarely	[lukskwɛɹlɪ]	[lukskwɛɹəlɪ]
/s/- delicious square	[dəlɪʃuzskwɛɹ]	[delɪʃow + iskwɛɹ]
/ʃ/- Josh squatted	[dʒɔʃskwɛtɪd]	[ʒɔʃskwɛtɪd]
/f/- Jeff squealed	[dʒɛfskwild]	[ʒɛfskwilɪd]
/θ/- Both squashy	[bowθskwɛʃɪ]	[bowfskwɛʃɪ]
/tʃ/- peach squash	[pitʃskwɛʃ]	[piʃiskwɛʃ]
/b/- Bob squeezed	[bɔbskizd]	[bɔbskizɪd]
/d/- hundred square	[hʌndɹədskwɛɹ]	[hʌndɹɪdskwɛɹ]
/g/- big squeeze	[bigəskwiz]	[bigiskwiz]
/z/- always squabbles	[ɔwweɪzskwɛbəlz]	[ɔlweɪz + skɛbowz]
/ʒ/- beige squares	[bidʒiskwɛɹ]	[beɪʒ + skwɛɹz]
/v/- of squalor	[əfskwɛləɹ]	[əfskwɛləɹ]

/ð/- with squirrels	[wiskwɪɹalz]	[wifiskwiɹəlz]
/dʒ/- Village squatters	[viladʒəskwɛtəɹz]	[vilaʒiskwɛɾəz]
/m/- him squeamish	[himskimɪʃ]	[him + iskwimɪʃ]
/n/-town square	[tawnskwɛɹ]	[tawnskɛɹ]
/ŋ/- strong squall	[əstɹɔŋəskwaw]	[stɹɔŋskwaw]
/r/- car squashed	[kaɹəskwɛʃəd]	[kwaɹiskwɛʃɪd]
/l/- Several squad	[sɛveɹawəskwad]	[sɛvəɹəiskwɛd]
null- Square	[əskwɛɹ]	[iskwɛɹ]

12) skr Clusters

/oʊ/- low scrub	[lowəskʌɹb]	[lawiskɹʌb]
/aɪ/- I scrabbled	[aɪəskɹʌbəld]	[aɪskɹɛbowd]
/aʊ/- how scrupulous	[hawəskɹupələz]	[hawiskɹupuləz]
/oɪ/- boy scribbled	[bɔɪ + skɹɪbəld]	[bɔɪ + + skɹibow]
/p/- hope screenwriters	[howpskɹinwɹaɪtəɹz]	[howpskɹinmaɪtəɹz]
/t/- somewhat scrappy	[sʌmwɒtskɹɛpɪ]	[sʌmwɔtskɹæpɪ]
/k/- like scrambled	[laɪkskɹʌmbəld]	[laɪiskɹʌmbow]
/s/- police scrawled	[polɪskɹɔld]	[polɪsəskɹalɪd]
/ʃ/ Josh scrambled	[dʒɔʃskɹʌbəld]	[ʒɔʃskɹʌmblow]
/f/- Jeff scraped	[dʒɛfskɹɛp]	[dʒɛpskɹɛpɪd]

/θ/- both scrape	[bowθskɹeɪp]	[bowθskɹɛp]
/tʃ/- such screening	[sʌtʃskwi̠nĩ]	[sʌtʃskɹ̠inĩ]
/b/- Rob screwed	[ɹɔbskɹu̠əd]	[hɔbskwju̠əd]
/d/- should scram	[ʃudskɹæm]	[ʃudskʌm]
/g/- Meg scratched	[mɛgəskɹɛ̠tʃə]	[mɛ̠gi + iskɹɛ̠tʃd]
/z/- his scraggy	[hɪskɹæ̠gɪ]	[hɪziskɹæ̠gɪ]
/ʒ/- beige scroll	[bidʒiskɹɔ̠w]	[beɪʒ + skɹow]
/v/- of scraps	[əvskɹɛps]	[əvskɹɛps]
/ð/- with scripted	[widskɹɪ̠ptə]	[wɪθskɹɪ̠pə]
/dʒ/- huge scrapbook	[hjudiskɹɛ̠pbuk]	[hjuʒ + iskɹɛ̠pbuk]
/m/- Sam screamed	[sãəskɹ̠imd]	[sɛmskɹ̠imən]
/n/- been scraped	[binskweɪp]	[binskɹɛ̠pɪd]
/ŋ/-long screwdriver	[loŋskɹu̠dɹaɪvəɹ]	[loŋ + iskrju̠draɪɹ]
/r/-over screes	[o̠wvəɹəskɹ̠iz]	[o̠w̠vəɹiskɹ̠iz]
/l/- small screens	[smɔlskɹinz]	[izmɔ̠wiskɹ̠imz]
null- Scruffy	[skwʌ̠fɪ]	[skɹʌ̠fɪ]

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