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The Production of English Initial /s/ Clusters by Portuguese and Spanish EFL Speakers

por

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To Moacir, Nelly and Wiland.

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Abstract

The Production of English Initial /s/ Clusters by Portuguese and Spanish EFL Speakers

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This study reviews, verifies and explains the different findings obtained by Carlisle (1991, 1991b in Carlisle 1992, 1992, 1997) and Rebello (1997a, 1997b) on the production of initial /s/ clusters by Portuguese and Spanish EFL speakers, complementing the findings obtained by previous research in the area of interphonology, since the same corpus was used in order to compare the production of speakers of both native languages. The results reveal that epenthesis (the addition of an extra vowel) to the initial clusters is the usual strategy for dealing with syllable structure difficulty, which can be a result of native language interference and linguistic universals. The predictions of learners' difficulties established by the Markedness Differential Hypothesis (MDH) and the Structural Conformity Hypothesis (SCH) were borne out, since longer initial /s/ clusters caused a greater rate of epenthesis than shorter ones for both Spanish and Portuguese speakers. Moreover, for Spanish speakers, initial clusters which violate Hooper's (1976) Syllable Structure Condition (SSC) were significantly more modified than those which do not violate it, whereas for Portuguese speakers, although they followed the same tendency as that of Spanish speakers, the findings were inconclusive due to the non-significant difference in rates. This lack of significance might be explained by the conflict between two types of markedness: that of the SSC and that of voicing, since, in Portuguese, the sibilant is voiced when followed by a sonorant; thus, voicing of the sibilant led to the formation of a more marked type of cluster. Concerning the environment where epenthesis is more likely to occur, the findings obtained by the production of Spanish speakers corroborate Carlisle's results, since a greater rate of epenthesis was produced when clusters followed a consonant. However, the results regarding the production of Portuguese speakers partially corroborate Rebello's findings, since these speakers produced more epenthesis after vowels, followed by consonants, and then by silence. The data provide insights for future teaching of English pronunciation in Brazil and in other South American countries.

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Resumo

**A Produção de Encontros Consonantais Iniciais do Inglês (/sC(C)/)
por Falantes de Português e Espanhol**

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2002

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Este estudo revisa, verifica e explica os diferentes resultados obtidos por Carlisle (1991, 1991b em Carlisle 1992, 1992, 1997) e Rebello (1997a, 1997b) sobre a produção de encontros consonantais iniciais /sC(C)/ em inglês por falantes de português e espanhol, complementando os resultados obtidos em pesquisas anteriores na área de interfonologia, já que o mesmo corpus foi usado para comparar a produção de falantes das duas línguas nativas. Os resultados revelam que a adição de uma vogal (epêntese) aos encontros consonantais iniciais é a estratégia mais utilizada para se lidar com as dificuldades relativas às estruturas silábicas mais difíceis, o que pode ser resultado da relação entre a interferência da língua materna e os universais lingüísticos. Os resultados relativos à influência do tamanho do encontro consonantal foram de acordo com as previsões estabelecidas pela Hipótese do Diferencial de Marcação (MDH) e a Hipótese da Conformidade Estrutural (SCH). Os encontros consonantais iniciais mais longos resultaram em maior índice de epêntese que os mais curtos para os falantes de espanhol e de português. Ainda, para os falantes de espanhol, os encontros consonantais iniciais que violam a Condição de Estrutura Silábica (SSC) proposta por Hooper (1976) resultaram numa maior produção de epêntese que aqueles não a violam, enquanto que para falantes de português, embora os resultados tenham sido semelhantes aos dos falantes de espanhol, os mesmos não são conclusivos, já que a diferença encontrada não foi significativa. Esta falta de significância pode ser explicada pelo conflito existente entre dois tipos de marcação: a da SSC e a do vozeamento, uma vez que, em Português, o /s/ é vozeado quando seguido de uma soante; portanto, o vozeamento da sibilante levou à formação de um tipo de encontro consonantal mais marcado. Com relação ao contexto fonológico, os resultados obtidos pelos falantes de espanhol corroboram os de Carlisle, já que a maior freqüência na produção de epêntese ocorreu em encontros consonantais precedidos por uma consoante. No entanto, os resultados relativos à produção dos falantes de português corroboram parcialmente os resultados de Rebello, uma vez que estes produziram mais epêntese após vogais, seguido por consoantes e por silêncio. Os resultados fornecem informações relevantes ao ensino da pronúncia do inglês no Brasil e nos demais países sul-americanos.

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Chapter 1- Introduction

As Hammond (1995) has pointed out, with the decline of the audiolingual method in the 1960s and 1970s and the popularity of communicative language teaching since then, less attention has been given to the production of accurate pronunciation by learners of English as a Foreign Language (EFL). The focus in EFL classes shifted, in the 1970s, to the ability to communicate, and form was believed to be acquired through learners' constant exposure to comprehensible input (information which can be understood by learners).

However, the attitude of encouraging learners' communication and ignoring pronunciation mistakes in order not to inhibit production has generated some reflection regarding learners' intelligibility and comprehensibility. Several researchers, (Hammond, 1995; Munro & Derwing, 2001; Seidlhofer, 2001) have started to notice that some attention to pronunciation should be given, since the reconceptualization of the role of English in the world has generated different purposes for learning it. Seidlhofer (2001, p. 56) points out the personal and social roles pronunciation plays in people's life and in second language communication. She states that people project their identity by the way they speak and that "pronunciation is responsible for intelligibility".

What is interesting about the diversification of English learning goals is that they demand teachers' awareness and knowledge in the area of pronunciation. Seidlhofer (2001) also claims that besides being sensitive to learners' needs, teachers should consider the delicate question of learners' identities, which may undergo modification due to the learning of the new sounds, rhythm and intonation of the target language (TL). What should be taken into account is the fact that some learners do not want to sound native-like, but prefer to keep their accent, since a person's accent expresses his/her "membership" in a particular community. Seidlhofer (2001)

discusses the importance of stress and the amount of effort that should be put into the teaching of significantly different sounds between the NL (native language) and TL compared to easier sounds that could be less emphasized. In this sense, teachers should be aware of "how much 'work' individual sounds, or sound contrasts, actually do in a particular language, that is, whether they have high or low functional load" (p. 59). Another aspect that should be considered when elaborating any pronunciation syllabus is the difference in teaching English as a second language (ESL) – to learners who are inserted in the community where mostly the TL is spoken – and as a Foreign Language (EFL) – to learners who live in the community where their NL is spoken and study a foreign language.

Therefore, depending on the country where English is taught, it is important to discern how much of EFL pronunciation difficulty is related to native language (NL) interference and how much to other factors, such as linguistic universals or the difference in syllable structure complexity between the NL and the TL. An approach that could facilitate this analysis is the investigation and contrast of the performance in English of speakers of two different native languages. Considering that the strategic geographical localization of Brazil allows a rather easy exchange of information between South American countries, a comparison between Brazilian Portuguese and Argentinean Spanish speakers of English could provide a valuable source of data for this kind of research. Findings like these could greatly contribute to teachers' awareness of the specific pronunciation difficulties their learners might have in the acquisition and production of difficult sounds, facilitating teachers' decisions about the level of emphasis to be given to the practice of the various TL sounds.

The aim of this study, then, is to investigate the difficulty in the production of initial /s/ clusters by Portuguese and Spanish EFL speakers. This difficulty has already been investigated with Spanish speakers by Carlisle (1991, 1992, 1997) and with Portuguese speakers by Rebello

(1997a, 1997b). In their studies, the production of epenthesis (the addition of an extra vowel) to the initial clusters was the usual strategy for dealing with syllable structure difficulty, given that in both Portuguese and Spanish, /s/-clusters are invariably preceded by a vowel.

Since Carlisle and Rebello report divergent findings, this investigation aims at verifying and explaining the different results obtained by the two researchers. Following Carlisle's (1991, 1992, 1997) and Rebello's (1997a, 1997b) studies, three variables were investigated as to their influence on the production of /s/ clusters: the structure of the cluster, its length and the phonological context where it occurs.

The Markedness Differential Hypothesis (MDH) and the Structural Conformity Hypothesis (SCH), both elaborated by Eckman (1977 in Eckman, 1996; Eckman, 1991), were the theories chosen to give support to the investigation. The first theory proposes that language universals and NL transfer predict difficulties in TL learning. This means that TL structures which are different from and more marked than the corresponding NL structures will be difficult to learn and that the relative degree of difficulty "will correspond to the relative degree of markedness". Katamba (1989, p. 98) defines markedness in terms of *naturalness*: what is *natural* can be considered *unmarked* in a language, and what is *not natural* can be considered *marked* or in some sense *unusual*. While the MDH makes predictions on the basis of both universals and differences between the NL and the TL, the second theory, the SCH, makes predictions only on the basis of universals, that is, it considers the tendency interlanguages (ILs)[1] have to follow the same universal principles that primary languages do.

The thesis is organized into five chapters: Chapter 2 reviews the literature on the syllable structures of English, Portuguese and Spanish, as well as some studies on IL syllable structure

[1] Learner's transitory competence or intermediary system between NL and TL.

based on the MDH. Chapter 3 describes the hypotheses elaborated for this study and the method adopted to collect and analyze the data. Chapter 4 provides the analysis and discussion of the results, and Chapter 5 gives the conclusions drawn from this research and discusses some pedagogical implications, limitations and suggestions for further research.

Chapter 2- Review of the Literature

Several centuries before Christ, attention was already being given to pronunciation by Indian scholars who, in their attempt to describe Sanskrit and maintain the accurate pronunciation of their language, already observed the points and manners of articulation of sounds (Clark & Yallop, 1990, p. 329). With the advance of technology by the end of the nineteenth century, studies on spelling and pronunciation were enhanced by the investigation of speech by instrumental methods.

There are several phonological models which have been used to analyze and describe spoken languages. The present study will be based on the claims of natural generative phonology, which, as pointed out by Clark and Yallop (1990, p. 341), emerged in the early 1970s in a number of papers by Vennemann and a book by Hooper (1976). The main proposal of this theory is to eliminate any underlying form that is not identical to a surface form. This means that, according to Hooper (1976, pp. xi-xii), rules and representations are directly related to surface forms and phonological analysis is more concrete and realistic than in the Sound Pattern of English (SPE), the most representative work of the transformational generative (TG) phonology of the 1960s, where it is claimed that phonological representations "are mentally constructed by the speaker and the hearer and underlie their actual performance in speaking and 'understanding'" (Chomsky & Halle, 1968, p. 14, as cited in Clark & Yallop, 1990, p. 341).

As a brief introduction to what is going to be described in the review of the literature concerning the syllable, it is important to state that the syllable has recently been analyzed from two different perspectives regarding its internal structure: the autosegmental model and the metrical model. Both imply that the syllable is a hierarchical unit in phonological representation. However, according to Clements and Keyser (1983, p. 186), the autosegmental theory claims that

the syllable is divided into independent tiers, whose nodes are directly linked to segments by association lines, that is, the relationship between any two segments is always the same in the hierarchy. On the other hand, according to Selkirk (1982, p. 329), metrical phonology claims that the relationship between segments in the hierarchy is much closer between the nucleus and coda than between the nucleus and the onset. The following description will be based on metrical phonology, since it considers phonotactic constraints and strength relations, which are fundamental notions for the data analysis.

2.1 Linguistic Universals and Syllable Structure

Several researchers have tried to define the syllable in different ways, but there has not yet been any consensus concerning its definition. According to Ladefoged (1982, p. 243), "there is no agreed *phonetic* definition of a syllable" (my italics). He claims that even though there is agreement on the number of syllables of the majority of words, there are many words which cause disagreement because of the difference in pronunciation from region to region or among dialects.

Pike (1943, p. 115 in Hogg & McCully 1987, p. 32) considers the syllable to be "a single unit of movement of the lung initiator… which includes but one crest of speed". He also claims that there are other criteria used to define the syllable, such as "the relative loudness of the phonemes, sonority, prominence (made up of inherent sonority, length, stress, special intonation or a combination of some of these), and change in stress or speech". Regarding sonority, Ladefoged (1982) defines it as the loudness of a sound relative to that of other sounds with the same length, stress and pitch. He claims that the loudness of a sound depends on its acoustic intensity (energy) and that a way to measure sonority is by estimating "the acoustic intensity of a

group of sounds that have been said on comparable pitches and with comparable degrees of length and stress" (p. 245). Thus, considering the concept of *sonority*, the sounds of languages can be classified according to the sonority relationship between one sound and another.

Another phonetic definition of the syllable is provided by Kikuchi (2001) and Ladefoged (1982), who claim that the syllable is a result of the movement of the vocal organs, and not a characteristic of speech sounds. This means that the basis of a syllable is a brief contraction of the respiratory muscles, which results in the expulsion of a small amount of air out of the lungs. The air from the lungs goes up through the vocal tract at the moment of the production of the syllable, forming the segments.

The concept of the syllable as an important *phonological unit* was first formally defined within natural generative phonology by Hooper (1976), who proposed a theory of universal and language-specific syllable structure. According to her, syllable boundaries (symbolized $) between sequences of segments lead to a formal and universal definition of the syllable and affect phonological processes, since in many languages these phonological processes are dependent upon syllable structure. In her theory, there is an explanation for the constraints related to syllable structure itself. One example is her analysis of Spanish syllable structure. In this language, the occurrence of segments within a syllable seems to depend on their natural classes (obstruent, nasal, liquid, glide or vowel). According to Hooper (1976, p. 197), the universal condition on syllable structure, which is called the Syllable Structure Condition (SSC), determines that the strongest C (consonant) elements[2] are to be found at the margins of the syllables (named *onset*, the initial consonant sequence, and *coda*, the final sequence of consonantal segments), and that an obligatory element V (vowel) comprises the acoustic peak or *nucleus*. Hogg and McCully (1987,

[2] Sonority and consonantal strength are opposite terms. Sounds which are the least sonorant are the strongest segments and vice-versa. Examples of this equivalence are shown on pages 8 and 9.

p. 35) also consider the sonority values within the internal syllable structure as being responsible for the correct determination of the number of syllables in a word.

However, exceptions to Hooper's condition are found in English, whose initial clusters with the fricative /s/ plus a stop violate the SSC condition, since the stop is stronger then the /s/, resulting in difficulty for speakers of other languages to produce these clusters in English. Studies concerning syllable structure difficulty (Broselow, 1987a; Carlisle, 1991, 1992, 1997; Rebello, 1997a, 1997b; Tarone, 1987b; Tropf, 1987) show that epenthesis and consonant deletion are strategies used for dealing with this difficulty, revealing that language transfer does influence the choice of strategy, and, thus, the syllable structure of interlanguage phonology. These studies are described in more detail in 2.4, and 2.4.1.

Even though, depending on the circumstances, the acoustic intensity of different sounds may vary considerably for different speakers, Hogg and McCully (1987, p. 33) provide a sonority scale to illustrate the relative degree of sonority of a number of sounds. This scale is relevant for the definition of *syllable*, since, as previously stated, where sonority is greatest is at the nucleus of a syllable, and where it is lowest, generally at its edges.

Table 1: Sonority scale according to Hogg & McCully (1987, p. 33).

Sounds	Sonority values	Examples
low vowels	10	/a,ɑ/
mid vowels	9	/e,o/
high vowels	8	/i,u/
flaps	7	/ɾ/
laterals	6	/l/
nasals	5	/m,n,ŋ/
voiced fricatives	4	/v,ð,z/
voiceless fricatives	3	/f,θ,s/
voiced stops	2	/b,d,g/
voiceless stops	1	/p,t,k/

Hooper (1976, p. 199) points out the need to determine consonantal strength in order to place consonants around the nucleus of a syllable. Concerning this notion, Roca and Johnson (1999, p. 245) claim that segments are arranged within the syllable according to their degree of sonority, which means that sonority increases from the onset to the nucleus and then decreases to the next onset. Based on phonological evidence, Hooper (1976, p. 199) considers syllable-initial position to be universally stronger than syllable-final position, a fact that explains why assimilation occurs more commonly at the end of a syllable than at the beginning: "As syllables are strung together, the end of one syllable (its weak position) immediately precedes the beginning of the next (the strong position)" (Hooper, 1976, p. 200). Therefore, assimilation is expected in syllable-final position because the consonant in the stronger position will influence the consonant in the weaker position, and not the opposite.

As strength relations are assumed to be universal, except for minor deviations found in some languages, Hooper (1976, p. 206) establishes the following universal strength hierarchy:

glides	liquids	nasals	voiced continuant	voiceless continuant voiced stop	voiceless stop
1	2	3	4	5	6

When comparing the sonority hierarchy and the strength hierarchy scales, it can be noticed that sonority and consonantal strength are opposite terms. Voiceless stops are considered the least sonorant but the strongest segments, while glides, the most sonorant consonant sounds, are the weakest on the consonantal strength hierarchy. Although affricates are not ranked in the scale, because there is little evidence for their position in the hierarchy, Hooper (1976, p. 206) suggests that voiceless affricates are the strongest of the consonants due to their phonological complexity.

The importance of strength relations led to the formulation of the SSC in order to assign syllable boundaries and to explain some strengthening phenomena. Hooper (1976, p. 220) states that, in Spanish, a syllable-initial C must "be stronger than the immediately preceding syllable-final C". She also proposes that besides the SSC and the strength scale, another principle is necessary to understand syllable structure: The *Optimal Syllable Principle*. This principle determines that

> the higher the strength scale value permitted in a given C position, the greater the likelihood that a C will occur in that position, and the higher the strength value for the C. Similarly, the lower the strength value permitted in a C position, the less likely that a C will occur in that position. (Hooper, 1976, p. 225).

Therefore, the following general form of the universal SSC is proposed by Hooper (1976, p. 229):

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

Where $m > n > p > q$

$r > s > t$ [sic][3]

$m > t$

$m \neq \emptyset$

This condition shows that there are four possible C positions at the beginning of the syllable and three at the end, which means that Cs are on the margins, and an obligatory V forms the nucleus of a syllable. Concerning the degree of consonantal strength, a Universal Canonical Syllable Structure (UCSS) determines that C values should decrease both from syllable-initial position toward the nucleus and from syllable-final position toward the nucleus. In other words,

in syllable-initial position m is greater than n, which is greater than p, which is greater than q. The same holds true for syllable-final position, where t is greater than s, which is greater than r. The condition m ≠ ø implies that all languages must allow CV syllables. Examples of English words whose C strength values obey the UCSS are *small, snow,* and *swallow*. The words *grains* and *birth* are examples of C strength values which decrease from syllable-final position toward the nucleus, also obeying the UCSS. However, all English words whose initial clusters are formed by the fricative /s/ plus a stop or whose final cluster is formed by stop plus /s/ violate the UCSS. Examples of this violation are the words ***sp**ace, **st**udent, **sk**unk, ca**ts,** mu**gs*** and *stam**ps*** (where the obstruents /p, t, k, g/ are greater in strength than /s/). Concerning the complexity of CV syllables, Roca and Johnson (1999, p. 246) consider the core syllable CV the simplest, and the VC syllables the most complex. The two other syllables (V and CVC) are considered by them to have intermediate complexity.

When associating SSC to the universal strength hierarchy, some conclusions can be drawn concerning syllable-initial and syllable-final clusters (only the former is relevant and will be discussed in the thesis). There are several implicational universals reported by Greenberg (1965), and five of them were reformulated by Cairns (1969, as cited in Hooper, 1976, pp. 230-231). The first claims that "if the strength value of the C in second position is high enough to allow nasals, it must also be high enough to allow liquids". The second predicts that "if a language allows syllable-initial obstruent clusters, it must also allow obstruent-nasal clusters". The third states that if a language allows syllable-initial clusters formed by voiced consonants, it must also allow clusters formed by voiceless consonants. The fourth claims that "if a language allows an initial sequence of $NLV, then it must also allow $CLV". And finally, the fifth implicational universal

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[3] The '>' symbol, mistakenly used by Hooper, should be inverted ('<').

asserts that syllable-initial clusters cannot be formed by two liquids because of "the requirement that m > n and the condition that there by [sic] some minimum difference in strength between the first and the second C in the cluster".

It is important to point out that although Hooper (1976) investigated Spanish syllable structure and, based on other phonologists' studies, formulated a universal sonority or consonantal strength scale, the placement of vowels and consonants in the scale varies somewhat from language to language. For this reason, subsections 2.3.1, 2.3.2 and 2.3.3 will deal specifically with the syllable structures of English, Portuguese and Spanish.

2.2 Syllable Contact

In the previous section, a discussion of the importance of syllable boundaries was presented. As stated above, the syllable is an important phonological unit, which can be universally defined by a rule consisting of the insertion of syllable boundaries between a given sequence of segments. In this section, the focus will be on the importance of syllable contact as another factor to be considered when investigating syllable structure.

Hooper (1976) has observed the important role strength relations between two adjacent heterosyllabic segments can play in subsequent environments. As previously stated concerning Spanish syllable structure, Hooper (1976, p. 220) concludes that "a syllable-initial C must 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 $_m>_r$".

In other words, 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. Examples of her condition in English would be the sentences, pronounced without a pause, (1) '*No problem'* [nou.prɔb.ləm], which obeys Hooper's condition, since the voiced stop /p/ is stronger than the diphthong /ou/ and /b/ is stronger than /ɔ/, and (2) '***I can wait'*** [kn.weɪt], which violates her condition, since the nasal /n/ is stronger than the glide /w/. To account for consonants at syllable boundaries, Murray and Venneman (1983, p. 519) proposed two modifications of the condition: the first claims that "for a sequence $VC_r\$C_mV$, the preferred syllable structure is such that $_m \geq _r$"; the second modification claims that, since the principle is applied not only to two-consonant clusters, but also to longer groups, "for a sequence $C_r\$C_m$, the preferred syllable structure is such that $_m \geq _r$". This second modification was further reformulated by Murray and Vennemann (1983, p. 520) in different terms: "for a pattern $A^{\$}B$ where A and B are marginal segments, the preferred syllable structure is such that the Consonantal Strength of A is not greater than that of B".

Going still further, to allow for degrees of violation, depending on the difference in strength between the consonants in contact, Murray and Vennemann (1983, p. 520) formulated a final version of the principle, providing a very general preference law for adjacent heterosyllabic marginal elements: the Syllable Contact Law. They claim that "the preference for a syllabic structure $A^{\$}B$, where A and B are marginal segments and *a* and *b* are Consonantal Strength values of A and B respectively, increases with the value of *b* minus *a*". Although this law was meant to refer to diachronic language changes, applied to interlanguage it means that, as a consequence of the consonantal strength of A exceeding that of B, the greater the syllable structure violation will be, and the more likely some remedial measures (e.g. epenthesis, deletion, assimilation) will be used in order to improve syllable contact.

Considering that both Carlisle (1991, 1992, 1997) and Rebello (1997a, 1997b) found that epenthesis was the usual strategy used by Portuguese and Spanish EFL speakers to simplify English syllable structure, more attention will be given to this phenomenon concerning syllable contact. Hooper (1976, pp. 235-236) claims that "the epenthetic vowel must always be the minimal vowel or a vowel whose features are copied from a nearby segment". In other words, the vowel inserted in segments can be predicted on the grounds of its features. Thus, a V segment, if not the minimal vowel, is usually identical to a nearby V, although in some cases surrounding Cs also have an effect. In both Portuguese and Spanish, a minimal vowel is used in epenthesis and Hooper (1976, p. 238) thus proposes a universal rule to explain the quality of this vowel: an unspecified vowel becomes a minimal or weak vowel. A strength scale of vowels is needed in order to operate this rule, which is presented below:

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

This rule may vary from language to language, but a strength scale for vowels "can be determined on the basis of synchronic and diachronic processes of vowel reduction." (Hooper, 1976, p. 238). In the case of Portuguese, the high front vowel [i] is the minimal vowel, since synchronic processes caused the raising of final /e/ and /o/, and /e/, lacking rounding, is a more neutral vowel. In Spanish, Hooper (1976, p. 238) explains that the mid front vowel [e] is the minimal vowel, since "historical processes of vowel reduction lowered high vowels in unstressed weak syllables". Hooper's (1976, p. 239) diachronic explanation for the use of epenthesis in Spanish /s/ + C clusters is that "a simplification of the SSC made the insertion of a V necessary". This means that there was not a new rule added to the grammar, but that the Spanish SSC

changed as a consequence of the phenomenon of syllable structure in general, which is considered phonologically predictable on the basis of universal principles.

Concerning epenthesis, Major (1987a, p. 216) claims that the insertion of a vowel to facilitate the pronunciation of clusters occurs only once in a given cluster. In order to exemplify this principle, he shows examples of Brazilians learning English, who produce [ispun] or [əspun] for *spoon*, but never *[isipun] or *[əsəpun]. The same happens to Spanish EFL learners who may produce [əspun] but never *[əsəpun]. Still related to Portuguese, Major also shows the strategies which may be used with loan words with initial consonant clusters: *scope* and *Sri* (in *Sri Lanka)* might be pronounced [iskɔpi] and [siri], but never *[isikɔpi] and *[isiri]. The insertion of only one vowel is sufficient to make these words conform to Portuguese and Spanish phonotactics.

Still concerning Major's theory, vowel epenthesis could be considered either a developmental or an interference process. Major (1994, p. 188) defines universal developmental processes as processes that occur in TL acquisition that cannot be directly attributed to the NL, although they may occur similarly in the native speaker's acquisition of the TL in question. His examples of developmental processes are English obstruent devoicing, consonant cluster simplifications, preference for open versus closed syllables and various types of substitutions in other languages. In relation to the production of epenthesis, Major's example about the insertion of [i] by Brazilians would be transfer, because it occurs in Brazilian Portuguese, but the insertion of [ə] would be developmental. Considering the influence of both transfer and developmental processes, Major's Ontogeny Model (1987b) proposes a hierarchical relationship between transfer

and developmental processes. This model claims that transfer decreases over time, while developmental processes first increase and then decrease.

Thus, based on universal principles, the difficulty concerning the acquisition of English by both Portuguese and Spanish speakers could be explained by the difference between the strength values of the segments of these languages, as well as the different sequences of segments allowed by each one. In order to better understand the findings obtained by the analysis of the data collected for this study concerning the dissimilarities between the syllable structures of English, Portuguese and Spanish, the next section will briefly describe their main characteristics.

2.3 Syllable Structure of the Languages in Question

2.3.1 English Syllable Structure

Since the aim of this study is to investigate the strategies used by both Brazilian Portuguese and Spanish EFL speakers to produce English initial /s/ clusters, English syllable structure is the first one to be analyzed in order to be more easily compared to the other two.

According to Brinton (2000, p. 65), the onset in English may optionally contain up to three consonants and the coda may be formed by one to four consonants, which can be represented as (C) (C) (C) (V) (C) (C) (C) (C). Some examples of English syllable types are:

(1) CV – be

(2) CVC – bid

(3) CCVC – stud

(4) CCVCC – stink

(5) CCCVC – strip

(6) CCCVCC – strict

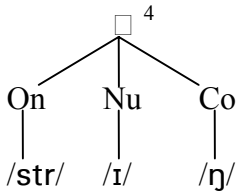
(7) CCCVCCC – strength

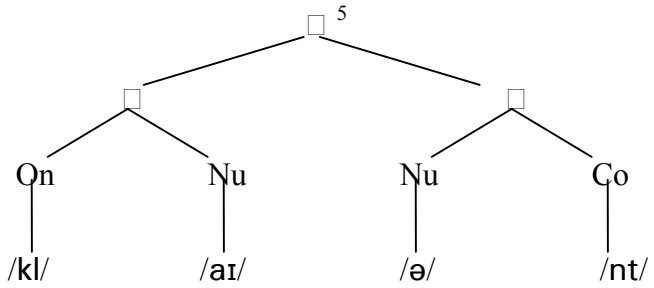
(8) CCCVCCCC – strengths

The word *be* has a CV syllable and is referred to as an *open syllable* because it ends in a vowel. All the other words are examples of *closed syllables*, since the coda contains a consonant. The wide variety of English syllable types can be considered one of the reasons EFL learners face difficulty in producing them correctly.

Avery and Ehrlich (1992, p. 59) exemplify this difficulty of accurately producing English syllables by showing the strategy used by Japanese, Cantonese and Vietnamese speakers to simplify the syllable structure. These languages do not have any consonant clusters consequently, as pronouncing word-initial clusters, Japanese speakers tend to insert a vowel between each pair of consonants of the cluster. Thus, the word *street* is pronounced [sutorito], thereby conforming to the Japanese pattern, formed by four open syllables (CV-CV-CV-CV). Cantonese and Vietnamese speakers, on the other hand, tend to delete one of the consonants of the cluster rather than insert a vowel, resulting in the production of a CVC word [gin] for the CCVC word *green*, for instance. Other studies showing syllable simplification strategies will be described later, when the notion of markedness is discussed.

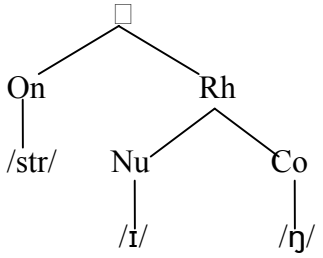
Concerning the internal structure of the English syllable, Hogg and McCully (1987, p. 35) claim that "phonological sequences are not merely concatenated strings of segments, but there is a higher level element, namely the syllable, which determines the possible sequence of segments". This notion, based on metrical phonology, means that if segments are subordinated to the 'higher level element' syllable, a way to better represent syllabic structure is by using tree diagrams. Examples of this representation are shown below with the words *string* and *client*:

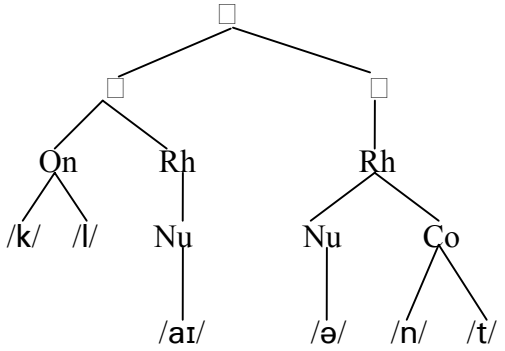




Hogg and McCully (1987, p. 37) affirm that in order for monosyllables to be acceptable in English, they need to consist of a nucleus which has to contain a long vowel or a diphthong (e.g. *pie*, go), or the nucleus may contain a short vowel if it has at least one element in the coda (e.g. *hit*, *odd*). Note that there is no need of a segment in the onset, as exemplified by the word *odd*. An example of an unacceptable monossylable is **[ba]*, since it "consists of a short vowel and the coda is empty" (Hogg & McCully, 1987, p. 37).

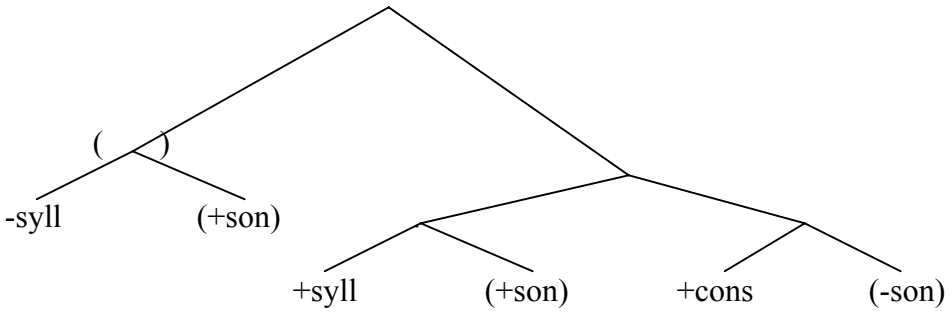
Hogg and McCully's conclusion concerning the elements which form a word is that the nucleus and the coda are more closely interrelated than either of them is with the onset. This explains the origin of the term *rhyme*, which means the combination of the nucleus and the coda to form a single constituent. This gives a different representation from the two tree diagrams shown above:





[4] '□' is the symbol for 'syllable'.
[5] '□' is the symbol for 'word'.

Concerning syllable structure, Selkirk (1982, pp.333-334) proposes the notion that each language should have a template and a set of phonotactic constraints (constraints on positions and sequences of sounds) to provide the possible syllable types. She suggests the following tree diagram to represent the English syllable template:



Selkirk (1982, p. 334) claims that by means of a template, the "gross characteristics" of syllable structure can be determined, such as "(i) the composition of the syllable in terms of segment types identified by the major class features [±syllabic], [±sonorant] [±consonantal], (ii) the order of these segment types within the syllable, (iii) the structural relations of these segment types, and (iv) the optionality of segments or groups of segments (= constituents) within the syllable". Thus, if the branching of a phonological representation matches the branching of the template, then the syllabic structure of the representation is well-formed; that is, it is non-distinct from the corresponding feature matrices of the template.

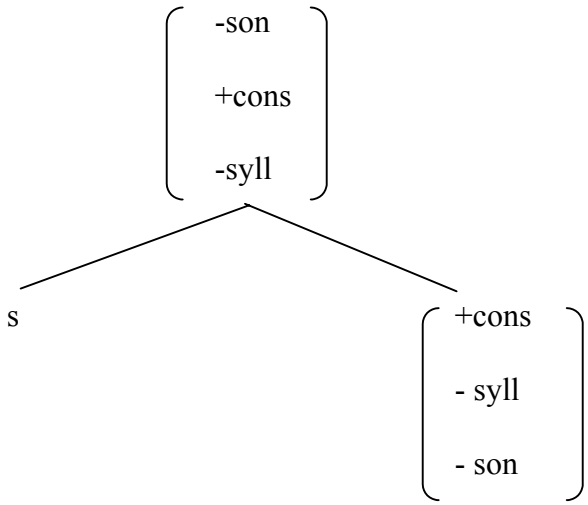
However, Selkirk (1982, p. 334) acknowledges that the template she proposes does not give a sufficiently restrictive characterization of English syllable structure. She cites Fudge's (1969, cited in Selkirk, 1982, p. 334) formal device required in the grammar to express phonotactic constraints: "collocational restrictions". These collocational restrictions imply a certain order of segments, for instance: "if a second position in onset is *w*, then first position is

not [+labial]". Selkirk affirms that in order for the well-formedness of the syllabic structure of a representation to be established it must not be prohibited by the collocational restrictions of the language.

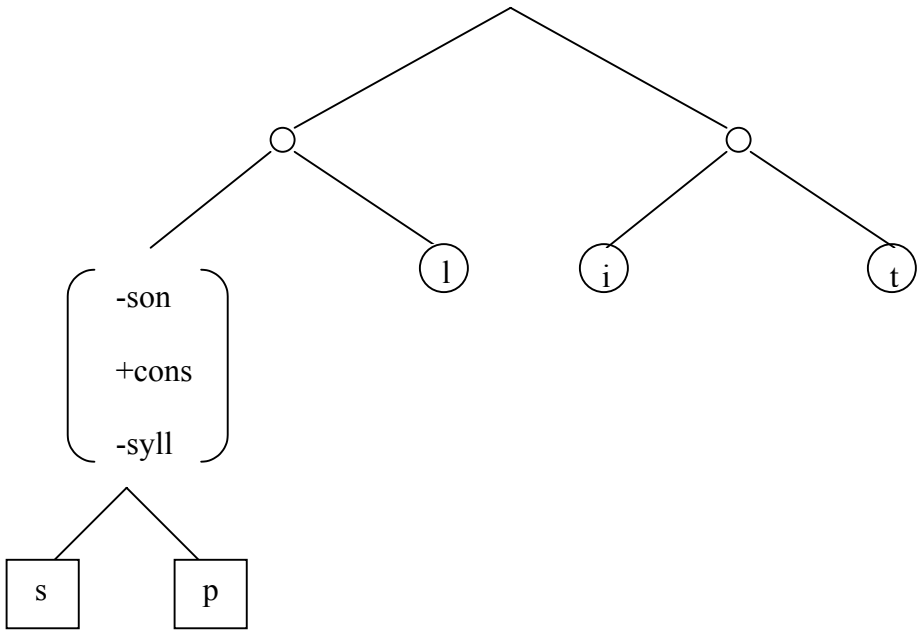
In Selkirk's (1982, p. 335) analysis of the template, any English consonant except /ʒ/ and /ŋ/ can serve alone as the onset. It is also observable that no more than two consonants can form the onset (with the exception of /s/ clusters, for which she provides a separate explanation, as cited below), and if it does contain two, the second must be a sonorant and the first must be an obstruent. In addition, several restrictions on possible onset combinations are proposed: (1) only stops and voiceless fricatives appear as the first member, (2) /j/ never appears as a second member, (3) only /s/ may appear with /m/ or /n/, (4) /w/ never appears after labial consonants, or /ʃ/ or /st/, (5) /r/ never appears after /s/ or /h/, and (6) /l/ never appears after /t/, /d/, /ʃ/, /h/, or /sk/. According to Selkirk, these constraints together with the template establish the well-formed English syllable structure, since "the existence of these constraints between first and second consonants, and the absence of any between these consonant positions and the vowels that follow indicate a grouping of the consonants into a constituent" (Selkirk, 1982, p. 335).

Sequences of two or three consonants are called *clusters,* which constitute an important aspect of restrictions on syllable types, since there is a limited number of allowed combinations of segments in both initial and final positions. Clusters with initial /s/, for instance, are the only instances of onsets where the second consonant may be an obstruent and where the onset may be formed by three consonants instead of one or two. In order to represent the particular category of /s/ clusters, Selkirk (1982, p. 336) provides an auxiliary template, considering that "/s/ plus

obstruent may qualify as a single obstruent in English". This is illustrated below, where the upper node is divided into two constituents, which would be the /s/ plus one of the voiceless stops:



Since Selkirk (1982) considers *s + obstruent* as a single obstruent in English, three-member clusters constituted by /s/ [-son] [+ son], as in *split,* may be represented as follows:



Still related to phonotactic constraints, besides the ones previously described, Brinton (2000, p. 54) adds the following: (1) "/h/, /y/, and /w/ are always syllable-initial before a stressed vowel[6]. They occur syllable-finally only as part of a diphthong"; (2) "/ð/ is word-initial only in certain pronouns, adverbs, prepositions [and] demonstratives…" It is used mostly in function words, and "it occurs freely word-medially and word-finally"; (3) "syllabic nasals and liquids /m, n, l, r/ are never word-initial"; (4) "unreleased stops occur only word- finally or before another stop".

Concerning the possible combinations of initial consonants, Brinton (2000, p. 55) lists the following nonpermissible sequences of consonants:

- stop + stop, such as in /pt/;
- stop + nasal, such as in /pn/;
- nasal + stop, such as in /np/;
- stop + fricative, such as in /ts/;
- fricative + stop, such as in /ft/, except where the fricative is /s/ (or in obviously 'foreign' words such as *shtick*).

A classification of the possible English clusters[7] taken from Avery & Ehrlich (1992, pp. 55-58) is provided below together with their example of each cluster:

(1) initial bi-literal (two-consonant) clusters beginning with a stop:

/pl, kl, pr, tr, kr, tw, kw, bl, gl, br, dr, gr/ - *play, clean, pray, tree, cream, twin, queen, blue, gleam, brew, dream, green.*

(2) initial bi-literal clusters beginning with a fricative:

/fl, sl, fr, θr, ʃr, sw, sp, st, sk, sm, sn, sf/ - *flew, slow, fry, three, shriek, switch, spit, stone, school, smile, snow, sphere*.

(3) initial tri-literal (three-consonant) clusters:
/spl, spr, str, skr, skw/ - *splice, spring, string, screw, squirt.*.

(4) final bi-literal clusters beginning with a nasal:

[6] Exceptions to Brinton's first constraint are the words *united* and *whenever*, in which the glides are not followed by a stressed vowel.

[7] Only the most common clusters were taken from Avery & Ehrlich's (1992) classification. Clusters which are rarely used, like /θw/ (as in *thwart*) or /gw/ (as in *Gwen*) were not included.

/mp, nt, ŋk, m(p)f, nd, ns, nθ, ntʃ, ndʒ/ - *bump, rant, think, triumph, hand, tense, tenth, wrench, strange.*

(5) final bi-literal consonants beginning with a liquid:

/lp, rp, lb, rb, lt, rt, ld, rd, lk, rk, rg, lf, rf, lv, rv, lθ, ls, lʃ, ltʃ, ldʒ, lm, ln, rθ, rs, rʃ, rtʃ, rdʒ , rm, rn, rl/ - *help, harp, bulb, curb, welt, art, old, cord, milk, cork, morgue, elf, scarf, shelve, serve, wealth, else, Welsh, belch, bulge, film, kiln, hearth, course, marsh, arch, barge, arm, barn, girl.*

(6) final clusters of two consonants beginning with a fricative or stop:

/sp, st, sk, ft, fθ/ - *wasp, trust, ask, rift, fifth;*

/pt, pθ, ps, ts, kt, ks, dz/ - *apt, depth, lapse, ritz, act, lax, adze*.

(7) final clusters of three consonants:

/kst, ksθ, mpt, mps, nts, nst, lts, rps, rts, rst, rld, rlz/ - *text, sixth, exempt, glimpse, prince, against, waltz, corpse, quartz, first, world, Charles*.

Avery & Ehrlich (1992, p. 58) also state that besides the clusters described in their list, four-consonant clusters may be created by the addition of grammatical endings, though some of them tend to be simplified by speakers, e.g:

(1) the past tense ending /t/ when added to verbs like *glimpse, triumph, fence* and *waltz* form the clusters /m(p)st/ - *glimpsed*, /m(p)ft/ - *triumphed*, /n(t)st/ - *fenced*, and /l(t)st/ - *waltzed*;

(2) the plural ending /s/ when added to words like *text, burst, strength,* and *sixth* form the clusters /ksts/ - *texts*, /rsts/ - *bursts*, /ŋkθs/ - *strengths*, and /ksθs/ - *sixths*.

Brinton (2000, p. 56) points out the fact that native speakers of a language are able to recognize permissible and nonpermissible sequences, since this capacity is part of their linguistic competence. Brinton also claims that the strategy used to pronounce difficult loan words which do not conform to the phonotactics of English generally consists of eliminating non-English clusters, such as /ps/ in *pseudonym*, which becomes /s/. Therefore, although the English language is marked, since its structure differs from the optimal CV syllable, there are several sequences which are not permissible in this language, but may be found in other languages.

In the next sub-section, the Portuguese syllable structure will be described with consideration of sonority and strength relations. A comparison of the languages under investigation will make it possible to understand why EFL speakers have specific difficulties concerning certain syllabic structures.

2.3.2 Portuguese Syllable Structure

As previously stated, there is no consensus among phonologists concerning the definition of syllables. The same holds true for the Portuguese language, whose number of possible segments forming a syllable is undetermined. Collischonn (2001) lists some examples of Portuguese syllable types:

(1) V – **é** (is)

(2) VC – **ar** (air)

(3) VCC – **ins**tante (instant)

(4) CV – **cá** (here)

(5) CVC **–** lar **(home)**

(6) CVCC – **mons**tro (monster)

(7) CCV – **tri** (tri-)

(8) CCVC – **três** (three)

(9) CCVCC – **trans**porte (transportation)

(10) VV – **au**la (class)

(11) CVV – **lei** (law)

(12) CCVV – **grau** (degree)

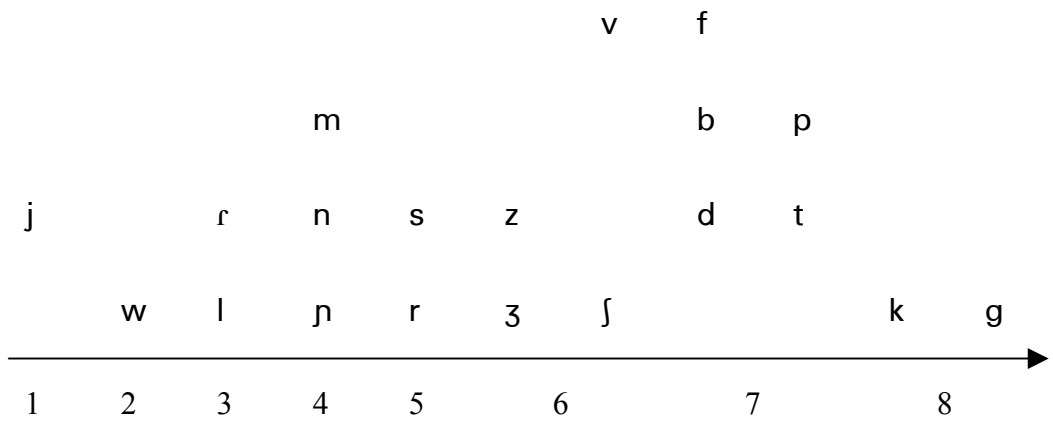
(13) CCVVC – **claus**tro

Baptista (1987, p. 7) provides a description of the Brazilian Portuguese syllable based on Hooper's (1976) discussion of strength relations concerning both the universal and the Spanish syllable structures. Baptista (1987, p. 7) formulated the following representation for Portuguese syllable structure[8]:

$C_mC_nVC_pC_q$
m1 = /p, t, k, b, d, g, f, v/ = initial, may be followed by C_n
m2 = /s, ʃ, z, ʒ, m, n, ŋ, l, ʎ, r/ = initial, may not be followed by C_n
n = /ɾ, l, w/ = may follow C_{m1} (/w/ follows only /k/ and /g/)
p = /j , w/ = may follow V; may be followed by C_{q1} (/r/ occasionally occurs in this position)
$_{q1}$ = /s/ = may follow V and/or Cp
$_{q2}$ = /s, m, n, l, ɾ or r/ = may follow V (/m/, /n/, and /l/ are doubtful in this position).

As can be observed, the permissible sequences that occur in Portuguese are strictly determined by language-specific phonotactic constraints, which appear in both initial and final clusters. These constraints differ from those of the English language, a fact that might explain EFL speakers' difficulties in pronouncing English clusters.

Based on Hooper's work on Spanish, Baptista has also developed a strength scale for the Portuguese language:



$C_mC_nVC_pC_q$

2 □ n □ 3	*If n < 3, then m > 7
m > n	p □ 2
If n, then m □ 7	q> p
	Q □ 5

As can be observed, the value of each segment in the scale is determined in terms of strength. Furthermore, the hierarchy of strength values determines the possible sequences that can occur within the syllable.

In this representation of the Portuguese syllable, the nucleus is always occupied by a vowel. Baptista (1987, p. 9) claims that the non-conforming statement is "if n < 3, then m > 7", since /w/ is more sonorous than /r/ or /l/. She affirms that the existence of /w/ as an on-glide is only occasionally possible after the velar consonants. Examples might be *cinqüenta* /s□kwenta/

[8] The symbols have been updated to current IPA symbols.

(fifty) and *lingüiça* /lgwisa/ (sausage). She states that the tendency, though, seems to be to eliminate it after /k/, and gives some words that have alternate pronunciations and spellings such as "*quatorze* /kwatorzi/" (fourteen) and "*catorze* /katorzi/".

Redenbarger's (1979, p. 41) analysis of Portuguese syllable structure shows that "if a prevocalic segment is [+consonantal], it obligatorily goes in the syllabic onset". He also observes that the only two-segment onsets permissible in internal syllables are those formed by an obstruent and a liquid ($OL-), as in the following examples:

$pr – [a.pɾo.vei.taɾ]	$pl - [a.plau.diɾ]
$br – [sɔ.bɾa]	$bl - [pro.ble.ma]
$tr - [a.tɾa.ve.saɾ]	$tl - [a.tlas]
$dr – [dɾɔ.ga]	
$kr – [a.kre.di.taɾ]	$kl - [o.klu.si.vo]
$gr – [a.gɾe.si.vo]	$gl - [a.glu.ti.nar]
$fr – [so.fɾeɾ]	$fl - [re.fle.kso]
$vr - [li.vɾaɾ]	

According to Major (1986, p. 55), the only word-final consonants in Portuguese are /s/, /r/, and /l/, corresponding to q 5 in Baptista's scale above. However, the segments /r/ and /l/ tend to be weakened by most Portuguese speakers in final position: The /l/ becomes more vowel-like, as in the word *canal* (channel) [kanau]; and the /r/ is often deleted. Nasals in final position tend to be deleted and their nasality assimilated to the previous vowel. Moreover, when /s/, /r/, /l/

or /N/ constitute the coda and are followed by any consonantal segment except /s/, they establish the end of the syllable.

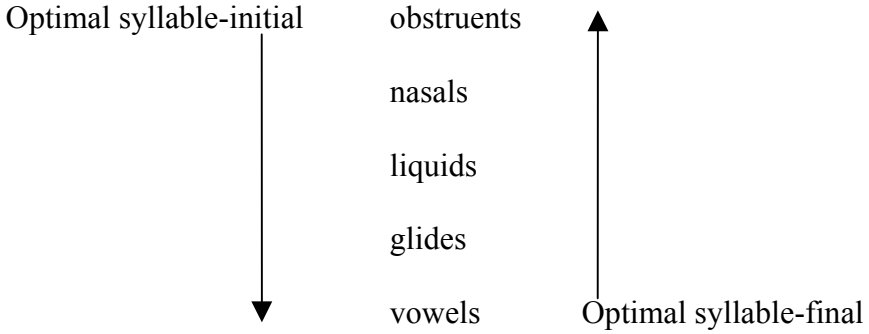
Concerning the processes of facilitating the production of difficult clusters, Major (1986, p. 55) explains the process of inserting a vowel after syllable-final word internal stops as in the word *absolutamente* (absolutely): [ab(i)solutamente]. He claims that this process also occurs when beginning Brazilian EFL learners pronounce words ending with obstruents, such as big [big(i)] and picnic [pik(i)nik(i)]. Some learners do realize that epenthesis marks a heavy accent and try to avoid the production of an extra vowel, but often substitute [ə] instead. Major affirms, though, that the insertion of this vowel is a developmental process, since it does not occur in native Portuguese phonology.

Thus, when comparing Portuguese and English syllable structures it is possible to conclude that the Portuguese syllable is closer to the optimal CV syllable, which means that Portuguese tends to adhere to universal principles of syllable structure. This difference implies that Portuguese syllable structure is less marked than English syllable structure, a fact that explains why Portuguese EFL speakers have difficulty in pronouncing certain structures. The next sub-section will describe Spanish syllable structure, thus providing further information in order to better understand the data analysis carried out in Chapter 4.

2.3.3 Spanish Syllable Structure

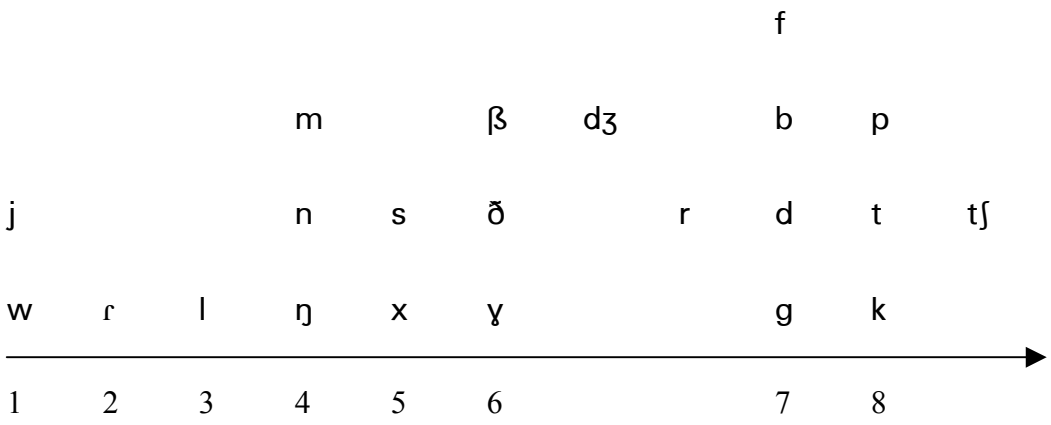
The similarities between the Portuguese and Spanish languages are very significant. Given that both are Romance languages, strength relations described in the previous sub-section concerning Portuguese are almost the same for Spanish. Thus, the number of clusters that occur in each language is nearly the same, the one exception being the cluster /vr/, which exists in Portuguese but not in Spanish. The voiced fricative /v/ does not occur in Spanish, since the letter *v* is pronounced as the voiced stop /b/, being spirantized in some environments, but always maintaining its bilabial place of articulation. Examples of this difference are the words *li**vr**o* (book) and *la**vr**ador* (farmer) in Portuguese and *li**br**o* and *la**br**ador* in Spanish.

Hooper (1974, p. 196) provides the following suitability hierarchy for initial and final positions:



This hierarchy shows that the optimal syllable-initial segments for Spanish are obstruents, followed by nasals, liquids, glides, and finally vowels, which are the least preferred segments to begin a Spanish syllable. The hierarchy for final positions is the exact opposite of the hierarchy for initial positions.

Hooper (1976, p. 208) proposes the following strength scale for American Spanish:



PC: $\$C_mC_nC_pVC_qC_r\$$ where $n \leq 3$

If $n > 1$, then $m \leq 6$

$m > n$

$p, q = 1$

$r \leq 5$

$n > p$

$r > q$

As can be observed in the scale, there is no condition for C_m, which implies that a C of any strength value can occupy this syllable-initial position. Furthermore, any C position can be empty, and when $m > n$ and $n > p$, the positions C_n and C_p may not be occupied if C_m is empty. Therefore, if the syllable-initial position is occupied by only one C, disregarding its strength scale value, it will be the C_m or the first C position will be occupied.

Concerning the m > n, n > p, and r> q conditions in the Spanish syllable, Hooper explains that they describe clustering behavior of Cs. The conditions m > n and n > p require that a syllable of glide plus vowel be analyzed as having the glide in C_m position, with C_n and C_p empty, because these conditions are universal and follow naturally from Hooper's theory of syllable structure. Moreover, if a glide occupies the C_p syllable-initial position, and p = 1, then it is not possible to explain the glide-strengthening process by which the glides /j/ and /w/ become obstruents [dʒ] and [gʷ] in syllable-initial position, as in the example "Yo me llamo", where the glides become obstruents.

As for the second C position in the syllable, the condition n = 3 restricts the segments /r/, /l/, /j/, and /w/ as the only segments allowed to occupy this position, eliminating clusters such as $pt, $sk, $ks. The condition "if n > 1, then m □ 6" excludes $mr, $sr, $lr, $rl, for instance, since it states that "only the stronger C's may be the first member in a cluster with a liquid" (Hooper, 1976, p. 211).

Concerning the positioning of the liquids /ɾ/, /r/ and /l/ in the scale, Hooper (1976, p. 211*)* explains that the trilled /r/ is much stronger than the other liquids due to its vibratory articulations of the tip of the tongue against the alveolar ridge. Its strength explains why it occurs only in syllable-initial position and never in clusters. The other two liquids /ɾ/ and /l/ conform to the predictable universal principles for liquids, which explains the occurrence of initial clusters such as /tr/ and /dr/, but not */tl/ and */dl/, which are not universally allowed.

The only obligatory part in the Spanish syllable is the nucleus, which "must contain a vowel and may contain only one vowel" (Hooper, 1976, p. 214). A glide near the nucleus may be analyzed as part of the nucleus or as part of the consonantal margin of the syllable. However,

Hooper prefers to consider it a consonant, since glides function like C's "in that they may strengthen in syllable-initial position, a position where they actually become obstruents", as already explained by the condition C_p, when p = 1. Hooper claims that if glides are considered consonants, "they must be the weakest consonants on the strength scale" (Hooper, 1976, p. 215). This is explained by the fact that glides occur closest to the vowel in relation to the other Cs and strengthen in syllable-initial position, conforming to Hooper's general hypothesis concerning the relation between consonantal strength and syllable structure.

In sum, when considering the possible combinations of segments within the syllable structure of each language, it is possible to observe that there are a great number of possible clusters in English, but a rather limited number in both Portuguese and Spanish. The phoneme /s/, for instance, occurs in syllable-initial position when not followed by any other consonant in the three languages; however, it forms initial clusters only in English. This difference is significantly relevant for this study on the production of initial /s/ clusters by EFL learners, since it accounts partially for the difficulty in producing this structure. The next sub-section will describe several studies that show the main strategies used by learners to avoid this difficulty.

2.4 Main Theories Concerning Linguistic Universals and NL Transfer

One of the most important factors influencing second language acquisition is native language transfer to target language pronunciation. The process of language transfer implies learners' considerable dependence of their NL in a TL learning situation. As stated by Gass and Selinker (1994, p. 54), the term *transfer* was used by the behaviorist school to explain the psychological process in which the learning of a certain task would affect the subsequent learning of another one. "The typical behaviorist position is that speech is a precondition for writing",

since “children learn to speak before they learn to write and many societies have no written language, although all societies have oral language”. Thus, behaviorists assert that speaking consists of habits: “speech is the practical reaction to some stimulus” (Gass & Selinker, 1994, p. 57).

As a result of this notion of language as habit, the role of the NL was considered, in the 1950s and 1960s, the main cause for lack of success, since TL learning was seen as the development of a new set of habits, which could undergo interference from habits already established in childhood. Therefore, if one is supposed to replace a set of habits of language A with another set of habits of language B, the rules of the two languages need to be described, which was the justification for contrastive analysis. However, Major (1986, p. 53) states that transfer can also be positive when characteristics of the NL are the same as those of the TL: these characteristics are automatically transferred from NL to TL and do not have to be relearned by the speaker.

The difficulty in producing and acquiring certain TL phonological forms is a topic that has generated much research and the proposal of several theories. Among them are the Contrastive Analysis Hypothesis (CAH), the Markedness Differential Hypothesis (MDH) and the Structural Conformity Hypothesis (SCH).

The CAH (Lado, 1957, cited in Eckman, 1996) was an attempt to explain and predict all substitutions in terms of NL transfer. This hypothesis predicts that TL forms which are different from NL equivalent forms will be difficult to learn, while forms that are similar will be learned and produced easily. Problems regarding the CAH are that (1) transfer by itself could not explain the order of acquisition of some phenomena in relation to others, and (2) some of the errors predicted by the hypothesis do not occur, while some of the problems that do occur are not predicted. In other words, NL-TL differences are neither necessary nor sufficient to explain all

substitutions, and the simple comparison of the two languages is not enough to predict the areas of difficulty that a language learner will have. Furthermore, the CAH did not take into consideration other factors that affect TL development, which can be, for instance, the innate principles of language, attitude, motivation, aptitude, age and other languages known.

With the aim of providing a better explanation for the difficulty in learning a TL, the Markedness Differential Hypothesis (MDH) considers both NL transfer and language universals to predict the difficulties in TL learning (Eckman, 1977, cited in Eckman, 1996). This hypothesis proposes that forms in the TL that differ from and are more marked than the NL forms will be difficult to learn and that the relative degree of difficulty "will correspond to the relative degree of markedness". Thus, the aspects of the TL that are different but unmarked will not be difficult to learn. To define markedness, Eckman states, "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" (Eckman, 1987b, p. 60). The hypothesis assumes that the less marked phenomenon is acquired before the more marked. In other words, if A has been acquired, B necessarily has also been acquired.

An example concerning the MDH is the degree of markedness of syllable structures. As previously discussed, it is assumed that the optimal syllable is the CV syllable and that all languages contain this syllable type (Hooper, 1976). Furthermore, according to Greenberg (1965), if a language contains more marked syllable types, the most marked type will always imply the presence of a less marked type. Thus, as pointed out by Weinberger (1987, p. 402), if a language contains CVCC syllables it will necessarily contain both CVC and CV syllable types, but the opposite is not true. Therefore, if a learner's NL contains only CV syllables and the TL contains CV, CVC, CVCC, and CVCC syllables, the MDH will predict difficulty with the

different syllable types, and it will also predict that the degree of difficulty will be found in the following decreasing order: CVCCC > CVCC > CVC syllables.

Major (1994, pp. 186-187) illustrates how the MDH could be falsified. He gives the example of voiced obstruents, which are more marked in word-final position than in initial or medial positions. His claim is that "if an L2 learner (whose NL had no voiced obstruents) were to acquire them in final position before the other two positions, it would be clear counterevidence".

Eckman (1996) himself revises his own theory, reflecting on the inability of the MDH to predict errors that might occur in areas in which the NL and the TL are not different. In order to solve this problem, he proposes the Structural Conformity Hypothesis (SCH), which makes NL-TL differences irrelevant and considers all universals that are true for primary languages to be also true for interlanguages. He claims that if TL errors are not in an area of NL-TL difference, then the MDH makes no prediction, and the SCH will be falsified by these errors if they do not conform to the predictions made by markedness relationships. His conclusion is that "the SCH is vulnerable where the MDH is not, making the SCH a stronger, more easily falsifiable hypothesis" (p. 208). Thus, the MDH makes predictions on the basis of universals and differences between the NL and the TL, while the SCH makes predictions only on the basis of universals.

Some studies focusing on transfer as the main source of foreign accent, as well as studies concerning universal NL processes in second language acquisition, are going to be described in the following subsections.

2.5 Studies in Interlanguage Syllable Structure

Concerning the interference of the NL in the learning of a TL, several researchers point out a relevant aspect of IL pronunciation that can be used to examine the hypotheses reviewed in

2.4: TL syllabification (Anderson, 1987; Tarone, 1987b; Tropf, 1987; Weinberger, 1987; Sato, 1987; Carlisle, 1991, 1992). Anderson (1987), Tarone (1987b) and Sato (1987) claim that a contrastive analysis showing differences in NL-TL syllabification does allow predictions about the relative difficulty of TL syllables and makes it possible to compare the performance of language learners from various language backgrounds. However, they claim that these predictions of syllable difficulty can also be made on the basis on language universals. As discussed in the previous section, since the most universal syllable type is the open CV and syllables with consonant clusters always imply the presence of simpler syllable types, it is concluded by phonologists that the longer the cluster, the more marked it is considered to be.

In order to confirm MDH predictions of difficulty, Anderson (1987) investigated Arabic and Chinese speakers of English, and considered the length of the clusters and their positions in syllables. She found evidence that the longer and more marked the clusters, the more difficult they were for both Arabic and Chinese speakers to produce. The Chinese group modified less than 1% of one-member onsets, but over 20% of the one-member codas. They also modified about 10% of two-member onsets, but 50% of the two-member codas. The Arabic-speaking participants modified only about 2% of one-member codas, but 30% of three-member codas, and the differences between the onsets and codas of both lengths were also significant. Thus, Anderson confirmed her hypothesis that the more marked final clusters were more difficult than the less marked initial ones. Her findings revealed that the MDH predicted TL performance more accurately than NL transfer alone did, and first language acquisition processes offered a better explanation for some of the errors than did the CAH.

In another study on interlanguage syllable structure, Broselow (1983 in 1987a, pp. 271-272) also found evidence that transfer influences TL acquisition and that language learners show a preference for less marked syllable structures. Broselow investigated syllabification errors in

the English of Egyptian Arabic participants, whose NL disallows consonant clusters in syllable-initial position. This group of participants produced epenthesis when pronouncing English words beginning with consonant clusters in the following way: *plastic*, for example, is pronounced [bilastik], with a vowel inserted to produce a syllable structure which is acceptable in Egyptian Arabic[9]. Based on these findings, she created the Syllable Structure Transfer Hypothesis (SSTH): "When the target language permits syllable structures which are not permitted in the native language, learners will make errors which involve altering these structures to those which would be permitted in the native language" (p. 272).

Confirming the SSTH, Tarone (1987b) analyzed six non-native speakers narrating a story in English: two speakers of Cantonese, two of Portuguese and two of Korean. She found that participants modified about 20% of the syllables they produced, and of these modifications Tarone could attribute about 22% to NL transfer. She also noticed that both epenthesis and consonant deletion were used as strategies for syllable simplification and that the NL background of the learner seemed to be related to the preference for one strategy over the other. Another important conclusion, similar to Broselow's (1987a), was that language transfer was the main process influencing the syllable structure of interlanguage phonology.

Another study which investigated syllable simplification strategies was carried out by Weinberger (1987). He recruited four Mandarin Chinese speakers of English who performed three different tests in order for the researcher to analyze the production of word-final codas: list-reading, paragraph-reading and story-telling tasks. Compared to English, Mandarin Chinese has a less marked syllable structure, which caused participants to produce epenthesis, devoice final consonants and use deletion as strategies to simplify syllable structure. Weinberger's aim was to

[9] Broselow explains that the substitution of /b/ for /p/ occurs since the latter is not a phoneme of Arabic.

investigate whether the different tasks would affect the ratio of epenthesis to deletion. He found that the degree of linguistic context in an elicitation task does affect the ratio of epenthesis to deletion and that other factors, such as NL syllable structure and the degree of TL proficiency, also contribute to influencing this ratio. Regarding proficiency level, Weinberger (1987, p. 413) claims that as learners become more proficient they are more able to acquire TL underlying representations and also become more aware of potential ambiguity, facts which explain why participants favor epenthesis. Weinberger's conclusion is that the CAH can predict only that errors will occur, while the MDH is only able to predict the relative degrees of oversimplification, but it cannot predict the relative degrees of the two different strategies discussed in the study.

One more characteristic of syllable structure that should be taken into account is sonority. Tropf (1987) investigated 11 Spanish speakers learning German as a second language to determine whether the sonority hierarchy had some influence on TL phonology. His findings revealed that in a certain context "the ease of acquisition of consonants and clusters correlates with their degree of sonority" (p.189). He found that the use of epenthesis before word-initial two-member and three-member onsets of the form /ʃC(C)/ was one of the five strategies that the subjects used to produce these onsets. This means that at a certain acquisitional stage, two syllables are necessary for realizing a variant of the TL cluster.

All of these findings provide important background data for the present study, since the MDH predicts that markedness and the differences between English, Portuguese and Spanish syllable structures will result in differences in difficulty in the production of initial /s/-clusters. As already described above, two significant differences between Portuguese, Spanish and English syllable structures are (1) the number of elements which can occupy onsets and codas, and (2) the

sequences permissible in each of these positions. When comparing the three languages analyzed in this investigation, initial clusters in Portuguese and Spanish consist of no more than two consonantal segments while in English they can have up to three. In this respect, both Portuguese and Spanish syllables are less marked than the English syllable, since they conform more closely to the universal CV syllable structure. In relation to the sequence of elements in initial clusters, neither Portuguese nor Spanish allows two-member onsets beginning with /s/, since they violate the sonority hierarchy principle within the syllable, which causes speakers to treat one of the members as an extrasyllabic consonant (Harris, 1983, cited in Carlisle, 1991).

Although few studies have investigated the phonological context where errors occur, another aspect that should be taken into account regarding epenthesis and consonant deletion for syllable simplification is the influence of environment in Spanish/English and Portuguese/English interphonology. Carlisle carried out several studies involving native Spanish-speaking learners of English as a second language, who were asked to read a number of topically unrelated and randomly ordered sentences containing initial /s/-clusters in two types of environment. Carlisle (1991) examined epenthesis before three word-initial onsets in English: /sk/, /st/ and /sp/; Carlisle (1991b in Carlisle 1992, p. 71) investigated the frequency of epenthesis before the word-initial onsets /sl/ and /st/; Carlisle (1992) investigated the production of epenthesis before the word-initial onsets /sl/, /sm/ and /sn/; and Carlisle (1997) compared the production of /sC/ vs. /sCC/ clusters. All the studies controlled the environments before the onsets and the sonority relationships among the consonants in the onsets. His findings in the four studies revealed that vowel epenthesis was significantly more frequent after consonants than after vowels. Concerning the variable length examined in Carlisle (1997), his findings reveal that tri-literal clusters, whose

structure is more marked, were more frequently modified than bi-literal clusters, confirming that language universals "influence the structuring of interlanguage phonology" (p. 327).

Similar results were obtained by Abrahamsson (1997, 1999). In his longitudinal study, he investigated a male native speaker of Spanish from Bolivia, who was a guest student at Stockholm University, and an absolute beginner of Swedish. Data were collected during eight months, and consisted of recordings where the participant and a native speaker of Swedish talked about various topics. Besides free speech, activities such as object/picture description and picture story retelling were adopted to elicit specific grammatical/discourse patterns and communication strategies. His findings corroborated those of Carlisle, since longer clusters were more frequently modified, and consonantal environments caused more epenthesis than silence and vocalic environments. Concerning the longitudinal aspect of the study, Abrahamsson concluded that the frequency of epenthesis increased in the beginning of the acquisition process, since the participant was starting to develop his TL proficiency/fluency.

In another study, Rebello (1997a, 1997b) adopted a type of instrumentation similar to that of Carlisle, but investigated six native Portuguese-speaking learners of English. She included six English two-segment /s/- clusters (/sp, st, sk, sm, sn, sl/), and five three-segment /s/-clusters (/spr, str, skr, spl, skw/) and found results contrary to those of Carlisle (1991, 1991b in Carlisle 1997, 1992, 1997). Concerning the phonological environment, epenthesis occurred most frequently after silence (72%), followed by vowels (57%) and finally by consonants (49%). Although there was little difference in the results concerning the variable *length*, Rebello's (1997a,b) findings are contrary to those of Carlisle (1997) and Abrahamsson (1997, 1999), since epenthesis was produced in 59% of bi-literal clusters, and 55% in tri-literal clusters, the latter being more marked. As to the structure of the word-initial onsets, Rebello found that bi-literal

clusters not in violation of Hooper's (1976) sonority hierarchy principle were more frequently modified (63%) than bi-literal clusters in violation (54%) and than tri-literal clusters, which are all in violation (55%). Her results contradict expectations based on Hooper (1976, p. 206) that clusters in violation should be more frequently modified than clusters not in violation. Rebello's (1997a, b) explanation for these unexpected findings regarding *length* and *structure* of the cluster is that participants tended to voice the /s/ before /s/-nasal and /s/-liquid clusters (transfer of the voicing assimilation process in Portuguese), which resulted in *voiced obstruent + sonorant* clusters. Since voiced obstruents are more marked than voiceless obstruents in any position, these clusters can be considered to be more marked than *voiceless obstruent + obstruent* clusters. Thus, she considers her results to conform to the MDH and the SCH, since "the more marked type of cluster caused more epenthesis than the less marked type". This difference in results will deserve much attention in the present study in order to confirm whether the NL does have such an influence on TL production as to result in opposite findings.

Chapter 3- Method

3.1 Hypotheses

As stated in the introductory chapter of the thesis, the purpose of this study is to further investigate, verify and explain the findings of the research carried out by Carlisle (1991, 1991b in Carlisle 1992, 1992, 1997) and Rebello (1997a, 1997b) regarding the production of initial /s/- clusters by both Portuguese and Spanish EFL speakers. The analysis will be based upon the Markedness Differential Hypothesis (MDH) and the Structural Conformity Hypothesis (SCH) in order to verify whether they make the right predictions concerning learners' difficulties. By basing the analysis on the MDH it will be possible to confirm whether the difference in the structure of Portuguese and Spanish syllables results in greater difficulties in different /s/ clusters in different environments, corresponding to the differences in findings by Carlisle (1991, 1991b in Carlisle 1992, 1992, 1997) and Rebello (1997a, 1997b). In addition, the SCH will allow the analysis of the influence of linguistic universals on the production of epenthesis concerning the length and structure of the clusters.

Although both Portuguese and Spanish syllable structures only allow bi-literal clusters, the first question to be answered is whether Spanish EFL speakers will have more difficulty to produce longer clusters, and Portuguese EFL speakers will have more difficulty to produce shorter clusters. Thus, following Carlisle's (1997) and Abrahamsson's (1997, 1999) findings, the first hypothesis is that Spanish speakers will modify tri-literal clusters more frequently than bi-literal clusters, corroborating the MDH, since it was found in previous research that the former type of cluster is considered more marked for these speakers. As for Portuguese speakers, it is expected that bi-literal clusters will be more frequently modified, given that Rebello (1997a,

1997b) found that voicing assimilation of /s/ before /s/-nasal and /s/-liquid clusters led to the formation of a more marked type of cluster (voiced obstruent + sonorant), thus causing more epenthesis in the production of shorter clusters.

The second hypothesis is based on Hooper's (1976) universal strength hierarchy, which establishes the positions each segment can occupy in the syllable. Based on the SSC, it could be predicted that speakers would have more difficulty in producing initial /s/ clusters that violate the sonority hierarchy principle within the syllable than those clusters that do not. Regarding sonority, Carlisle (1991b in Carlisle 1992) investigated word-initial onsets /sl/ and /st/ and Carlisle (1992) investigated word-initial onsets /sl/ and /sN/ (where N represents the category of nasals existent in this type of onset, /n/ and /m/), revealing that Spanish speakers tended to produce epenthesis more significantly after more marked onsets (/sN/ and /st/, respectively). Similarly, Carlisle (1997) investigated the production of bi-literal and tri-literal clusters, and found that tri-literal clusters, which are more marked, were modified significantly more frequently. Rebello (1997a, 1997b), on the other hand, investigated the production of bi-literal and tri-literal clusters by Portuguese speakers and concluded, due to the voicing assimilation of the /s/ before /sN/ and /sl/ clusters, that epenthesis was more frequently produced in bi-literal clusters not in violation of the sonority hierarchy (/sN, sl/), which means her participants tended to modify less marked structures more frequently, unlike in Carlisle's findings. Concerning the analysis of bi-literal clusters in violation versus tri-literal clusters, which are all in violation, Rebello's (1997a, 1997b) findings are inconclusive, since there was a one-percent difference between the total rates of epenthesis production between the two categories, with tri-literal clusters being the category more frequently modified. Thus, the replication of these studies making use of the same corpus for both NL groups allows further investigation of the differences

found concerning sonority. Characterized this way, the second hypothesis of this study predicts that Spanish speakers will tend to modify more marked structures while Portuguese speakers will modify less marked structures more frequently.

The third hypothesis predicts that, by using the same corpus, the context producing the most frequent epenthesis will be consonants, followed by vowels and then by silence for Spanish speakers, corroborating Carlisle's (1991, 1991b in Carlisle 1992, 1992, 1997) findings, and silence, followed by vowels and then by consonants for Portuguese speakers, confirming Rebello's (1997a, 1997b) results. Thus, in the present study the use of the same corpus will show whether the Brazilian and Argentinean participants tend to produce epenthesis similarly to Carlisle's and Rebello's participants.

3.2 Participants

In order to verify the different findings in the production of initial /s/-clusters by Portuguese and Spanish EFL speakers, a quantitative methodology was applied. The subjects chosen for this experiment were nine native Spanish speakers from Argentina, enrolled in the introductory, first and second years of the *Letras* course at the University of Montoya, in the city of Posadas, in the province of Misiones; and ten native Portuguese speakers from Brazil, enrolled in the second and third years of the *Letras* course at the Universidade Federal de Santa Catarina (UFSC), in the city of Florianópolis. The difference in phases of the undergraduate courses is explained by the fact that the University of Montoya is a private institution and requires that learners have a level of proficiency equivalent to the Cambridge First Certificate in English to enter the course, while UFSC is a public university which has no requirements regarding the level

of English proficiency for entrance in the course. This means that although learners were in different phases of their undergraduate course, their level of proficiency was similar.

Brazilian participants were selected for the experiment based on the percentage of epenthesis produced. A group of 24 students were asked to read and record the sentences and only participants whose epenthesis production was higher than 20% and lower than 75% of the target words were selected, totaling ten participants. The same procedure was followed with the Argentinean participants: Fourteen students recorded the sentences, and only those whose production of epenthesis ranged from 10% to 65% were selected, totaling nine participants. This difference in percentage range is due to the fact that the Argentinean learners produced less epenthesis than the Brazilian learners. This also explains why there are ten participants in the first group and only nine in the second. Participants whose production was lower than 15% and higher than 75% were not considered suitable for this investigation, because the non-production of epenthesis is not relevant for this study, and the excessive production of epenthesis also implied difficulty in reading the sentences, which caused learners to pause very frequently between words, strongly interfering in the analysis of results.

Out of the nineteen participants, only two Brazilians speak a language other than Portuguese: One is of Italian descendent, so Italian is also spoken at home, and the other is the daughter of Bolivian parents, which means she speaks Spanish besides Portuguese at home. Only one Argentinean participant has some basic notions of another foreign language (Portuguese). One Brazilian has studied other foreign languages (French and German) and another Brazilian has some knowledge of five other languages (Latin, Greek, Spanish, French and Italian). Two Brazilians speak Japanese fluently, since one lived in Japan for two years and the other for six years. Another Brazilian does not speak any foreign language other than English, but lived in the

United States for five months. A summary showing more details about each participant is shown in Table 2:

Table 2: Participants' characteristics.

Part.	Nat.	Age	Sex	Level	Only the NL spoken at home?	Knowledge of other languages	If lived abroad, where?
1	A	22	M	Intro	Yes	No	No
2	A	19	F	Intro	Yes	No	No
3	A	25	F	Intro	Yes	No	No
4	A	18	F	Intro	Yes	No	No
5	A	18	F	Intro	Yes	No	No
6	A	21	F	Intro	Yes	No	No
7	A	18	F	Intro	Yes	No	No
8	A	21	M	2nd	Yes	No	No
9	A	21	F	1st	Yes	Portuguese	No
10	B	28	M	2nd	Yes	No	No
11	B	28	F	2nd	Yes	No	No
12	B	20	F	2nd	Yes	French, German	No
13	B	19	F	2nd	Yes	No	No
14	B	19	F	2nd	Yes	No	Arkansas, USA
15	B	20	F	2nd	Yes	No	No
16	B	34	F	2nd	Yes	Japanese	Japan
17	B	23	F	2nd	Yes	Japanese	Japan
18	B	58	M	6th	No, Italian too	Latin, Greek, Spanish, French, Italian	No
19	B	30	F	6th	No, Spanish too	French	USA and Bolivia

3.3 Material

The participants' production was analyzed from their reading of 180 topically-unrelated sentences, similarly to Carlisle and Rebello's studies. This technique was preferred to guarantee all relevant phonological contexts were included in the corpus. This corpus included 13 sentences

containing one occurrence of each of the bi-literal and tri-literal /s/ clusters: /sp, st, sk, sw, sm, sn, sl, spr, str, skr, spl, skw/, each preceded by one of the phonological contexts /p, t, k, b, d, g, f, s, tʃ, dʒ, m, n, ŋ, i, u, oʊ, aʊ, ɔɪ/ or silence (when the /s/-cluster initiates the sentence), distributed as follows: 5 vowels, 5 consonants, and 3 null contexts (silence). This gave a total of 156 target sentences, to which were added 24 distractor sentences, meaning each participant read 180 sentences. The voiced fricatives /z, v/ were not included because they do not occur in Spanish and thus might be pronounced as different segments. Each subject read the sentences in a different order to prevent any possible ordering effect. Some of the sentences used in this study were taken with permission from Rebello's (1997) corpus.

3.4 Procedure

Participants were given a form containing biographical questions and a term of agreement for participating in the study (see Appendix A). Then, in order to make sure that they would read all the sentences without pausing between words, they were given both oral and written instructions. Participants were told that the aim of the study was to investigate fluency, thus they were allowed to reread the sentences up to three times in order to read them without hesitating, a procedure that guaranteed the fluent reading of the majority of sentences. Participants were also told beforehand that many words could be unfamiliar to them, another reason for repeating the sentences that they hesitated to read, since only the production without pauses would be considered.

The sentences were recorded in the language lab of each institution, both using a Sony educational recorder EF 5030, and a Sony headset H5-95. Since each student recorded the corpus independently using a headset, all of them recorded the material simultaneously. The time spent for each recording varied from 12 to 25 minutes, depending on the number of times each participant needed to reread the sentences. In order for participants not to get lost while reading, they were asked to tick each sentence read.

Following Carlisle (1991, 1991b in Carlisle 1992, 1992, 1997) and Rebello (1997a, 1997b), the procedure to analyze the data focused on the three aspects already mentioned: (1) the structure of each cluster, (2) the length of each cluster and (3) the context in which they appear. Concerning the structure of the initial cluster, a comparison was made between bi-literal clusters in violation of the sonority hierarchy and the bi-literal clusters not in violation. In relation to length, another comparison was carried out between bi-literal and tri-literal clusters in order to find out which ones cause more epenthesis. Finally, an analysis related to the influence of consonants versus vowels across the syllable boundary was made to investigate which of them result in the production of more epenthesis in the contexts to be studied.

3.5 Transcriptions

Concerning the transcription procedure, only the part of each sentence considered relevant to this study was transcribed. Three aspects were focused on: The absence or presence of the epenthetic vowel, the phonetic realization of the preceding environments, and the phonetic representation of the onsets.

The relevant sections of each sentence were first transcribed by the researcher twice, within the interval of a week. Then the items were independently transcribed by one more judge

with experience in phonetic transcription. The original percentage of disagreement was 2.56% for epenthesis, a total of 76 items. The two transcribers listened together to all the sentences which had caused disagreement, and discrepancies were solved. Only 1.38% of items (41 items) were eliminated from statistical analysis after the second examination. Some sentences which participants skipped or misread were also eliminated, a total of 115 (3.88%). Consequently, out of the 2,964 items read, 2,808 (94.74%) were left for statistical analysis.

3.6 Statistical analysis

The statistical test used to analyze the variables that were considered to be possible constraints in the production of accurate segments was the chi-square ($\chi 2$). This procedure allows the testing of significance concerning the association of qualitative variables (Barbetta, 2001). According to Woods, Fletcher and Hughes (1986, p. 144), in order for the chi-square to have satisfactory properties, "all expected frequencies must be sufficiently large", and this was the case in this study, since there were a great number of items.

In order to carry out this test of significance, the first procedure is to calculate for each class of variables the difference between the observed number of scores and the expected number of scores. Then, the relative discrepancy is calculated "by dividing the square of each absolute discrepancy by the expected frequency" (Woods e*t al*, 1986, p. 135). This procedure provides a measure of deviance from the model for each class. The next step is to sum the deviances in order "to decide whether or not the sample scores are consistent with their being drawn from a population of normally distributed scores" (p. 136). In order to measure the number of independent pieces of information on which to base the test of the hypotheses, it is necessary to

calculate the *degrees of freedom* (df), which depend on the number of classes which have contributed to the total deviance. To calculate the degrees of freedom of an analysis, the number of lines of the table must be subtracted by one, and the number of columns needs to be subtracted by one. The results of these subtractions must be multiplied like this: df = (total of lines – 1) (total of columns – 1). For the present study, in most of the instances when a statistical test was applied, the degree of freedom was 1, since in these cases only two classes of variables were compared (df = (2 – 1) (2 – 1) = 1). One example of how a p value (which means the significance of the test) will be described in the present study is the following: (χ2(1, N = 2,808) = 6.88, p > .008). In this statement, 1 means the degree of freedom, N represents the number of items used to find the expected and observed frequencies, 6.88 is the figure found after applying the chi-square formula, and the p value indicates the significance. According to Barbetta (2001, p. 200), in the area of social studies, it is common to consider significant the results whose p value is less than .05. In the present study, the program Microsoft Excel was used, since it has a calculator which requests the values of the N and the *df* and gives the exact value of p.

Barbetta (2001, p. 252) claims that, when there are only two variables (2 x 2 tables), a special correction procedure should be carried out in order to take care of the discrepancy caused by the comparison between the chi-square distribution and the observed chi-square value. This is called the Yates Correction Factor (YCF), and its formula was applied only in the 2 x 2 tables of this study. In the 3 x 2 tables, only the chi-square formula without YCF was used.

Chapter 4- Results and Discussion

This chapter is organized into four sections which report and discuss the results concerning the three hypotheses being investigated: (1) longer clusters will be more frequently modified by Spanish speakers, while shorter clusters will be more frequently modified by Portuguese speakers, (2) Spanish speakers will have more difficulty in producing initial /s/ clusters that violate Hooper's (1976) sonority hierarchy principle within the syllable, while Portuguese speakers will have more difficulty in producing /s/ clusters that do not violate this principle, and (3) epenthesis will be more frequently produced after consonants for Spanish speakers and after silence for Portuguese speakers.

4.1 The production of epenthesis by Brazilian and Argentinean EFL speakers

As previously stated, the Portuguese speakers who participated in this study were selected from a group of learners studying in the second and third years of the *Letras* undergraduate course at a public university in Brazil, and the Spanish speakers were learners attending the introductory, first and second years of the same undergraduate course, but at a private institution in Argentina. The first analysis carried out reports the individual and total rates of epenthesis produced by participants of each group, as can be seen in Table 3 and Figure 1. The results show that the Argentinean scores ranged from 12.67% to 63.50% and the Brazilian scores from 20.67% to 74.10%. The difference between the averages of epenthesis produced by the two groups is of 4.58%, which resulted in a non-significant chi-square ($\chi 2$ (1, N = 2,808) = 3.32, $p > .05$). This

means that the variable 'nationality' had no influence on the total production of epenthesis in English initial /s/ clusters, and that the two groups are, therefore, comparable.

Table 3: Individual and total rates of epenthesis production by Portuguese and Spanish speakers.

	Brazilians			Argentineans		
Participant	# productions	# epenthesis	% epenthesis	# productions	# epenthesis	% epenthesis
1	150	31	20.67	138	39	28.26
2	139	103	74.10	149	23	15.44
3	156	37	23.72	148	55	37.16
4	151	37	24.50	150	19	12.67
5	140	73	52.14	144	31	21.53
6	152	51	33.55	137	87	63.50
7	150	56	37.33	154	40	25.97
8	151	34	22.52	147	36	24.49
9	148	35	23.65	148	44	29.73
10	156	36	23.08	--	--	--
Total	1493	493	33.02	1315	374	28.44

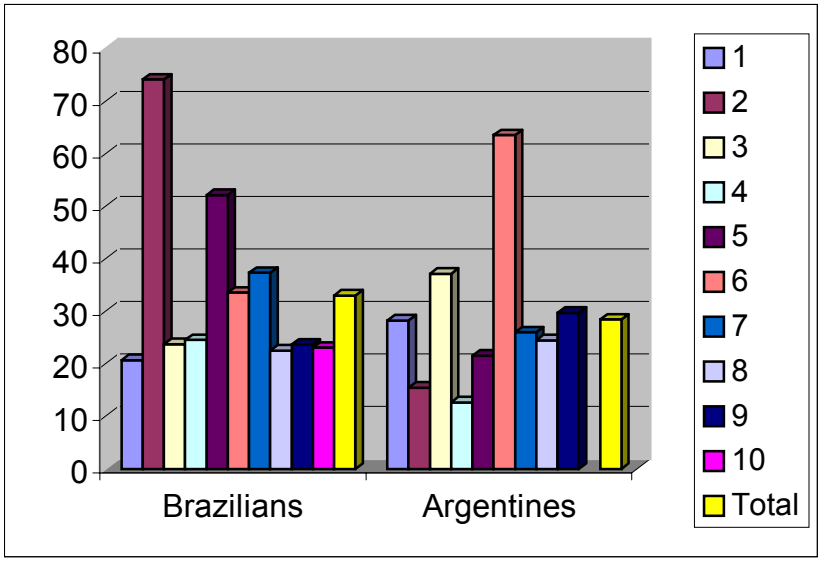


Figure 1: Individual and total rates of epenthesis production by Portuguese and Spanish speakers.

4.2 Analysis of /sC/ versus /sCC/ clusters

The results of this section are based on the first hypothesis, which predicted that longer clusters would be more difficult for Spanish speakers to produce, and that shorter clusters would

be more difficult for Portuguese speakers to produce. In the studies carried out by Anderson (1987), Tarone (1987b), Sato (1987), Carlisle (1997) and Abrahamsson (1997, 1999), most participants had more difficulties in pronouncing longer clusters, corroborating the MDH hypothesis, which states that more marked structures are more difficult for TL speakers to produce. Concerning length of clusters, Rebello (1997a, 1997b) found that shorter clusters resulted in a greater rate of epenthesis production by Portuguese speakers of English. In order to confirm whether by using the same corpus the length of the initial cluster influenced the rate of epenthesis production by Portuguese and Spanish speakers of English, three analyses were carried out. The first analysis compared epenthesis production between the bi-literal clusters /sp, st, sk, sm, sw, sn, sl/ and the tri-literal clusters /spr, str, skr, spl, skw/. The second analysis considered the second component of the clusters and, thus, compared /sp/ versus /spC/ (where C comprises the approximants /r, l/), /st/ versus /str/, and /sk/ versus /skC/ (where C comprises the approximants /r, w/). The third analysis considered strength relations within the syllable and compared bi-literal clusters in violation of the sonority hierarchy /sp, st, sk/ versus tri-literal clusters, which are all in violation.

4.2.1 General analysis of /sC/ versus /sCC/

The results of the first analysis revealed that both Brazilian and Argentinean participants produced significantly more epenthesis before longer clusters, since there was a 9.62% average difference between /sC/ and /sCC/ clusters within the Brazilian group, which resulted in a very significant chi-square ($\chi 2$ (1, N = 1,493) = 15.19, $p < .0001$), and a 10.72% difference within the group of Argentineans ($\chi 2$ (1, N = 1,315) = 17.98, $p < .0001$).

Concerning the group of Portuguese speakers, all of the participants had more difficulty with tri-literal clusters: They produced epenthesis in 28.98% of /sC/ clusters compared to 38.60% of /sCC/ clusters (see Table 4 and Figure 2). Within the group of Spanish speakers, out of the nine participants, only participant 4 produced more epenthesis before bi-literal clusters; the eight others had more difficulties with /sCC/ clusters, with an average of 34.75%, compared to 24.03% for /sC/ clusters, confirming that the more marked structures were more difficult to produce (see Table 5 and Figure 2).

Table 4: Individual and total rates of epenthesis production for /sC/ and /sCC/ clusters by Portuguese speakers.

	/sC/			/sCC/		
Participant	# productions	# epenthesis	% epenthesis	# productions	# epenthesis	% epenthesis
1	88	15	17.05	62	16	25.81
2	79	51	64.56	60	52	86.67
3	91	19	20.88	65	18	27.69
4	86	21	24.42	65	16	24.62
5	81	42	51.85	59	31	52.54
6	89	21	23.60	63	30	47.62
7	87	32	36.78	63	24	38.10
8	88	13	14.77	63	21	33.33
9	86	20	23.26	62	15	24.19
10	91	17	18.68	65	19	29.23
Total	866	251	28.98	627	242	38.60

Table 5: Individual and total rates of epenthesis production for /sC/ and /sCC/ clusters by Spanish speakers.

	/sC/			/sCC/		
Participant	# productions	# epenthesis	% epenthesis	# productions	# epenthesis	% epenthesis
1	82	20	24.39	56	19	33.93
2	85	10	11.76	64	13	20.31
3	89	25	28.09	59	30	50.85
4	87	13	14.94	63	06	11.11
5	86	15	17.44	58	16	27.59
6	79	41	51.90	58	46	79.31
7	90	19	21.11	64	21	32.81
8	88	19	21.59	59	17	28.81
9	88	24	27.27	60	20	33.33
Total	774	186	24.03	541	188	34.75

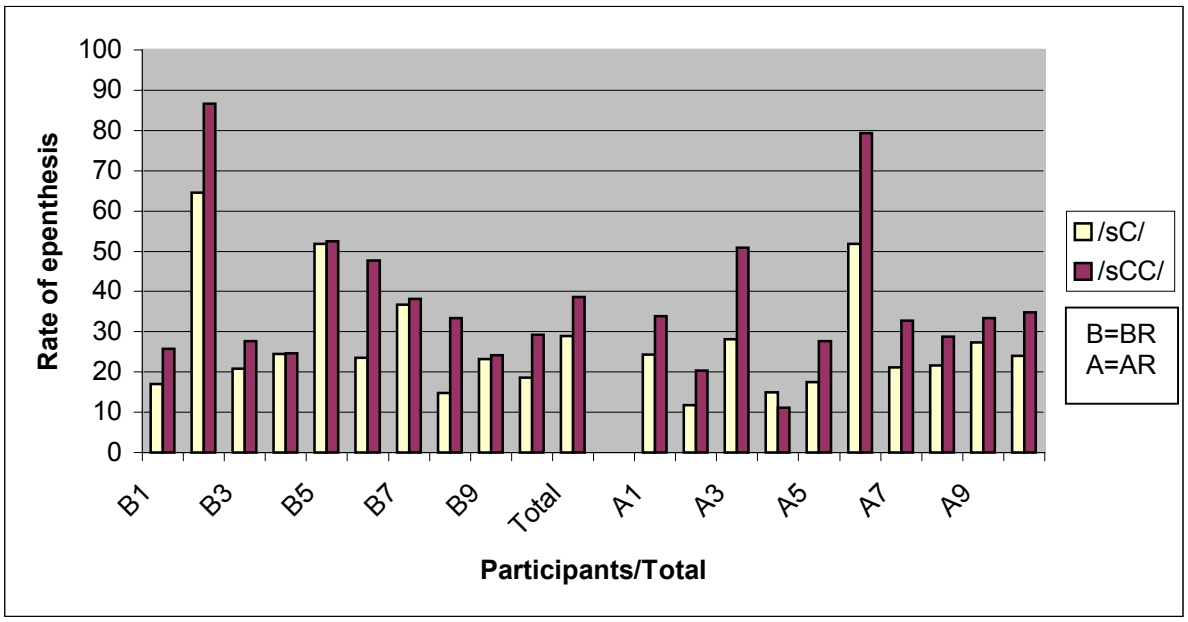


Figure 2: Individual and total rates of epenthesis production for /sC/ and /sCC/ clusters by Portuguese and Spanish speakers.

Considering Greenberg's (1965, p. 29) claim that shorter clusters are more frequently found in the world's languages than longer clusters, and thus taking into account the effect of universals versus that of NL transfer, this study supported the hypothesis that the tendency to simplify a syllable structure occurs more frequently with tri-literal clusters than with bi-literals for Spanish speakers. However, contrary to my expectations and Rebello's (1997a, b) study,

Portuguese speakers also tended to simplify three-member onsets more frequently than two-member onsets. Evidence that the participants were transferring the rule of epenthesis from their NL is that they did not produce epenthesis between the members of the clusters in order to form an initial CV syllable; rather, the addition of an extra vowel to the initial clusters occurred only before the initial /s/, a process which, according to generative models of phonology, happens in both Portuguese and Spanish in words containing /s/ + consonant, such as *especial* [es.pe.si.al] (special), *escrito* [es.kri.to] (written), *estratégia* [es.tra.tɛ.ʒi.a] (strategy) in Portuguese and *estrategia* [es.tra.te.χi.a] (strategy) in Spanish. The difference, though, is that in these languages the /s/ and the consonant are in different syllables.

This tendency to insert an epenthetic vowel into foreign clusters to conform to the NL syllable structure was also found in a study carried out by Broselow (1983 in Broselow, 1987a, pp. 271-272). In her analysis of the production of Egyptian Arabic speakers learning English, she observed that since in her participants' NL the syllables must begin with only one consonant, English words such as *plastic* were pronounced as [bilastik], thus conforming to Egyptian Arabic syllable structure

Thus, the results obtained by the comparison of /sC/ and /sCC/ clusters provide strong evidence that universals existing among the world's languages operate in IL phonology, since more marked structures were more frequently modified than less marked structures, but that NL processes also interfere.

4.2.2 Analysis of clusters grouped by second component

In order to analyze the length of clusters without the intervening variable *sonority*, the bi-literal and tri-literal clusters were compared grouped by their second component. In Rebello (1997a, p. 67), this analysis showed "a balance in terms of number of subjects who produced more epenthesis before /sC/ clusters and before /sCC/". In addition, in her study the longer clusters yielded more epenthesis when the second cluster was /p/, whereas the shorter clusters yielded more epenthesis when the second cluster was /t/ or /k/. This means that her results were inconclusive concerning to what extent the length of a given cluster might cause difficulties. Given that in this study the participants have a higher level of English proficiency than in Rebello's (1997a), the analysis of the second element of the clusters might be expected to present clearer results concerning Portuguese speakers.

4.2.1.1 Cluster /sp/ versus clusters /spC/

In Rebello (1997a), four out of six participants produced more epenthesis before /spC/ than before /sp/. The total rates in her study show that 53% of productions contained an epenthetic vowel before /sp/, and 60% before /spC/.

In the present study, within the group of Portuguese speakers, only participant 9 produced a greater rate of epenthesis before /sp/ than before /spC/, although this participant produced the same rate of epenthesis before /sp/ and /spr/. As seen in Table 6 and Figure 3, the group results

show that the participants modified /spC/ clusters (37.90%) more frequently than /sp/ clusters (26.40%), resulting in a significant chi-square ($\chi 2(1, N = 373) = 4.39, p < .04$). Within the group of Spanish speakers, there was a greater variation among participants concerning the production of /sp/ versus /spC/ clusters compared to that of Portuguese speakers. Participants 1, 3 and 6 produced more epenthesis before /sp/ than before /spC/. As seen in Table 7 and Figure 3, although the six other participants had the same tendency as that of Portuguese speakers, the group rates are not statistically significant, and show that epenthesis occurred more frequently before /spC/ clusters (30.81%) than before /sp/ clusters (26.32%), resulting in a chi-square ($\chi 2(1, N = 325) = .29, p > .50$).

Table 6: Individual and total rates of epenthesis production of cluster /sp/ vs. /spC/ by Portuguese speakers.

	/sp/			/spr/			/spl/			Both /spC/		
	Prod	Epen	Rate	Prod	Epen	Rate	Prod	Epen	Rate	Prod	Epen	Rate
P1	13	02	15.38	12	03	25.0	13	01	7.69	25	04	16.0
P2	12	06	50.0	12	10	83.33	10	08	80.0	22	18	81.82
P3	13	02	15.38	13	02	15.38	13	06	46.15	26	08	30.77
P4	13	03	23.08	13	04	30.77	13	03	23.08	26	07	26.92
P5	11	05	45.45	13	06	46.15	12	07	58.33	25	13	52.0
P6	13	03	23.08	12	05	41.67	13	06	46.15	25	11	44.0
P7	12	05	41.67	12	04	33.33	12	09	75.0	24	13	54.17
P8	13	02	15.38	13	04	30.77	12	03	25.0	25	07	28.0
P9	12	03	25.0	12	03	25.0	12	02	16.67	24	05	20.83
P10	13	02	15.38	13	04	30.77	13	04	30.77	26	08	30.77
Group	125	33	**26.40**	125	45	**36.0**	123	49	**39.84**	248	94	**37.90**

Table 7: Individual and total rates of epenthesis production of cluster /sp/ vs. /spC/ by Spanish speakers.

	/sp/			/spr/			/spl/			Both /spC/		
	Prod	Epen	Rate	Prod	Epen	Rate	Prod	Epen	Rate	Prod	Epen	Rate
P1	12	04	33.33	11	03	27.27	10	02	20.00	21	05	23.81
P2	13	02	15.38	13	05	38.46	13	03	23.08	26	08	30.77
P3	13	06	46.15	13	05	38.46	10	05	50.00	23	10	43.48
P4	12	00	0.00	13	00	0.00	11	01	9.09	24	01	4.17
P5	13	02	15.38	12	05	41.67	11	01	9.09	23	06	26.09
P6	12	08	66.67	12	07	58.33	08	06	75.00	20	13	65.00
P7	13	02	15.38	13	03	23.08	12	02	16.67	25	05	20.00
P8	13	02	15.38	13	02	15.38	11	03	27.27	24	05	20.83
P9	13	04	30.77	12	06	50.00	13	04	30.77	25	10	40.00
Total	114	30	**26.32**	112	36	**32.14**	99	27	**27.27**	211	63	**30.81**

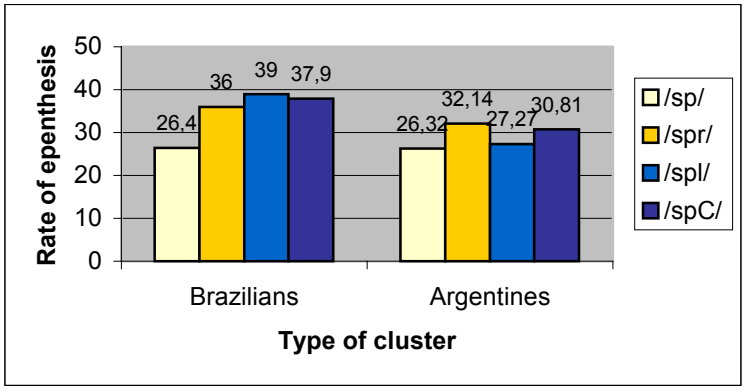


Figure 3: Total rates of epenthesis production of cluster /sp/ vs. /spC/ by Portuguese and Spanish speakers.

Thus, the results obtained in this study corroborate Rebello's (1997a, 1997b) findings concerning the production of Portuguese speakers' /sp/ clusters versus /spC/ clusters, since in both cases participants tended to modify /spC/ clusters more frequently than /sp/. As for the production of Spanish speakers, although the tendency was to conform to the MDH, since the more marked clusters were more frequently modified, the results are inconclusive, given that there was some variation among individual rates and the difference in epenthesis production between /sp/ versus /spC/ was not statistically significant.

4.2.1.2 Cluster /st/ vs. cluster /str/

In the analysis comparing the production of the cluster /st/ and the cluster /str/, Rebello (1997a, 1997b) found a small difference between the rates of epenthesis production of these clusters. Her participants modified 50% of /st/ clusters and 48% of /str/ clusters.

In the present study, expectations concerning the group of Portuguese speakers were not borne out, since, although statistically insignificant, the total rate of epenthesis production before the /st/ cluster (36.43%) was lower than before the /str/ cluster (38.76%), resulting in a chi-square ($\chi 2(1, N = 258) = .06, \ p > .75$). Individual rates show that participants 3, 4 and 7 modified the /st/ cluster more frequently than the /str/ cluster, participant 9 produced the same rate of epenthesis before both types of clusters, and the six others inserted an epenthetic vowel before the longer cluster, as can be seen in Table 8 and Figure 4.

Table 8: Individual and total rates of epenthesis production of cluster /st/ vs. /str/ by Portuguese speakers.

Participants	/st/			/str/		
	Prod	Epen	Rate	Prod	Epen	Rate
P1	13	03	23.08	13	04	30.77
P2	13	09	69.23	13	12	92.31
P3	13	05	38.46	13	02	15.38
P4	13	05	38.46	13	03	23.08
P5	13	06	46.15	13	07	53.85
P6	13	06	46.15	13	07	53.85
P7	13	06	46.15	13	03	23.08
P8	12	02	16.67	12	05	41.67
P9	13	03	23.08	13	03	23.08
P10	13	02	15.38	13	04	30.77
Group	129	47	**36.43**	129	50	**38.76**

Concerning the group of Spanish speakers, the findings confirmed expectations, since the longer cluster was more frequently modified. The total rates show that, although statistically insignificant, the difference between the insertion of an epenthetic vowel before the /str/ cluster (43.36%) was greater than before the /st/ cluster (37.27%), resulting in a chi-square ($\chi 2(1, N = 223) = .62$, $p < .50$). Individual rates show that participants 2, 5 and 9 produced more epenthesis before the shorter cluster, whereas the six others inserted an epenthetic vowel more frequently before the longer cluster, as can be observed in Table 9 and Figure 4.

Table 9: Individual and total rates of epenthesis production of cluster /st/ vs. /str/ by Spanish speakers.

Participants	/st/			/str/		
	Prod	Epen	Rate	Prod	Epen	Rate
P1	13	03	23.08	13	07	53.85
P2	12	03	25.00	13	01	7.69
P3	12	04	33.33	12	07	58.33
P4	12	03	25.00	13	04	30.77
P5	11	03	27.27	13	03	23.08
P6	13	10	76.92	13	12	92.31
P7	12	04	33.33	13	06	46.15
P8	13	04	30.77	11	05	45.45
P9	12	07	58.33	12	04	33.33
Group	110	41	**37.27**	113	49	**43.36**

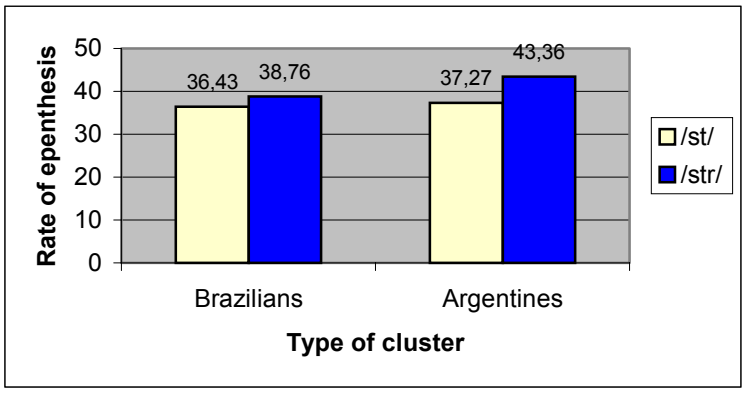


Figure 4: Total rates of epenthesis production of cluster /st/ vs. /str/ by Portuguese and Spanish speakers.

4.2.1.3 Cluster /sk/ versus clusters /skC/

The comparison between the /sk/ cluster versus the /skC/ clusters in Rebello (1997a, 1997b) show that her participants tended to modify the two-member onset (59%) more frequently than the three-member onsets (51%). Her results showed counterevidence to the MDH, since it is claimed in this hypothesis that longer clusters are more difficult to produce.

In this study, however, the total rates of epenthesis produced by Portuguese speakers tended to conform to the MDH, contradicting Rebello's (1997a, 1997b) study, although the difference was not statistically significant, since the insertion of an epenthetic vowel occurred in 39.20% of three-member onsets and in 29.57% of two-member onsets, resulting in a chi-square ($\chi 2(1, N = 365) = 1.38, p > .20$). Concerning individual rates, only participant 5 modified the /sk/ cluster more frequently than the /skC/ clusters. However, individual rates varied in the comparison between the clusters /skr/ and /skw/: participants 1, 3 and 4 produced the same rates of epenthesis before the two clusters; participants 2, 9 and 10 modified /skr/ more frequently than /skw/; and participants 5, 6, 7 and 8 modified /skw/ more frequently than /skr/, as can be observed in Table 10 and Figure 5.

Table 10: Individual and total rates of epenthesis production of cluster /sk/ vs. /skC/ by Portuguese speakers.

	/sk/			/skr/			/skw/			Both /skC/		
	Prod	Epen	Rate	Prod	Epen	Rate	Prod	Epen	Rate	Prod	Epen	Rate
P1	12	01	8.33	12	04	33.33	12	04	33.33	24	08	33.33
P2	12	09	75.0	13	12	92.31	12	10	83.33	25	22	88.0
P3	13	03	23.08	13	04	30.77	13	04	30.77	26	08	30.77
P4	10	01	10.0	13	03	23.08	13	03	23.08	26	06	23.08
P5	09	06	66.67	10	04	40.0	11	07	63.64	21	11	52.38
P6	11	05	45.45	13	06	46.15	12	06	50.0	25	12	48.0
P7	12	02	16.67	13	02	15.38	13	06	46.15	26	08	30.77
P8	12	03	25.0	13	04	30.77	13	05	38.46	26	09	34.62
P9	11	03	27.27	13	04	30.77	12	03	25.0	25	07	28.0
P10	13	01	7.69	13	04	30.77	13	03	23.08	26	07	26.92
Group	115	34	**29.57**	126	47	**37.30**	124	51	**41.13**	250	98	**39.20**

The total rates of epenthesis production within the group of Spanish speakers tended in the same direction as those produced by Portuguese speakers, giving support to the MDH, since longer clusters were more modified than shorter clusters. An epenthetic vowel was more frequently inserted before the clusters /skC/ (35.32%) than before the cluster /sk/ (26.61%), resulting in a non-significant chi-square ($\chi 2(1, N = 327) = 1.06$, $p > .30$). Again individual rates varied within the group: participant 4 produced the same rate of epenthesis in both clusters; participants 1 and 6 modified /skr/ more frequently than /skw/; and the six others modified /skw/ more frequently than /skr/, as can be seen in Table 11 and Figure 5.

Table 11: Individual and total rates of epenthesis production of cluster /sk/ vs. /skC/ by Spanish speakers.

	/sk/			/skr/			/skw/			Both /skC/		
	Prod	Epen	Rate	Prod	Epen	Rate	Prod	Epen	Rate	Prod	Epen	Rate
P1	11	02	18.18	12	04	33.33	11	03	27.27	23	07	30.43
P2	13	00	0.00	12	01	8.33	13	03	23.08	25	04	16.00
P3	12	03	25.00	12	06	50.00	12	07	58.33	24	13	54.17
P4	13	01	7.69	13	01	7.69	13	01	7.69	26	02	7.69
P5	11	04	36.36	09	02	22.22	13	05	38.46	22	07	31.82
P6	11	06	54.55	13	11	84.62	12	10	83.33	25	21	84.00
P7	13	04	30.77	13	02	15.38	13	08	61.54	26	10	38.46
P8	12	07	58.33	12	02	16.67	12	05	41.67	24	07	29.17
P9	13	02	15.38	12	03	25.00	11	03	27.27	23	06	26.09
Group	109	29	**26.61**	108	32	**29.63**	110	45	**40.91**	218	77	**35.32**

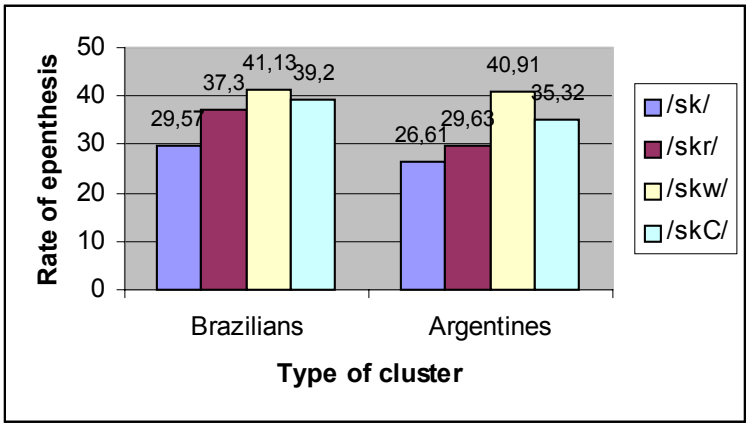


Figure 5: Total rates of epenthesis production of cluster /sk/ vs. /skC/ by Portuguese and Spanish speakers.

In sum, although the tendency in the analysis of clusters grouped by second component was to conform to the MDH, since the more marked clusters were more frequently modified, the results are inconclusive, given that there was some variation among individual rates and the difference in epenthesis production between the total rates were not statistically significant, with the only exception being the analysis of /sp/ versus /spC/ clusters produced by Portuguese speakers, which was statistically significant and confirmed that longer clusters are more difficult to produce, since they resulted in a greater rate of epenthesis.

4.2.3 Analysis of bi-literal clusters in violation versus tri-literal clusters

According to the SSC, the clusters /sp/, /st/, and /sk/ violate the universal strength hierarchy, since the fricative /s/ has the value of 5 in the scale and the voiceless stops that follow it have the value of 6. The same happens with the tri-literal clusters, which all violate the SSC.

In the comparison of bi-literal clusters in violation versus tri-literal clusters shown in Table 12 and Figure 6, epenthesis was more frequently produced before the latter, 38.60%, than the former, 30.89%, which resulted in a significant chi-square ($\chi 2$ (1, N = 996) = 5.91, p < .02).

Table 12: Rates of epenthesis for bi-literal clusters in violation of the SSC vs. tri-literal clusters by Portuguese speakers.

	Bi-literal clusters in violation			Tri-literal clusters		
Participants	Prod	Epen	Rate	Prod	Epen	Rate
P1	38	06	15.79	62	16	25.81
P2	37	24	64.86	60	52	86.67
P3	39	10	25.64	65	18	27.69
P4	36	09	25.00	65	16	24.62
P5	33	17	51.52	59	31	52.54
P6	37	14	37.84	63	30	47.62
P7	37	13	35.14	63	24	38.10
P8	37	07	18.92	63	21	33.33
P9	36	09	25.00	62	15	24.19
P10	39	05	12.82	65	19	29.23
Group	369	114	**30.89**	627	242	**38.60**

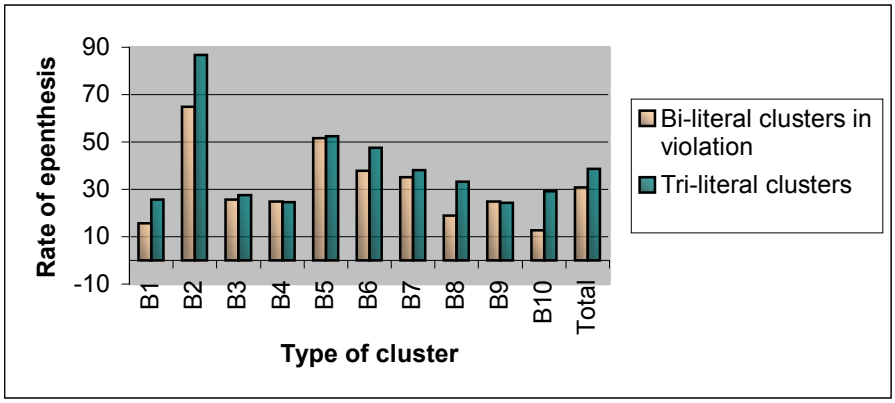


Figure 6: Rates of epenthesis for bi-literal clusters in violation of the SSC vs. tri-literal clusters by Portuguese speakers.

Within the group of Spanish speakers, the total rates of epenthesis production in the comparison of bi-literal clusters in violation versus tri-literal clusters tended in the same direction as those produced by Portuguese speakers, revealing that epenthesis was more frequently produced before the latter, 34.94%, than the former, 30.03%, but this analysis resulted in a non-significant chi-square ($\chi 2$ (1, N = 874) = 2.47, p > .10), as can be seen in Table 13 and Figure 7.

Table 13: Rates of epenthesis for bi-literal clusters in violation of the SSC vs. tri-literal clusters by Spanish speakers.

	Bi-literal clusters in violation			Tri-literal clusters		
Participants	Prod	Epen	Rate	Prod	Epen	Rate
P1	36	09	25.00	56	19	33.93
P2	38	05	13.16	64	13	20.31
P3	37	13	34.14	59	30	50.85
P4	37	04	10.81	63	07	11.11
P5	35	09	25.71	58	16	27.59
P6	36	24	66.67	58	46	79.31
P7	38	10	26.32	64	21	32.81
P8	38	13	34.21	59	17	28.81
P9	38	13	34.21	60	20	33.33
Group	333	100	**30.03**	541	189	**34.94**

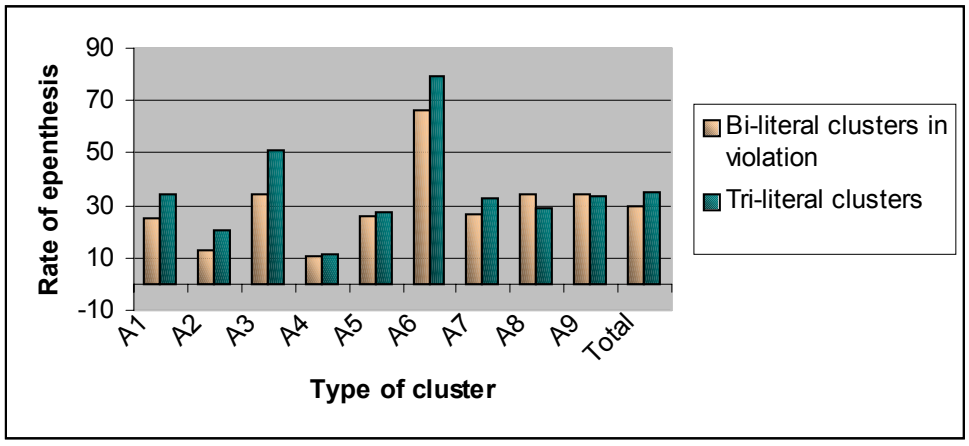


Figure 7: Rates of epenthesis for bi-literal clusters in violation of the SSC vs. tri-literal clusters by Spanish speakers.

Thus, the results obtained with the comparison of bi-literal clusters in violation and tri-literal clusters support the hypothesis based on the MDH, that longer clusters are more difficult to acquire than shorter clusters (Anderson, 1987; Carlisle, 1997; Abrahamsson, 1997). According to the MDH, three-member onsets were expected to cause more epenthesis than two-member onsets, given that neither occurs in either Portuguese or Spanish, and longer clusters are more marked in English. Contrary to expectations, the Brazilian participants inserted an epenthetic vowel significantly more frequently before longer clusters, and, although the Argentinean participants confirmed the expectations concerning the production of epenthesis before these longer clusters, their rate of epenthesis was not significant. The fact that more marked clusters caused more epenthesis than the less marked clusters indicates that in the interlanguage of most participants, bi-literal clusters existed before tri-literal clusters.

4.3 Analysis of bi-literal clusters in violation of the Syllable Structure Condition (SSC) vs. bi-literal clusters not in violation

Another analysis was carried out in order to investigate whether strength relations within the clusters exerted some influence on the production of epenthesis. In this analysis, bi-literal /s/ clusters in violation (/sp/, /st/, and /sk/) were compared to bi-literal /s/ clusters not in violation (/sw/, /sm/, /sn/, /sl/), thus eliminating the intervening variable *length*. In Rebello (1997a, 1997b), the findings did not support the hypothesis based on the SSC, because her participants produced more epenthesis before bi-literal clusters not in violation than bi-literal clusters in violation.

However, the findings obtained in this study seem to contradict Rebello's (1997a, 1997b) findings, corroborating the SSC. The results described in Table 14 and Figure 8 show the

individual and the total frequencies of epenthesis produced by Brazilian participants in the analysis concerning strength relations. The total rate of epenthesis produced by this group reveals that a vowel was more frequently inserted before bi-literal clusters in violation, 30.89%, than before bi-literal clusters not in violation, 27.57%, which resulted in a non-significant chi-square ($\chi 2$ (1, N = 866) = 1.31, p > .25). Individual frequencies of epenthesis production varied among participants: As can be observed, participants 1, 5, 7 and 10 produced more epenthesis before bi-literal clusters not in violation than bi-literal clusters in violation. The six others inserted an epenthetic vowel more frequently after bi-literal clusters in violation. Although these differences are not great, except for participant 10, they do constitute exceptions, and as such, weaken somewhat the general tendency.

Table 14: Rates of epenthesis for bi-literal clusters not in violation of the SSC vs. bi-literal clusters in violation by Portuguese speakers.

	Bi-literal clusters not in violation			Bi-literal clusters in violation		
Participants	Prod	Epen	Rate	Prod	Epen	Rate
P1	50	09	17.31	38	06	15.79
P2	42	27	64.29	37	24	64.86
P3	52	09	17.31	39	10	25.64
P4	50	12	24.00	36	09	25.00
P5	48	25	52.08	33	17	51.52
P6	52	07	13.46	37	14	37.84
P7	50	19	38.00	37	13	35.14
P8	51	06	11.76	37	07	18.92
P9	50	11	22.00	36	09	25.00
P10	52	12	23.08	39	05	12.82
Group	497	137	**27.57**	369	114	**30.89**

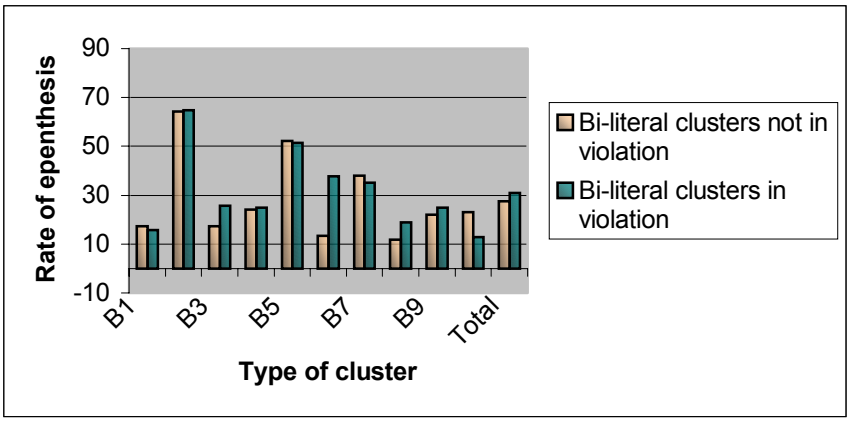


Figure 8: Rates of epenthesis for bi-literal clusters not in violation of the SSC vs. bi-literal clusters in violation by Portuguese speakers.

In the group of Spanish speakers, the total rate of epenthesis tended in the same direction as the results obtained by Portuguese speakers: Epenthesis was more frequently produced before bi-literal clusters in violation, 30.03%, than bi-literal clusters not in violation, 19.50%, which resulted in a very significant chi-square ($\chi 2$ (2, N = 774) = 12.25, $p < .0005$), as can be observed in Table 15 and Figure 9.

For this NL group, only participant 4 produced more epenthesis after bi-literal clusters not in violation. The nine others produced more epenthesis before bi-literal clusters in violation than bi-literal clusters not in violation, conforming to the MDH, which states that more marked structures are more difficult to produce.

Table 15: Rates of epenthesis for bi-literal clusters not in violation of the SSC vs. bi-literal clusters in violation by Spanish speakers.

	Bi-literal clusters not in violation			Bi-literal clusters in violation		
Participants	Prod	Epen	Rate	Prod	Epen	Rate
P1	46	11	23.91	36	09	25.00
P2	47	05	10.64	38	05	13.16
P3	52	12	23.08	37	13	34.14
P4	50	09	18.00	37	04	10.81
P5	51	06	11.76	35	09	25.71
P6	43	17	39.53	36	24	66.67
P7	52	09	17.31	38	10	26.32
P8	50	06	12.00	38	13	34.21
P9	50	11	22.00	38	13	34.21
Group	441	86	**19.50**	333	100	**30.03**

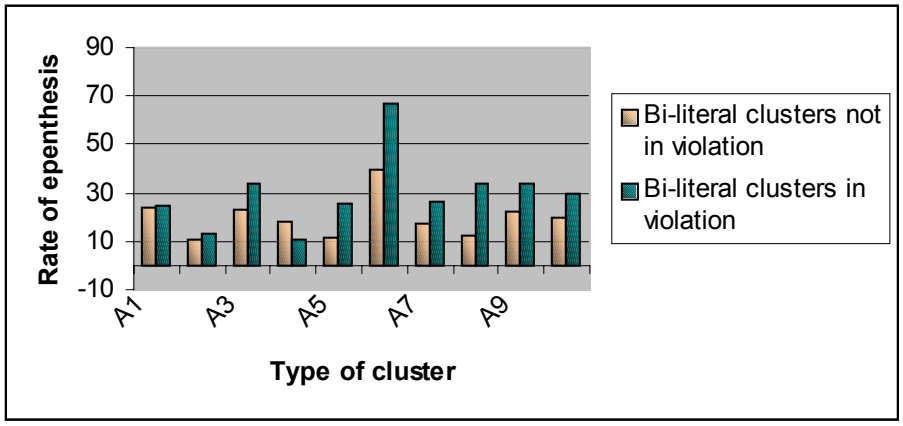


Figure 9: Rates of epenthesis of bi-literal clusters not in violation of the SSC vs. bi-literal clusters in violation by Spanish speakers.

4.4 Comparison of /s/-nasals versus /s/-liquid

The previous findings obtained with the comparison of /s/ clusters not in violation versus clusters in violation corroborate the Syllable Structure Condition (SSC), since epenthesis was more frequently produced before the latter than before the former in both NL groups. According to Greenberg's (1965, p. 27) study on implicational universals, "in initial systems, the existence of at least one cluster consisting of obstruent + nasal implies the existence of at least one cluster consisting of obstruent + liquid". Previous studies (Carlisle, 1992; Rebello, 1997a, 1997b) show

that obstruent-nasal onsets would result in more epenthesis by Spanish and Portuguese speakers than the obstruent-liquid onset, since nasals are stronger than liquids. Thus, in order to verify whether the same would occur in the present study, a comparison between /sN/ (where N represents the nasals /n/ and /m/) and /sl/ clusters was carried out, based on both Greenberg's universal and the SSC.

The first analysis compared /sN/ clusters to /s/ + liquid clusters in order to verify whether the /s/ + nasals would cause more difficulty. Within the Brazilian group, six participants produced a higher rate of epenthesis before /sN/ clusters compared to four before /sl/, but the average rates were almost identical: 36.80% before /sN/ clusters, and 36.59% before /sl/ clusters. The difference was very insignificant, .21%, resulting in a significant chi-square ($\chi 2$ (1, N = 373) = .005, $p < .95$), which shows that no strong claim can be made about the /sN/ clusters being easier to produce than the /sl/ clusters (see Table 16 and Figure 10).

Table 16: Rates of epenthesis for clusters /sN/ vs. /sl/ by Portuguese speakers.

	Both /sm, sn/			/sl/		
Participant	# productions	# epenthesis	% epenthesis	# productions	# epenthesis	% epenthesis
1	26	05	19.23	12	04	33.33
2	21	18	85.71	11	09	81.82
3	26	05	19.23	13	04	30.77
4	26	10	38.46	12	02	16.67
5	23	15	65.22	12	10	83.33
6	26	05	19.23	13	02	15.38
7	25	14	56.00	13	05	38.46
8	26	05	19.23	12	01	8.33
9	25	06	24.00	12	05	41.67
10	26	09	34.62	13	03	23.08
Total	250	92	36.80	123	45	36.59

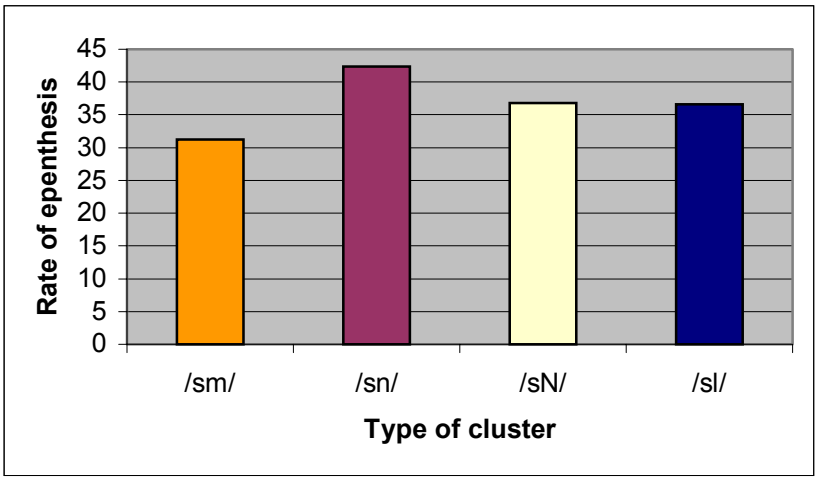


Figure 10: Rates of epenthesis for clusters /sN/ vs. /sl/ by Portuguese speakers.

The difference in the total rate of epenthesis produced by Argentinean participants for /sN/ clusters versus /sl/ clusters was slightly greater than that of Brazilian participants, 5.31%, although this difference was not statistically significant either. Table 17 and Figure 11 show that /sN/ clusters were also more frequently modified, 25.68%, than /sl/ clusters, 20.37%, which resulted in a non-significant chi-square ($\chi 2$ (1, N = 330) = .85, p > .35).

Table 17: Rates of epenthesis for clusters /sN/ vs. /sl/ by Spanish speakers.

	Both /sm, sn/			/sl/		
Participant	# productions	# epenthesis	% epenthesis	# productions	# epenthesis	% epenthesis
1	23	06	26.09	11	03	27.27
2	24	03	12.50	11	02	18.18
3	26	07	26.92	13	03	23.08
4	26	06	23.08	13	03	23.08
5	25	02	8.00	13	02	15.38
6	21	16	76.19	11	00	0.00
7	26	05	19.23	13	04	30.77
8	25	04	16.00	12	02	16.67
9	26	08	30.77	11	03	27.27
Total	222	57	25.68	108	22	20.37

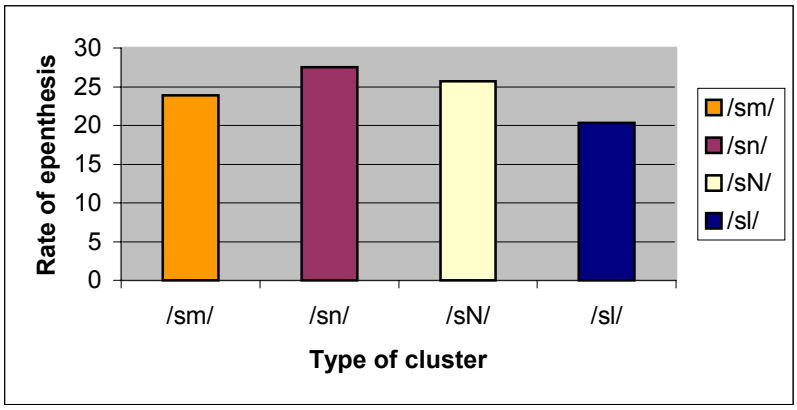


Figure 11: Rates of epenthesis production for clusters /sN/ vs. /sl/ by Spanish speakers.

The second analysis investigated only the /sN/ group. Considering the manner of articulation, /sm/ clusters should be more difficult to produce than /sn/, because they are heterorganic, and thus more difficult to articulate. In other words, the place of articulation of the segments /s/ and /m/ is different, while the point of articulation of /s/ and /n/ is the same, which means the latter are homorganic. However, out of ten Brazilian participants, only three (participants 1, 3 and 9) tended in the right direction according to prediction, producing more epenthesis before /sm/ than before /sn/ clusters. All the other participants' results were contrary to the prediction, with more epenthesis before /sn/ clusters, totaling 42.4% compared to a 31.2% rate of epenthesis before /sm/ clusters (see Table 18). This difference, 11.2%, resulted in a significant chi-square ($\chi 2$ (1, N = 250) = 3.86, $p < .05$), meaning that place of articulation of the nasal exerted some effect.

Table 18: Rates of epenthesis production for /sN/ clusters by Portuguese speakers.

	/sm/			/sn/		
Participant	# productions	# epenthesis	% epenthesis	# productions	# epenthesis	% epenthesis
1	13	03	23.08	13	02	15.38
2	10	07	70.00	11	11	100.00
3	13	03	23.08	13	02	15.38
4	13	04	30.77	13	06	46.15
5	12	07	58.33	11	08	72.73
6	13	01	7.69	13	04	30.77
7	13	07	53.85	12	07	58.33
8	13	01	7.69	13	04	30.77
9	12	03	25.00	13	03	23.08
10	13	03	23.08	13	06	46.15
Total	125	39	31.20	125	53	42.40

As for the Argentinean participants, the same tendency occurred: although statistically insignificant, the total rate of epenthesis shows that the group produced more epenthesis before /sn/ clusters, 27.52%, than before /sm/ clusters, 23.89%, which resulted in a non-significant chi-square ($\chi 2$ (1, N = 222) = .59, $p < .50$), contradicting Carlisle's (1992) findings, since he found more epenthesis before /sm/ clusters than before /sn/ clusters. In the group of Argentineans, only participants 4, 5 and 8 produced more epenthesis before /sm/ clusters than before /sn/ clusters, the last two producing epenthesis only before /sm/ clusters (see Table 19).

Table 19: Rates of epenthesis for /sN/ clusters by Spanish speakers.

	/sm/			/sn/		
Participant	# productions	# epenthesis	% epenthesis	# productions	# epenthesis	% epenthesis
1	12	03	25.00	11	03	27.27
2	11	0	0.00	13	03	23.08
3	13	02	15.38	13	05	38.46
4	13	04	30.77	13	02	15.38
5	13	02	15.38	12	00	0.00
6	12	08	66.67	09	08	88.89
7	13	02	15.38	13	03	23.08
8	13	04	30.77	12	00	0.00
9	13	02	15.38	13	06	46.15
Total	113	27	**23.89**	109	30	**27.52**

In sum, the findings obtained in this section are contrary to expectations, since homorganic clusters were more frequently modified. These results are not strong enough to contradict Greenberg's (1965, p. 29) claim that "liquids are preferred over nasals", given that /s/ + liquid clusters were less frequently modified that /s/ + nasal clusters, and the tendency is contrary to his claim that "the dental-alveolar point of articulation is preferred over other positions", since /sn/ clusters were more frequently modified than the /sm/ clusters.

4.4.1 Voicing assimilation of /s/-sonorant clusters by Portuguese speakers.

During the data analysis, a high frequency of voicing assimilation of /s/-sonorant clusters was observed in the Brazilian participants' output (production). Rebello (1997 a, 1997b) had already found that voicing assimilation of /s/ before /s/-nasal and /s/-liquid clusters lead to the formation of a more marked type of cluster (voiced obstruent + sonorant), thus causing more epenthesis in the production of clusters which are not in violation.

Evidently, Argentinean participants did not voice the /s/, since the voiced fricative /z/ does not exist in Spanish. In order to investigate whether there is a possible relation between the voicing assimilation of the /s/ and the rate of epenthesis, an analysis considering all /sN/ and /sl/ clusters was carried out. The cluster /sw/ was not included in this analysis, because there were only three instances when participants voiced the /s/ of this cluster, coincidently all three in the same word, *swallow*, and some of them with epenthesis: participant 2 produced [zweɪloʊ], and participants 4 and 7 produced [zwɔloʊ].

Voicing assimilation before sonorants does seem to influence the production of epenthesis. The total frequency of voicing assimilation and the rate of epenthesis of /sN/ and /sl/ clusters is summarized in Table 20 and Figure 12. As can be observed, participants voiced the /s/ in 55.60% of /sN/ clusters, and out of these, 56.83% were pronounced with epenthesis. A much lower rate of epenthesis, 11.71%, was obtained in the productions of clusters where the /s/ was not voiced. Still concerning the category of /sN/ clusters, the contrast between the production of epenthesis in voiced items and in voiceless items resulted in a very significant chi-square ($\chi 2(1, N = 250) = 52.10$, $p < .0001$). Similar rates were obtained in the production of the /sl/ cluster. In this cluster, the /s/ was voiced in 59.35% of the items, and out of these, 53.42% were pronounced with epenthesis. Again, epenthesis production without the voicing of the /s/ was considerably lower, 12.0%. The difference between the percentages obtained for epenthesis in voiced and

voiceless /sl/ clusters also resulted in a very significant chi-square ($\chi 2$ (1, N = 123) = 20.19, p < .0001).

Table 20: Rates of epenthesis and voicing assimilation by Portuguese speakers.

	/s/-nasal	/s/-liquid
Number of [+vd] items	139 (55.60%)	73 (59.35%)
Number of epenthesis	79	39
Rate of epenthesis	**56.83%**	**53.42%**
Number of [-vd] items	111 (44.40%)	50 (40.65%)
Number of epenthesis	13	06
Rate of epenthesis	**11.71%**	**12.0%**

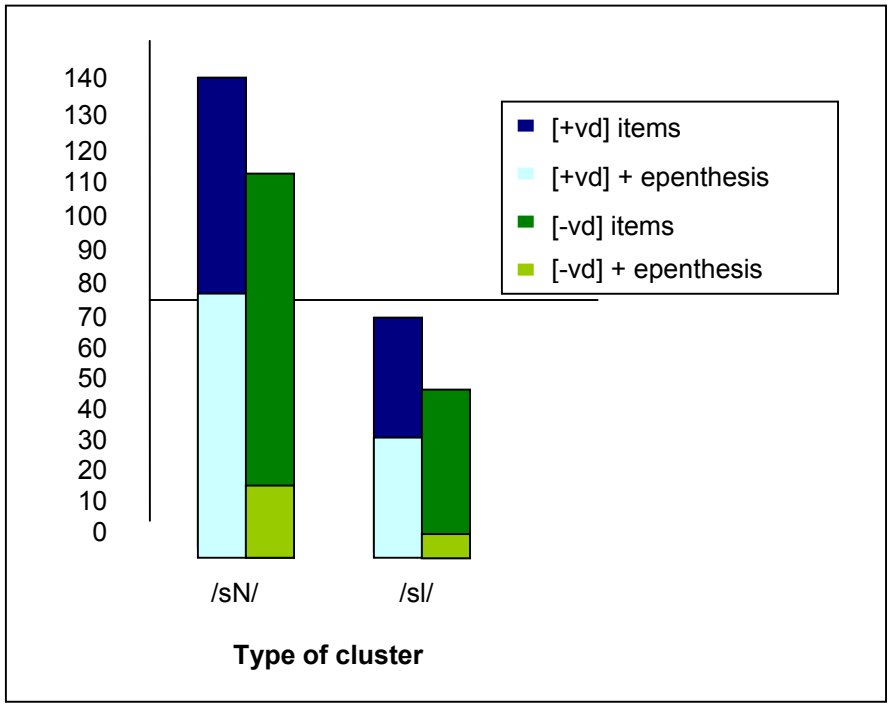


Figure 12: Rates of epenthesis production by voicing by Portuguese speakers.

These results corroborate Rebello's (1997a, 1997b) in that they show evidence of the strong relationship between voicing assimilation and epenthesis, giving support to the claim that voicing assimilation in /s/ + sonorant clusters causes these clusters to become more marked:

voiced obstruent clusters are more marked than *voiceless obstruent* + *obstruent* clusters, since, according to Greenberg`s (1965, p. 29) generalizations, *voiced obstruents* are more marked than *voiceless obstruents* in any position; therefore, clusters with voiced obstruents should be more marked than clusters containing voiceless obstruents. Thus, although the voicing of the /s/ in /s/ + sonorant clusters did not cause them to yield more epenthesis than the /s/ + obstruent clusters, it resulted in a sort of conflict between two types of markedness: That of the SSC and that of voicing. This conflict seems to have caused a neutralization of the effect of each, that is, it resulted in very little difference in frequency of epenthesis between clusters not in violation and clusters in violation.

4.4.2 Discussion of clusters in violation versus clusters not in violation

Considering the second hypothesis, which predicts that speakers would have more difficulty in producing initial /s/ clusters that violate Hooper's (1976) sonority hierarchy principle within the syllable, results obtained concerning frequency of epenthesis produced by both the Brazilian and Argentinean participants confirm that strength relations did cause a difference in difficulty among the clusters. As predicted by Hooper's theory, clusters which violate the Syllable Structure Condition (SSC) caused more epenthesis than /s/ + sonorant clusters. Although these findings contradict Rebello's (1997a, 1997b), since her Brazilian participants pronounced an epenthetic vowel more frequently before clusters not in violation, they corroborate studies by Carlisle (1992, 1997), given that in these studies more marked onsets were also more frequently modified than less marked ones. A possible explanation for the discrepancies between the present research and Rebello's (1997a, 1997b) might be the participants' different levels of English proficiency, since in her study the participants were

learners studying in the extracurricular courses of a federal university, while in the present investigation both Argentinean and Brazilian participants were undergraduate students of the *Letras* course, who already had some previous knowledge of English phonology. A lower level of English proficiency might explain why the Brazilian participants in Rebello (1997a, 1997b) hesitated while reading the sentences, which may have increased the chances for them to voice the initial /s/ before clusters not in violation of the SSC, resulting in the greater frequency of epenthesis before these clusters than before those in violation.

The strategy of inserting an epenthetic vowel more frequently before clusters in violation in order to overcome the difficulty in pronouncing them can be explained by NL interference and by the MDH, which claims that /s/ clusters in violation are expected to cause more epenthesis than /s/ clusters not in violation, given that they do not exist in the NLs (Portuguese and Spanish) and are more marked in the TL (English).

The results concerning /s/ + sonorant clusters confirm the Structural Conformity Hypothesis (SCH), since they showed that universals that hold for primary language also held for the participants' interlanguages, given that /sN/ clusters are also more marked among the world's languages than /sl/ clusters, and they resulted in the greatest rates of epenthesis in both Brazilians' and Argentineans' interlanguages.

Still concerning /s/-nasal and /s/-liquid clusters, the voicing assimilation of the segment /s/ was a particular characteristic found in the output of Brazilian participants. The results found in this study confirm Rebello's (1997a, 1997b), whose findings also revealed that the voicing assimilation of the /s/ is related to the insertion of an epenthetic vowel. She points out that the NL can be responsible for the occurrence of the voicing assimilation of the /s/, 'since this sibilant is always voiced in Portuguese when preceding nasals or liquids, although in Portuguese they are

always in separate syllables' (p. 84). Examples of Portuguese words which show voicing assimilation are *esmeralda* [ez.me.rau.da] (emerald), *asno* [az.no] (donkey), *desligado* [dez.li.ga.do] (turned off), *Islã* [iz.lã] (Islam).

After the analysis of strength relations within the syllable, the next section will show the results concerning the different phonological environments preceding /s/ clusters.

4.5 The influence of phonological environment in the production of epenthesis

Several studies in interlanguage phonology have found that the phonological environment is a constraint that conditions variability (Abrahamsson, 1997, 1999; Carlisle 1991, 1991b in Carlisle 1992, 1992, 1997; Rebello, 1997a, 1997b). Thus, this section was divided into four sub-sections in order to better investigate how different environments affect the production of /sC(C)/ clusters by Portuguese and Spanish speakers.

4.5.1 Environment as a variable constraint

The variable 'phonological environment' resulted in different findings in the studies by Carlisle (1991, 1991b in Carlisle 1997, 1992, 1997) and Rebello (1997a, 1997b). In the four studies on Spanish EFL speakers carried out by Carlisle, epenthesis was more frequently produced after word-final consonants than after word-final vowels, unlike Rebello's study, which found that the highest frequency of epenthesis produced by Portuguese speakers was after silence, followed by word-final vowels and then by word-final consonants. Carlisle (1997, p. 349) claims that the insertion of an epenthetic vowel before /sC(C)/ onsets occurs significantly

more frequently after word-final consonants due to the fact that 'an extrasyllabic consonant in the underlying representation will trigger epenthesis', as observed in his example 'los.#s'.ku.dos' (the shields). In this case, an epenthetic vowel is inserted, resulting in the resyllabification of this epenthetic vowel to the extrasyllabic consonant, thus 'los.#es.ku.dos'. Then, the rule of prosodic resyllabification is applied, resulting in 'lo.s#es.ku.dos'. This means that when following the pattern of resyllabification which exists in Spanish, prosodic resyllabification occurs in the speakers' interlanguage, resulting in productions like ei.t#es.trits (eight streets).

The results of this study partially corroborate those of Rebello (1997a, 1997b), in that epenthesis was more frequently produced after a word-final vowel than after a word-final consonant. However, whereas Rebello (1997a, 1997b) found the greatest frequency of epenthesis at the beginning of an utterance (the null context), in this study, silence was the context which yielded the lowest frequency of epenthesis production. Considering the whole group of Brazilian participants, epenthesis occurred more frequently after open syllables, 40.70%, followed by closed syllables, 32.12%, and by silence, 21.80%. These figures resulted in a very significant chi-square ($\chi 2$ (2, N = 1,493) = 34.98, $p < .0001$). Individual rates show that only participant 2 produced more epenthesis after silence, although her rates of epenthesis did not differ much from word-final consonants and word-final vowels. Participants 6 and 9 tended to insert an epenthetic vowel more frequently after word-final consonants, followed by word-final vowels, and finally after silence. The seven others produced more epenthesis after a word-final vowel, as can be seen in Table 21 and Figure 13.

Table 21: Rates of epenthesis production by Portuguese speakers in different environments.

	Null			Vowels			Consonants		
Participant	# prod.	# epen.	% epen.	# prod.	# epen.	% epen.	# prod.	# epen.	% epen.
1	35	0	0.00	58	25	43.10	57	06	10.53
2	35	27	77.14	49	35	71.43	55	41	74.55
3	36	08	22.22	60	19	31.67	60	10	16.67
4	34	01	2.94	59	20	33.90	58	16	27.59
5	32	18	56.25	54	30	55.56	54	25	46.30
6	35	06	17.14	59	21	35.59	58	24	41.38
7	35	08	22.86	57	24	42.11	58	24	41.38
8	34	03	8.82	57	20	35.09	60	11	18.33
9	32	01	3.13	57	15	26.32	59	19	32.20
10	36	03	8.33	60	23	38.33	60	10	16.67
Total	344	75	21.80	570	232	40.70	579	186	32.12

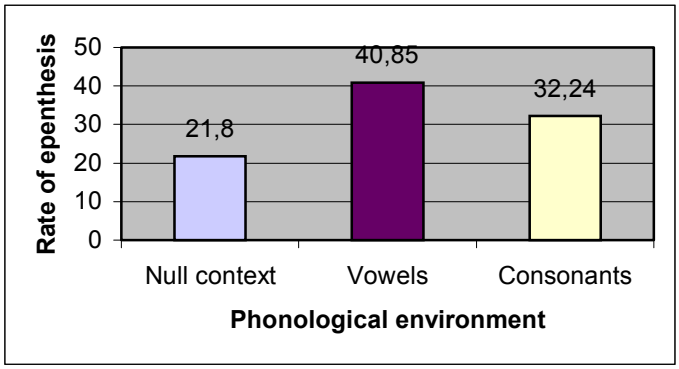


Figure 13: Rates of epenthesis production by Portuguese speakers in different environments.

The results obtained with Argentinean participants, however, corroborate those of Carlisle (1991, 1991b in Carlisle 1992, 1992, 1997), since all the participants produced more epenthesis after a word-final consonant, 39.64%, followed by a word-final vowel, 22.65%, and then by silence, 16.88%, which resulted in a significant chi-square ($\chi 2$ (2, N = 1,315) = 60.48, p < .0001). Considering individual rates, it is shown in Table 22 and Figure 14 that only participant 6 produced more epenthesis after silence, followed by a word-final vowel and then by a word-final consonant. What the two NL groups had in common, then, was the low rate of epenthesis after silence. This may be explained by their similar proficiency level.

Table 22: Rates of epenthesis production by Spanish speakers in different environments.

	Null			Vowels			Consonants		
Participant	# prod.	# epen.	% epen.	# prod.	# epen.	% epen.	# prod.	# epen.	% epen.
1	33	01	3.03	54	17	31.48	51	21	41.18
2	36	00	0.00	54	09	16.67	59	14	23.73
3	34	07	20.59	57	17	29.82	57	31	54.39
4	36	01	2.78	57	08	14.04	57	11	19.30
5	34	04	11.76	52	08	15.38	58	19	32.76
6	35	22	62.86	52	25	48.08	50	40	80.00
7	36	07	19.44	59	12	20.34	59	21	35.59
8	35	04	11.43	56	09	16.07	56	23	41.07
9	35	07	20.00	58	18	31.03	55	19	34.55
Total	314	53	16.88	499	113	22.65	502	199	39.64

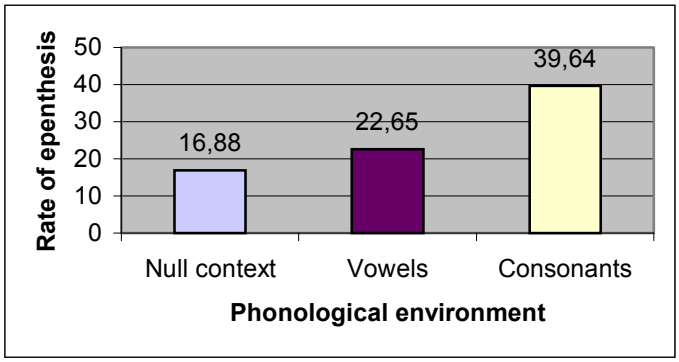


Figure 14: Rates of epenthesis production by Spanish speakers in different environments.

4.5.2 Voicing assimilation of the vowel in the phonological context

Since the results regarding the production of epenthesis by Portuguese speakers revealed that /s/ clusters are more frequently modified after vowels, followed by consonants, and then by silence, and that voicing assimilation of the /s/ seems to influence the production of epenthesis before /s/ + sonorant clusters, another analysis concerning voicing assimilation was carried out. In this analysis, the aim was to investigate whether Brazilian participants would voice the /s/ in /s/ + sonorant clusters more frequently after vowels, since all vowels are voiced, and, in

Portuguese, the alveolar sibilant normally assimilates the voicing of the following consonant and is voiced between vowels, unless when it is spelled with a "z".

Concerning the environment where the /s/ is voiced in the /sm/ cluster, as can be seen in Table 23, the total rates reveal that Brazilian participants tended to voice the /s/ more frequently after a word-final vowel, 57.1%, followed by silence, 48.3%, and then by a word-final consonant, 38.3%. Considering that word-final vowels yielded more epenthesis than word-final consonants and silence, the chi-square test was carried out comparing two contexts at a time. The three comparisons of the phonological contexts resulted in non-significant p values: For *vowels* x *consonants* the chi-square was ($\chi 2(1, N = 96) = 2.70, p > .10$); for *vowels* x *silence* the chi-square was ($\chi 2(1, N = 78) = .27, p > .60$); and for *consonants* x *silence* the chi-square was ($\chi 2(1, N = 76) = 1.19, p > .25$). This means that the presence of a vowel before the cluster /sm/ does not significantly influence the voicing assimilation of the /s/.

Table 23: Rates of voicing assimilation and epenthesis production before the /sm/ cluster by Portuguese Speakers.

	/sm/								
	Word-final vowel			Word-final consonant			Null context		
Participant	# prod.	# +vd	% +vd	# prod.	# +vd	% +vd	# prod.	# +vd	% +vd
1	5	3	60.0	5	0	0.0	3	0	0.0
2	4	4	100.0	3	2	66.7	3	3	100.0
3	5	0	0.0	5	0	0.0	3	1	33.3
4	5	4	80.0	5	3	60.0	3	1	33.3
5	5	4	80.0	4	1	25.0	3	3	100.0
6	5	3	60.0	5	3	60.0	3	2	66.7
7	5	3	60.0	5	2	40.0	3	2	66.7
8	5	0	0.0	5	1	20.0	3	0	0.0
9	5	4	80.0	5	4	80.0	2	2	100.0
10	5	3	60.0	5	2	40.0	3	0	0.0
Total	49	28	**57.1**	47	18	**38.3**	29	14	**48.3**

Concerning the cluster /sn/, total rates of voicing assimilation and epenthesis production reveal that, although participants also tended to modify this cluster more frequently after a word-final vowel, 75.5%, they modified the /sn/ cluster at a greater rate after a word-final consonant, 52.1%, than after silence, 46.4%, as can be seen in Table 24. The test of significance showed the following results: *vowels* x *consonants*: ($\chi 2(1, N = 97) = 3.86$, $p < .05$); *vowels* x *silence* ($\chi 2(1, N = 77) = 5.40$, $p < .05$); and *consonants* x silence ($\chi 2(1, N = 76) = .05$, $p > .80$). This means that the presence of a vowel in the phonological context significantly influences the voicing of the /s/ in the /sn/ cluster, since the p values for the comparisons *vowels* x *consonants* and *vowels* x *silence* were < .05.

Table 24: Rates of voicing assimilation of the sibilant in the /sn/ cluster by Portuguese speakers.

	/sn/								
	Word-final vowel			Word-final consonant			Null context		
Participant	# prod.	# +vd	% +vd	# prod.	# +vd	% +vd	# prod.	#+vd	% +vd
1	5	2	40.0	5	1	20.0	3	1	33.3
2	5	5	100.0	4	4	100.0	2	2	100.0
3	5	1	20.0	5	1	20.0	3	0	0.0
4	5	5	100.0	5	4	80.0	3	1	33.3
5	4	3	75.0	4	4	100.0	3	2	66.7
6	5	5	100.0	5	4	80.0	3	2	66.7
7	5	4	80.0	5	3	60.0	2	0	0.0
8	5	4	80.0	5	0	0.0	3	1	33.3
9	5	4	80.0	5	3	60.0	3	2	66.7
10	5	4	80.0	5	1	20.0	3	2	66.7
Total	49	37	**75.5**	48	25	**52.1**	28	13	**46.4**

Concerning the cluster /sl/, total rates of voicing assimilation and epenthesis production tended in a similar direction to those of the /sn/ cluster, revealing that participants also tended to modify this cluster more frequently after a word-final vowel, 62.5%, followed by a word-final consonant, 55.1%, and then by silence, 46.1%, as can be seen in Table 25. However, the difference in percentage was small, resulting in the following non-significant chi-squares: *vowels*

x *consonants*: (χ2(1, N = 97) = .77, p > .35); *vowels* x *silence* (χ2(1, N = 74) = 1.23, p > .25); and *consonants* x silence (χ2(1, N = 75) = .24, p > .60). The p values reveal that although vowels have a greater influence on the voicing of the /s/ in the /sl/ cluster, this difference is not statistically significant.

Table 25: Rates of voicing assimilation and epenthesis production before the /sl/ cluster by Portuguese speakers.

	/sl/								
	Word-final vowel			Word-final consonant			Null context		
Participant	# prod.	# +vd	% +vd	# prod.	# +vd	% +vd	#prod.	# +vd	% +vd
1	5	4	80.0	5	1	20.0	2	0	0.0
2	4	4	100.0	4	4	100.0	3	2	66.7
3	5	2	40.0	5	1	20.0	3	0	0.0
4	5	3	60.0	5	3	60.0	2	1	50.0
5	5	4	80.0	5	5	100.0	2	2	100.0
6	5	4	80.0	5	3	60.0	3	1	33.3
7	5	3	60.0	5	4	80.0	3	3	100.0
8	4	1	25.0	5	0	0.0	3	0	0.0
9	5	4	80.0	5	1	20.0	2	1	50.0
10	5	1	20.0	5	5	100.0	3	2	66.7
Total	48	30	**62.5**	49	27	**55.1**	26	12	**46.1**

The chi-square was carried out considering the total rates of voicing assimilation of the sibilant in the /s/ + sonorant clusters (see Table 26 and Figure 15). The test of significance showed the following results: *vowels* x *consonants*: (χ2(1, N = 290) = 7.34, p < .007); *vowels* x *silence* (χ2(1, N = 229) = 6.40, p < .02); and *consonants* x *silence* (χ2(1, N = 227) = .009, p > .90). Thus the results concerning vowels in the context were significantly different from the results concerning the other two contexts – consonants and silence – but these two were not significantly different from each other.

Table 26: Total rates of voicing assimilation in /s/ + sonorant clusters by Portuguese speakers.

	/s/ + sonorant clusters								
	Word-final vowel			Word-final consonant			Null context		
Participant	# prod.	# +vd	% +vd	# prod.	# +vd	% +vd	#prod.	# +vd	% +vd
Brazilians	146	95	**65.1**	144	70	**48.6**	83	39	**47.0**

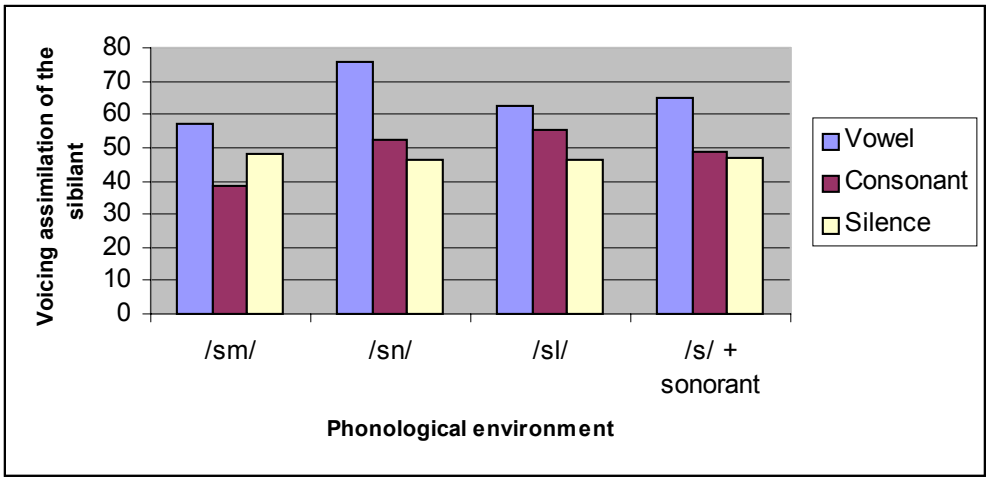


Figure 15: Total rates of voicing assimilation of the sibilant by Portuguese speakers.

In sum, although the individual cluster results concerning the environment where the /s/ in /s/ + sonorant clusters is more frequently voiced show statistically significant rates only for the /sn/ cluster, the tendency was to modify /s/ + sonorant clusters more frequently after a word-final vowel, as shown by the overall results concerning the environment, collapsing the three /s/ + sonorant clusters. Although it is not possible to make strong claims regarding voicing assimilation in /s/ + sonorant clusters, it is possible to suggest that the phonological context of a word-final vowel results in more epenthesis because the high level of sonority of the vowel influences the voicing of the following segment.

4.5.3 Discussion of *sonorants* and *obstruents* as variable constraints in the phonological environment

Given that the Spanish speakers produced epenthesis more frequently after consonants, an analysis comparing the sub-groups *sonorants* and *obstruents* was carried out in order to verify whether they could be acting as a variable constraint in the phonological environment preceding the /s/ clusters.

Both Argentinean and Brazilian participants tended to insert an epenthetic vowel more frequently after sonorants than after obstruents. Within the Brazilian group, the total frequency of epenthesis produced was 38.14% after sonorants, and 30.59% after obstruents, which resulted in a non-significant chi-square ($\chi 2$ (1, N = 579) = 2.12, p > .10). Concerning individual rates, only participants 1 and 8 did not follow this tendency, since the former did not produce epenthesis after sonorants, but inserted an epenthetic vowel in the items following obstruents. Participant 8 produced more epenthesis after obstruents than after sonorants, as described in Table 27 and Figure 16.

Table 27: Rates of epenthesis production by Portuguese speakers in the context of sonorants vs. obstruents.

	Sonorants			Obstruents		
Participant	# productions	# epenthesis	% epenthesis	# productions	# epenthesis	% epenthesis
1	11	0	0.00	46	06	13.04
2	12	09	75.00	43	32	74.42
3	12	03	25.00	48	07	14.58
4	12	04	33.33	46	12	26.09
5	11	06	54.55	43	19	44.19
6	12	06	50.00	46	18	39.13
7	12	07	58.33	46	17	36.96
8	12	01	8.33	48	10	20.83
9	12	05	41.67	47	14	29.79
10	12	04	33.33	48	06	12.50
Total	118	45	38.14	461	141	30.59

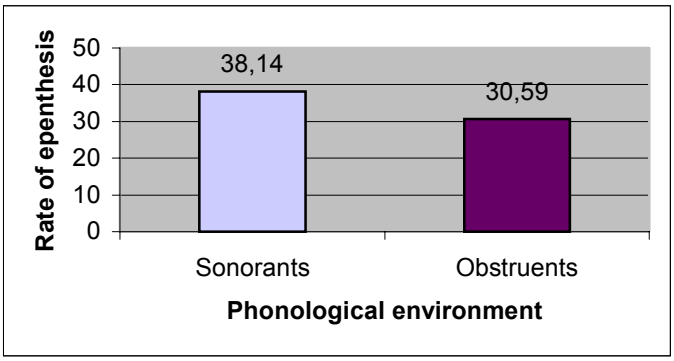


Figure 16: Rates of epenthesis production by Portuguese speakers in the context of sonorants vs. obstruents.

Concerning the group of Spanish speakers, the total frequencies of epenthesis produced was 45.0% after sonorants, and 38.24% after obstruents, which resulted in a non-significant chi-square ($\chi 2$ (1, N = 508) = 1.26, p > .25). Considering individual rates, only participants 4 and 9 produced less epenthesis after sonorants than after obstruents, as shown in Table 28 and Figure 17.

Table 28: Rates of epenthesis production by Spanish speakers in the context of sonorants vs. obstruents.

	Sonorants			Obstruents		
Participant	# productions	# epenthesis	% epenthesis	# productions	# epenthesis	% epenthesis
1	09	05	55.56	43	19	44.19
2	11	04	36.36	48	11	22.92
3	12	08	66.67	45	23	51.11
4	11	01	9.09	46	10	21.74
5	12	06	50.00	46	13	28.26
6	09	08	88.89	46	32	69.57
7	12	06	50.00	47	15	31.91
8	12	04	33.33	44	19	43.18
9	12	03	25.00	43	14	32.56
Total	100	45	45.00	408	156	38.24

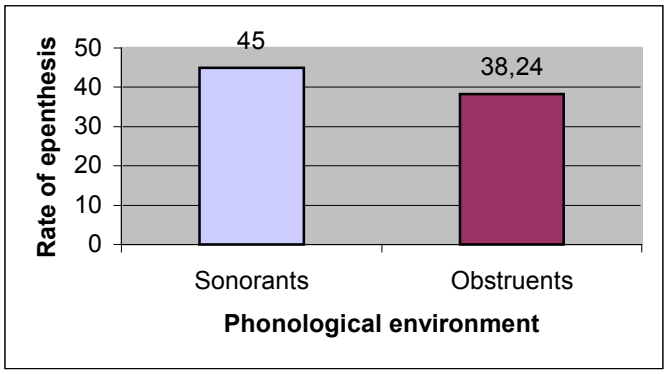


Figure 17: Rates of epenthesis production by Spanish speakers in the context of sonorants vs. obstruents.

These results show that the environment of sonorants and obstruents does not significantly influence the production of epenthesis in /s/ clusters. Although both NL groups modified the clusters more frequently after sonorants than after obstruents, it is not possible to make strong claims concerning this variable.

4.5.4 Discussion of *voiced* and *voiceless obstruents* as variable constraints in the phonological environment

Another sub-category that could be influencing the production of epenthesis in phonological environments is voiced versus voiceless obstruents. Within the Brazilian group, the total frequency of epenthesis produced was 42.0% after voiced obstruents, and 21.84% after voiceless obstruents, a difference of 20.16%, which resulted in a very significant chi-square ($\chi 2$ (1, N = 461) = 20.73, $p < .0001$). Concerning individual rates, only participant 3 produced less epenthesis after voiced than after voiceless obstruents, as can be seen in Table 29 and Figure 18.

Table 29: Rates of epenthesis production by Portuguese speakers in the context of voiced vs. voiceless obstruents.

	[+vd] obstruents			[-vd] obstruents		
Participant	# productions	# epenthesis	% epenthesis	# productions	# epenthesis	% epenthesis
1	20	05	25.00	26	01	3.85
2	20	16	80.00	23	16	69.57
3	21	02	9.52	27	05	18.52
4	20	08	40.00	26	04	15.38
5	17	12	70.59	26	07	26.92
6	20	10	50.00	26	08	30.77
7	20	09	45.00	26	08	30.77
8	21	09	42.86	27	01	3.70
9	20	10	50.00	27	04	14.81
10	21	03	14.29	27	03	11.11
Total	200	84	42.00	261	57	21.84

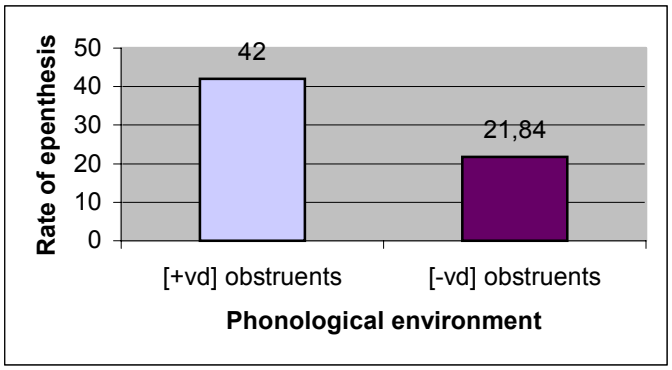


Figure 18: Rates of epenthesis production by Portuguese speakers in the context of voiced vs. voiceless obstruents.

Within the group of Spanish speakers, although the results followed the same tendency as the results obtained by Portuguese speakers, most participants produced higher frequencies of epenthesis after voiced obstruents, 40.91%, than after voiceless obstruents, 37.0%, resulting in a non-significant chi-square ($\chi 2$ (1, N = 403) = .48, p > .45). Only participants 4, 5 and 8 produced lower epenthesis after voiced obstruents than after voiceless obstruents, as can be seen in Table 30 and Figure 19.

Table 30: Rates of epenthesis production by Spanish speakers in the context of voiced vs. voiceless obstruents.

	[+vd] obstruents			[-vd] obstruents		
Participant	# productions	# epenthesis	% epenthesis	# productions	# epenthesis	% epenthesis
1	18	09	50.00	25	10	40.00
2	21	05	23.81	27	06	22.22
3	20	11	55.00	25	12	48.00
4	21	05	14.29	25	05	20.00
5	20	06	23.81	26	07	26.92
6	19	16	84.21	22	16	72.73
7	21	07	33.33	26	08	30.77
8	19	07	36.84	25	12	48.00
9	17	06	35.29	26	08	30.77
Total	176	72	40.91	227	84	37.00

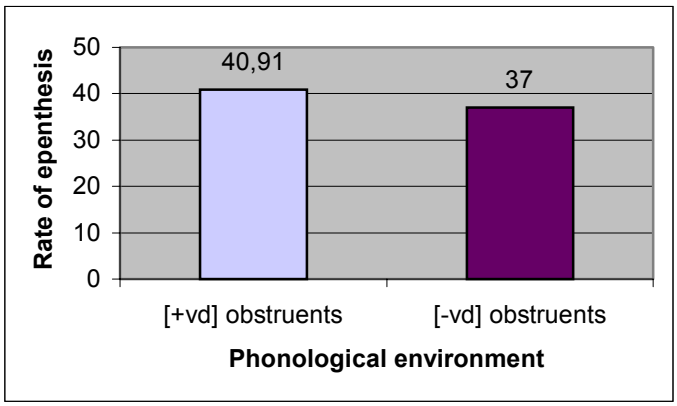


Figure 19: Rates of epenthesis production by Spanish speakers in the context of voiced vs. voiceless obstruents.

The results obtained in this section show that environment is a powerful variable constraint concerning the frequency with which epenthesis occurs. As stated by Carlisle (1991, p. 90), the degree of sonority of the preceding environment may affect the frequency of epenthesis production. Portuguese speakers tended to insert an epenthetic vowel before both /sC/ and /sCC/ onsets significantly more frequently after a word-final vowel, followed by a word-final consonant, and then by silence, partially differing from the study carried out by Rebello (1997a, 1997b), since her Brazilian participants produced epenthesis more frequently after silence,

followed by vowels, and then by consonants. Spanish speakers, on the other hand, tended to produce a greater rate of epenthesis after consonants, followed by vowels, and then by silence, corroborating the results found by Carlisle (1991, 1991b in Carlisle 1992, 1992, 1997) and Abrahamsson (1997, 1999).

Concerning the analysis of the subgroups of consonants, both Brazilian and Argentinean participants inserted an epenthetic vowel more frequently after sonorants than obstruents, although the difference was not statistically significant, meaning that this subcategory does not act as a variable constraint. With the subcategory of obstruents, though, statistical analysis revealed that Brazilian participants produced epenthesis significantly more frequently after voiced obstruents than after voiceless obstruents. This confirms the tendency for epenthesis production after a higher degree of sonority of the preceding syllable, since word-final vowels, which have a high degree of sonority, also caused more epenthesis, showing evidence that voicing again proved to be an important variable for Brazilians. Argentinean participants also tended to insert an epenthetic vowel more frequently after voiced obstruents than after voiceless obstruents, although the frequencies were not statistically significant.

The difference in results concerning the phonological environment in which epenthesis occurred shows that although there are universal properties that occur in different languages, some of the specific features of the NL may sometimes influence the process of acquisition more strongly than the universal characteristics of languages. Curiously, epenthesis occurred more frequently after Portuguese speakers pronounced a word ending in an open syllable than in a closed syllable. This means that, according to Carlisle's (1997, pp. 348-349) interpretation, they did not resyllabify the word-initial extrasyllabic consonant to the preceding word-final vowel, as in *guy skin*, [gai#s.kin], but there was a need to insert an epenthetic vowel after a word-final

vowel, resulting in epenthesis + resyllabification: [gai.#es.kin]. Argentinean participants, on the other hand, tended to resyllabify the onsets with the open syllables preceding them, which explains the lower frequency of epenthesis after word-final vowels than after consonants, resulting in productions like in *Bob skimps*, [bɔ.b#əskɪmps].

4.6 Summary of overall results

In this study, I aimed to verify whether the use of the same corpus with both Portuguese and Spanish EFL speakers would result in the same differences in findings obtained in the studies by Carlisle (1991, 1991b in Carlisle 1997, 1992, 1997) and Rebello (1997a, 1997b) concerning the production of English initial /sC(C)/ clusters, and thus confirm and explain the differences.

Results concerning the first hypothesis, that longer clusters would be more difficult to produce for Spanish spakers and shorter clusters for Portuguese speakers, reveal that both Portuguese and Spanish EFL speakers inserted an epenthetic vowel more frequently after tri-literal than after bi-literal clusters, confirming the predictions based on the Markedness Differential Hypothesis (MDH), which claims that more marked structures are more frequently modified. The hypothesis for Spanish speakers was thus confirmed, but not for Portuguese speakers. This might be explained by the fact that in Rebello (1997a, 1997b) differences between shorter and longer clusters were extremely small, since her participants did not read the sentences fluently, given that they had a low level of English proficiency, which led them to produce epenthesis so frequently that the length of the clusters did not seem to be an influencing variable.

The second hypothesis claimed that clusters in violation of the Syllable Structure Condition (SSC) [sp, st, sk, spr, str, skr, spl, skw] would be more frequently modified by

Spanish speakers than clusters not in violation [sw, sm, sn, sl], and that clusters not in violation would be more frequently modified by the Portuguese speakers than clusters in violation. This hypothesis was confirmed for the Spanish speakers, corroborating the results found in previous studies by Carlisle (1991, 1991b in Carlisle 1991, 1992, 1997), and Abrahamsson (1997, 1999). The findings regarding the Portuguese speakers were inconclusive, which probably indicates the neutralization of opposing tendencies generated by the two different kinds of markedness: The first referring to the SSC, and the second referring to voicing.

The third hypothesis, which aimed at determining whether the phonological environment could be considered a variable constraint, predicted that Portuguese EFL speakers would produce a higher frequency of epenthesis after silence, followed by vowels and then by consonants, and that Spanish EFL speakers would insert an epenthetic vowel more frequently after word-final consonants, followed by vowels and then by silence. The results for the Spanish speakers followed the expected order. However, the results concerning the Portuguese speakers only partially confirm the hypothesis, since epenthesis was more frequently produced after vowels than after consonants, but silence was the context that produced the least rather than the most frequent epenthesis. This means that strength relations across the syllable affected the difficulty in producing English initial /sC(C)/ clusters, but differently for the two NL groups.

Therefore, some results found in this study are contrary to Rebello's (1997a, 1997b) findings. The production of Portuguese EFL speakers was analyzed in both studies; however, the difference in results might be explained by the participants' different levels of English proficiency. While in Rebello's investigation participants were learners attending English classes at the extracurricular course of a public Brazilian university, in the present study participants were learners attending the *Letras* course of the same university, which means that they were

more proficient and already had some knowledge of English phonology, given that they are future EFL teachers. Thus, although the findings in this study are different from Rebello (1997a, 1997b), the results show that the production of /s/ clusters by Portuguese speakers is very different from that of Spanish speakers.

Concerning the production of /s/ clusters by Spanish speakers, the results corroborate both Carlisle's (1991, 1991b in Carlisle 1992, 1992, 1997) and Abrahamsson's (1997, 1999) findings, since (1) participants modified longer clusters more frequently than shorter cluster; (2) the insertion of an epenthetic vowel occurred more frequently before clusters in violation of the sonority hierarchy than before clusters not in violation; and (3) epenthesis occurred more frequently after vowels, followed by consonants, and then by silence. Considering, then, what was found by Carlisle and Rebello, the difference in results does not seem to have been caused by the differences in corpora. Differences in Spanish and Portuguese L1 show that native language interference and language universals can more accurately explain the dissimilarities.

Chapter 5- Conclusion

5.1 Theoretical implications

The findings involving the nineteen participants and the 2808 items of analysis in this investigation contributed to the corroboration of previous studies on English syllable structure. In this study, it was observed that, even though a few Argentinean and Brazilian participants deleted one of the members of the cluster, this strategy to deal with syllable structure difficulty was very infrequent. The addition of an epenthetic vowel in order to modify TL structures which are not permitted in the NL syllable structure supports Tarone's (1987b) Syllable Structure Transfer Hypothesis, which claims that some TL learners may alter difficult structures to those which are permitted in their NL. Similarly to Carlisle's (1991, 1991b in Carlisle 1992, 1992, 1997) findings, the difference between the English syllable structure and that of Spanish and Portuguese caused participants to use epenthesis as a strategy to facilitate the production of the /s/ clusters, which do not exist in either Spanish or Portuguese in initial position.

The conclusion regarding the first hypothesis was to corroborate Greenberg's (1965) universals and the findings of Anderson (1987), Carlisle (1997), and Abrahamsson (1997, 1999) that longer clusters are more marked and, as a consequence, more difficult to produce. The findings obtained in this study confirmed this supposition, since longer clusters caused more epenthesis than shorter clusters for both Portuguese and Spanish speakers.

Regarding the second hypothesis, there are separate conclusions concerning the Spanish and Portuguese-speaking learners. The simplification of syllable structure by Portuguese speakers was the result of a sort of conflict between two types of markedness: that of the SSC and that of voicing, since the voicing assimilation of /s/ before the nasals and the liquid led to the formation of a more marked type of cluster (voiced obstruent + sonorant). This conflict seems to have

caused a neutralization of the effect of each, since there was very little difference in frequency of epenthesis between clusters not in violation and clusters in violation. Spanish speakers, on the other hand, simplified the English syllable structure in conformity to language universals, given that the production of epenthesis by these speakers was more significantly frequent before clusters in violation of the Syllable Structure Condition than clusters not in violation. The different findings involving the two NL groups lead to the conclusion that which language universals it is more important to follow depends on the native language; thus, transfer is also an important factor affecting TL production.

The conclusions regarding the third hypothesis also confirm the results found by Carlisle (1991, 1991b in Carlisle 1992, 1992, 1997) and Abrahamsson (1997, 1999), and partially confirm Rebello's (1997a, 1997b) findings regarding the environment where epenthesis is more frequently produced. The results revealed that the phonological context significantly influenced the frequency of vowel epenthesis before /s/ clusters in Spanish/English and Portuguese/English interphonology. In the four studies by Carlisle and in the present one, Spanish EFL speakers produced a greater frequency of epenthesis after word-final consonants, followed by word-final vowels and then by silence. Portuguese EFL speakers, however, inserted an epenthetic vowel more frequently after word-final vowels, followed by word-final consonants, and then silence, partially corroborating Rebello's (1997a, 1997b) results regarding consonants versus vowels, even though her Brazilian participants produced the highest rate of epenthesis after silence, which was the environment which yielded the most frequent epenthesis in Rebello's study.

In sum, the results, in general, conform to the Markedness Differential Hypothesis (MDH) in that some characteristics of a given NL may influence the process of acquisition of a TL and that TL production is constrained by Universal grammar, since, in this study, what was more marked and different from the NL phonological structures was more frequently modified. The

results conform also to the Structural Conformity Hypothesis (SCH), since those markedness generalizations that have been made about primary languages were found to be true, in general, for both interlanguages investigated, although some conflicts between markedness generalizations were found among the Brazilian learners.

5.2 Pedagogical implications

The results found in this study contribute to the teaching of English pronunciation in South American countries where Portuguese and Spanish are spoken insofar as, according to Schmidt (1990), one is able to learn an item only when he/she notices it. This means that it is the teachers' responsibility to be the first to be aware of the difficulties in the pronunciation of initial /s/ clusters in order to help their learners to notice and overcome these difficulties.

Moreover, the number of allowed combinations of segments that form clusters within the syllable structure of each language is relatively high in English, whereas this number is rather limited in both Portuguese and Spanish syllable structures. The phoneme /s/ occurs in initial position in the three languages (English, Portuguese and Spanish), but it only forms word-initial clusters in English.

However, there are various similarities between the phonology of the three languages in question. One example of these similarities is what occurs in informal Portuguese when native speakers produce reduced forms of words such as *esperar* [s.pe.ɾa] (to wait), *escutar* [s.ku.ta] (to listen), *esperto* [s.pɛr.tu] (smart). Thus, according to Nunes (1987, pp. 124-25), it is possible to make use of similarities in order to show learners that English might not be as different from Portuguese as it might seem. Therefore, if learners have difficulty in producing TL sounds, it is

important to help them to notice that TL syllable structures which seem so far from their phonological reality are also present in their NL, especially in informal conversation, when the tendency to omit sounds is very frequent. It is the teacher's role, then, to make use of what learners already know about their NL in order to facilitate the process of learning the TL.

Concerning Spanish EFL speakers, teachers could help learners when teaching English initial /s/ clusters by calling their attention to NL-TL syllable structure differences and by asking them to emphasize the initial /s/ when producing these clusters, since in many Spanish speaking countries the /s/ tends to be aspirated in syllable-final position, resulting in productions like [eʰ.pe.ɾa] (to wait) and [eʰ.ki.si.to] (delicious).

Furthermore, the results of this and other studies on interlanguage phonology should convince materials writers to design pronunciation materials by presenting less marked TL structures before more marked structures. In this sense, bi-literal clusters should be presented before tri-literal clusters, clusters not in violation should be presented before clusters in violation, at least for Spanish speakers, and the /sl/ cluster should be presented before /sN/ clusters. Concerning phonological environment, this and other studies investigating Spanish EFL speakers found that /s/ clusters in vocalic environments cause less difficulty; thus they should be presented first to these learners. As regards Portuguese EFL speakers, this study and Rebello (1997a, 1997b) lead to the suggestion that consonantal and voiceless environments should be presented before vocalic and voiced environments.

Thus, research in interlanguage phonology would play an important role in helping both teachers and learners if the findings obtained in this interphonology research were taken into consideration in the development of language-specific series of English pronunciation manuals or textbooks that focus on the difficulties of each native language learner group.

5.3 Limitations of the research

One limitation of this study has to do with the participants' level of proficiency. Although the sentences were rather long and there were 24 distractors to disguise the focus of the study, the participants had already received phonological instruction regarding /s/ clusters, which is an aspect that influences the results of epenthesis production. Thus, an analysis encompassing EFL beginners and fluent speakers could reveal to what extent the variable *proficiency* plays a role in influencing the production of epenthesis before English initial /s/ clusters.

Another limitation of this investigation is that data were gathered only through list-reading, which might result in more accurate pronunciation than natural speech would. Although there is a tendency to produce more accurate pronunciation in elicited speech, Abrahamsson (1999, p. 504) concluded that the patterns found when participants read the sentences were also found in spontaneous, natural data.

5.4 Future research

In addition to the inclusion of several proficiency levels and both elicited and natural speech, as suggested in the sub-section concerning limitations, the difference between acquisition in natural settings and in the language classroom could also be analyzed. This way, it would be possible to verify to what extent acquisition processes, defined by Littlewood (1984, p. 3) as 'subconscious processes', lead to different results from those of learning processes, defined by Littlewood as 'conscious processes for internalizing a second language'.

It is worth stressing that the studies by Carlisle were carried out in the United States, where learners were acquiring the language in a natural environment, unlike the learners in this

study. However, a systematic study comparing the two environments would be useful, since it could contribute to a better understanding of how the learning process takes place in an informal versus a classroom environment.

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Appendices

Appendix A – Instructions and Term of Agreement

1. Name: 2. Year at *Letras* course:_____
3. Age: 4. Sex:
5. Is Spanish/Portuguese the only language spoken in your house? If not, what is the other foreign language?
6. Have you studied or are you studying any other foreign language at the moment? If you are, what is it (or are they)?
7. Have you ever lived in any other country where the medium of communication was not Spanish/Portuguese? If so, which country(ies) was(were) it(they)? For how long have you lived there?

INSTRUCTIONS:

1. Read the sentences fluently. If you feel that you paused while reading, read the sentence again. It is not necessary to stop the tape. This means you can read and repeat the same sentence several times in order to read it fluently (without any interruption or hesitation).
2. There are many unfamiliar words, but your correct pronunciation of strange words is NOT important to this study. What is important is FLUENCY.

Note:
I would like to thank you for participating in this study.
Andréia S. Rauber

TERM OF AGREEMENT

I, _____ (name of participant), have no objection in participating in this study. I am aware that my name is not going to be mentioned in the researcher's final paper.

Participant's signature

Appendix B – Corpus

1. /sp/ Clusters

1. H**e sp**eaks with the girls often.	/i/
2. Th**ey sp**oilt everything.	/eɪ/
3. N**o sp**itting on the floor.	/oʊ/
4. Lee is m**y sp**ouse.	/aɪ/
5. How do yo**u sp**ell your name?	/ju/
6. Do no**t sp**eed up, please.	/t/
7. She is a famou**s sp**eech therapist.	/s/
8. Among these boys, Davi**d sp**ecially attracts me.	/ d /
9. They sa**ng sp**ectacular songs.	/ŋ/
10. What a hu**ge sp**ider!	/dʒ/
11. **Sp**eak up, please.	/ø/
12. **Sp**orts are important to our health.	/ø/
13. **Sp**aghetti is my favorite dish.	/ø/

2. /st/ Clusters

1. You m**ay st**ay here.	/eɪ/
2. N**o st**anding near the door.	/oʊ/
3. Those guys are t**oo st**ubborn.	/u/
4. She likes t**o st**udy in the morning.	/ə/
5. M**y st**aff is better trained.	/aɪ/
6. Don't ge**t st**uck there.	/ t /
7. Bo**b st**eals all the time.	/b/

8. I’**m st**arving. /m/

9. That is su**ch st**ill water. /tʃ/

10. The ju**dge st**ood by the window. /dʒ /

11. **St**udents are not present today. / ø /

12. **St**ains are hard to remove. / ø /

13. **St**op crying, please. / ø /

3. /sk/ Clusters

1. Do you d**o sk**ateboarding in the summer? /u/

2. I enjoy looking at th**e sk**y at night. /ə/

3. **A sk**unk is a black-and-white animal. /ə/

4. That g**uy sk**in-dives every weekend. /aɪ/

5. The c**ow sk**ipped across the pasture. /aʊ/

6. That bi**ke sk**idded off the road. /k/

7. Bo**b sk**imps on his warm-up exercises all the time. /b/

8. Sa**m sk**inned his knee. /m/

9. Whi**ch sk**i lift are you taking? /tʃ/

10. She was wearing a hu**ge sk**irt. /dʒ/

11. **Sk**iing is my favorite sport. /ø/

12. **Sk**ates are nice to ride. /ø/

13. **Sk**irts make girls look charming. /ø/

4. /sw/ Clusters

1. H**e sw**eats a lot in the summer. /i/

2. **A sw**ear word is an offensive word. /ə/

3. M**y** **sw**eets are delicious. /aɪ/

4. You must n**ow** **sw**ear on the Bible. /aʊ/

5. The b**oy** **sw**ept the floor yesterday. /ɔɪ/

6. Sto**p** **sw**anking, please. /p/

7. Your wi**fe** **sw**ept the room today. /f/

8. Bo**b** **sw**ims every day. /b/

9. Don't take a lon**g** **sw**allow of this whiskey. /ŋ/

10. Whi**ch** **sw**eater should I wear? /tʃ/

11. **Sw**eets are bad for your teeth. /ø/

12. **Sw**ampy areas should be cleared. /ø/

13. **Sw**itch on the TV, please. /ø/

5. /sm/ **Clusters**

1. We always s**ee** **sm**ugglers crossing the border. /i/

2. Sh**e** **sm**ashed her finger at the door. /i/

3. N**o** **sm**oking, please. /oʊ/

4. I have **a** **sm**all gift for you. /ə/

5. Linda gave me a c**oy** **sm**ile. /ɔɪ/

6. You loo**k** **sm**art tonight. /k/

7. London is famous for it**s** **sm**og. /s/

8. His da**d** **sm**acked him on the face. /d/

9. They're always maki**ng** **sm**all talk. /ŋ/

10. The wallpaper had hu**ge** **sm**udges all over it. /dʒ/

11. **Sm**art kids are lovely. /ø/

12. **Sm**ile, please. /ø/

13. **Sm**oking is not permitted. /ø/

6. /sn/ **Clusters**

1. L**ee sn**ores every night. /i/
2. Th**ey sn**eezed because of the flower. /eɪ/
3. M**y sn**ake's name is Pepa. /aɪ/
4. H**ow sn**obbish can she be? /aʊ/
5. I enj**oy sn**uggling close to him. /ɔɪ/
6. It must sto**p sn**owing soon. /p/
7. They ate delicious **sn**acks. /s/
8. Bo**b sn**eaked up behind me. /b/
9. Children like the ga**me** '**sn**akes and ladder'. /m/
10. The hotel has a hu**ge sn**ack bar. /dʒ/
11. **Sn**obbish people are disgusting. /ø/
12. **Sn**orkeling here is wonderful. /ø/
13. **Sn**oozing after lunch makes me relax. /ø/

7. /sl/ **Clusters**

1. Paul uses man**y sl**ang words. /i/
2. Th**ey sl**eep long hours every day. /eɪ/
3. J**o sl**owly left the house. /oʊ/
4. S**ue sl**apped him across the face. /u/
5. The little b**oy sl**iced the bread. /ɔɪ/
6. She has a beautiful bla**ck sl**eeping bag. /k/

7. Je**ff sl**andered her behind her back. /f/
8. Te**d sl**oshed water all over the room. /d/
9. Mark has bee**n sl**eeping for hours. /n/
10. There is a hu**ge sl**ammer in their town. /dʒ/
11. **Sl**im girls are really admired. /ø/
12. **Sl**ight headaches are caused by stress. /ø/
13. **Sl**ippery guys cannot be trusted. /ø/

8. /spr/ **Clusters**

1. W**e spr**ayed some perfume on ourselves. /i/
2. Th**ey spr**awled out on the bed last night. /eɪ/
3. That old man is s**o spr**y! /oʊ/
4. I really enj**oy spr**ingtime. /ɔɪ/
5. Did y**ou spr**ead the news around? /ju/
6. Ja**ck spr**ained his ankle. /k/
7. Me**g spr**inted to her car. /g/
8. Ji**m spr**inkled the pie with sugar. /m̩/
9. Ea**ch spr**ing we go to the countryside. /tʃ/
10. The villa**ge spr**awled all over the mountain. /dʒ/
11. **Spr**ead out the tablecloth, please. /ø/
12. **Spr**inters can reach 30 miles an hour. /ø/
13. **Spr**ing is my favorite season. /ø/

9. /spl/ **Clusters**

1. Sh**e spl**ashed the water. /i/

2. The motorw**ay spl**its this town in half. /eɪ/
3. Tin**a spl**urged on a new dress. /a/
4. Peter is s**o spl**enetic sometimes. /oʊ/
5. They d**o spl**endid clay work. /u/
6. Tina wro**te spl**endid detective novels. /t/
7. Little Ana's bi**b spl**it. /b/
8. Bria**n spl**iced the film together. /n/
9. Whi**ch spl**it peas do you want? /tʃ/
10. It's a hu**ge spl**it-level house. /dʒ/
11. **Spl**itting headaches are much painful. /ø/
12. **Spl**endid nature is found in Argentina. /ø/
13. **Spl**ashy clothes call much attention. /ø/

10. /str/ **Clusters**

1. Don't s**ay str**ange things. /eɪ/
2. You should g**o str**aight ahead. /oʊ/
3. J**o str**uggles against racism. /oʊ/
4. They acted t**oo str**angely. /u/
5. M**y str**ategy is to avoid the enemy. /aɪ/
6. Ei**ght str**eets have been closed. /t/
7. Loo**se str**ands of wire can be dangerous. /s/
8. I went to be**d str**aight away. /d/
9. Brend**on str**ode along the river. /n/
10. We hate su**ch str**ess. /tʃ/
11. **Str**awberries are delicious! /ø/

12. **Str**ict rules won't do her any good. /ø/

13. **Str**ay animals may disturb passers-by. /ø/

11. /skw/ **Clusters**

1. H**e squ**ashed all of the tomatoes. /i/
2. N**o squ**ads will be located at the boarder. /oʊ/
3. He's chosen the bl**ue squ**are. /u/
4. That g**uy squ**eezed dozens of oranges. /aɪ/
5. You don't seem to enj**oy squ**alid flats. /ɔɪ/
6. They ea**t squ**ash at every meal. /t/
7. It was an area of a hundre**d squ**are miles. /d/
8. There was a stro**ng squ**all over the bay yesterday. /ŋ/
9. I like pea**ch squ**ash. /tʃ/
10. Villa**ge squ**atters were praised by the president last night. /dʒ /
11. **Squ**irrels are lovely animals. /ø/
12. **Squ**eeze these lemons, please. /ø/
13. **Squ**id is a kind of seafood. /ø/

12. /skr/ **Clusters**

1. Let m**e scr**atch your broken foot. /i/
2. Only l**ow scr**ub can survive on that land. /oʊ/
3. **I scr**abbled weakly at the sanded floor. /aɪ/
4. You don't know h**ow scr**upulous he is. /aʊ/
5. The b**oy scr**eamed until losing his voice. /ɔɪ/
6. I ho**pe scr**eenwriters will appear soon. /p/

7. They both shoul**d scr**am. /d/

8. All nuts have bee**n scr**aped. /n/

9. There's no policy concerning su**ch scr**eening. /tʃ/

10. It was a hu**ge scr**apbook. /dʒ/

11. **Scr**atch my back, please! /ø/

12. **Scr**ambled eggs are delicious! /ø/

13. **Scr**awny horses are not lovely. / ø /

Appendix C – Transcriptions

Symbols: "∗" mispronounced item; "+" short pause; "++" long pause.
Sentences produced by Argentine participants 1, 2 and 3.

/sp/ Clusters

	Participant 1	Participant 2	Participant 3 .
/i/ - He speaks	[hi:əspi:ks]	[hi:spi:k]	[hi:spi:ks]
/eɪ/ - They spoilt	[deɪspɔɪl]	[ðeɪsɔɪlt]	[deɪspoɪlt]
/oʊ/ - No spitting	[noʊəspitɪŋ]	[noʊspitɪŋ]	[noʊəspitɪŋ]
/aɪ/ - my spouse	[maɪəspoʊs]	[maɪspoʊs]	[maɪspoʊs]
/ju/ - you spell	[juspɛl]	[juspɛl]	[juspɛl]
/t/ - not speed	[n ɔtspid]	[n ɔtəspid]	[n ɔtəspid]
/s/ - famous speech	[feɪmus + spitʃ]	[feɪməspitʃ]	[feɪmʊsəspitʃ]
/d/ - David specially	[deɪvɪdəspɛʃəli]	[deɪvɪdspeʃəli]	[deɪvɪdəspeʃɪəli]
/ŋ/ - sang spectacular	[saŋspɛktikjular]	[sangəspɛktɛkjulər]	[saŋəspəktakjulər]
/dʒ/ - huge spider	[hjuspaɪdər]	[hjugspaɪdər]	[hʌgspaɪdər]
/ø/ - Speak	[spi:k]	[spi:k]	[əspi:k]
/ø/ - Sports	[spɔrts]	[spɔrts]	[spɔrt]
/ø/ - Spaghetti	[spagɛti]	[spagɛti]	[spagɛti]

/st/ Clusters

	Participant 1	Participant 2	Participant 3 .
/eɪ/ - may stay	[meɪsteɪ]	[meɪsteɪ]	[meɪsteɪ]
/oʊ/ - No standing	[noʊstandɪŋ]	[noʊstandɪŋ]	[noʊstandɪŋ]
/u/ - too stubborn	[tustərbɔrn]	[tʃuəstərbɔn]	[tʃustubɔrn]
/ə/ - to study	[tustʌdi]	[tʃustʌdi]	[tʃustʌdi]
/aɪ/ - My staff	[maɪstaf]	[maɪstaf]	[maɪstaf]
/t/ - get stuck	[gɛtəstʌk]	[gɛtstʌk]	[gɛtstʌk]
/b/ - Bob steals	[bɔbəstil]	[bɔbəstils]	[bobstils]
/m/ - I'm starving	[aɪmstərvɪŋ]	[aɪmstɑrvɪŋ]	[aɪɛməstɑrvɪŋ]
/tʃ/ - such still	[sʌtʃəstɪl]	[sʌtʃəstɪl]	[sʌtʃəstɪl]
/dʒ/ - judge stood	[dʒʌdʒstud]	[dʒudʒstud]	[dʒjuəsto]
/ø/ - Students	[stjudənts]	[stjudənts]	[stjudənt]
/ø/ - Stains	[steɪns]	[steɪns]	[steɪns]
/ø/ - Stop	[stɔp]	[stɔp]	[əstɔp]

/sk/ Clusters

	Participant 1	Participant 2	Participant 3 .
/u/- do skateboarding	[du + skeɪbɔtɪŋ]	[duskeɪtbɔrdɪŋ]	[duskatərbordɪŋ]
/ə/ - the sky	[ðəskaɪ]	[ðəskaɪ]	[dəski]
/ə/ - A skunk	[eskʌnk]	[əskʌnk]	[sʌnk]*
/aɪ/ - guy skin	[gaɪəskin]	[guɪskin]	[geɪ++skin]
/aʊ/ - cow skipped	[kaʊəski:pəd]	[kaʊskipt]	[koʊskipt]
/k/ - bike skidded	[baɪkəski:dəd]	[baikskidɪd]	[baɪkəskidɪd]
/b/ - Bob skimps	[bɔbskɪmps]	[bɔbskims]	[bɔbəskims]
/m/ - Sam skinned	[samskinɪ]	[samskind]	[sam+skin]
/tʃ/ - Which ski	[witʃskaɪ]	[witʃskaɪ]	[witʃ+ski]
/dʒ/ - huge skirt	[hjuskərt]	[hjugskərt]	[hʌgskərt]
/ø/ - Skiing	[ski:ŋ]	[ski:ŋ]	[əski:n]
/ø/ - Skates	[skeɪtis]	[skeɪts]	[skeɪts]
/ø/ - Skirts	[skərts]	[skərts]	[skərt]

/sw/ Clusters

	Participant 1	Participant 2	Participant 3 .
/i/ - He sweats	[hi:swi:ts]	[hi:swi:ts]	[hi:swets]
/ə/ - A swear	[aswɛr]	[ɛsəswɛr] *	[ɛswɛr]
/aɪ/ - My sweets	[maɪswits]	[maɪswits]	[maɪswits]
/aʊ/ - now swear	[naʊswɛr]	[naʊswɛr]	[naʊswɛr]
/ɔɪ/ - boy swept	[bɔɪəswɛp]	[bɔɪswɛpt]	[bɔɪswɛp]
/p/ - Stop swanking	[stɔp + swɔkɪŋ]	[stɔpswɔkɪŋ]	[stɔpswankɪŋ]
/f/ - wife swept	[waɪfəswɛpt]	[waɪfswɛpt]	[waɪfəswɛp]
/b/ - Bob swims	[bɔbswims]	[bɔbswims]	[bɔbswim]
/ŋ/ - long swallow	[loŋswɔloʊ]	[loŋswɔloʊ]	[loŋswaloʊ]
/tʃ/ - Which sweater	[witʃswɛɾər]	[witʃswɛtər]	[witʃəswitər]
/ø/ - Sweets	[swi:s]	[swi:ts]	[swi:t]
/ø/ - Swampy	[swɑmpi]	[swampi]	[swampi]
/ø/ - Switch	[swi:tʃ]	[swi:tʃ]	[swi:t]

/sm/ **Clusters**

	Participant 1	Participant 2	Participant 3 .
/i/ - see smugglers	[siəsmɔgləɾs]	[sismʌgləɾs]	[si+smʌgləɾs]
/i/ - She smashed	[ʃiəsmaʃt]	[ʃismaʃt]	[ʃis+maʃt]
/oʊ/ - No smoking	[noʊsmoʊkɪŋ]	[noʊsmoʊkɪŋ]	[noʊsmoʊkɪŋ]
/ə/ - a small	[əsmɔl]	[əsmɔl]	[əsmɔl]
/ɔɪ/ - coy smile	[kɔusmaɪl]	[kɔɪsmaɪl]	[kɔusmaɪl]
/k/ - look smart	[luksmart]	[lʊksmɑrt]	[luksmart]
/s/ - its smog	[its + smɔg]	[ɪtsmɔg]	[ɪtsəsmog]
/d/ - dad smacked	[dadsmakəd]	[dɛdsmakt]	[dadəsmækəd]
/ŋ/ - making small	[meɪkɪŋsmɔl]	[meɪkɪŋsmɔl]	[meɪkɪŋsmɔl]
/dʒ/ - huge smudges	[hjudəsmʌdʒəs]	[hjugsmʌdʒəs]	[hug + smudχəs]
/ø/ - Smart	[smɑrt]	[smart]	[smart]
/ø/ - Smile	[smail]	[smail]	[smail]
/ø/ - Smoking	[smoʊkɪŋ]	[smoʊkɪŋ]	[smoʊkɪŋ]

/sn/ **Clusters**

	Participant 1	Participant 2	Participant 3 .
/i/ - Lee snores	[li + sn ɔrs]	[lisn ɔrs]	[lisn ɔrs]
/eɪ/ - They sneezed	[deɪsniz]	[ðeɪəsnizd]	[deɪsnizd]
/aɪ/ - My snake's	[maɪsneɪks]	[maɪsneɪks]	[maɪ+əsneɪks]
/aʊ/ - How snobbish	[haʊsnɔbɪʃ]	[haʊsn ɔbɪʃ]	[haʊəsnobɪʃ]
/ɔɪ/ - enjoy snuggling	[əndʒɔɪəsnʌglɪŋ]	[əndʒoʊəsnʌgkɪŋ]	[ɪndʒoʊsnʌglɪŋ]
/p/ - stop snowing	[əstɔpsnoʊɪŋ]	[stɔpəsnoʊɪŋ]	[stɔpsoʊɪŋ]*
/s/ - delicious snacks	[deliʃuəsnaks]	[deliʃəsnæks]	[deliʃəsəsnæks]
/b/ - Bob sneaked	[bɔb + snak]	[bɔbsnikt]	[bɔbəsneɪkt]
/m/ - game snakes	[geɪm + sneɪks]	[geɪm+sneɪks]	[geɪm + sneɪks]
/dʒ/ - huge snack	[hjuəsnɛk]	[hjusnɛk]	[hʌgəsnɛk]
/ø/ - Snobbish	[sn ɔbɪʃ]	[sn ɔbɪʃ]	[sn ɔbɪʃ]
/ø/ - Snorkeling	[sn ɔrklɪŋ]	[sn ɔrkəlɪŋ]	[sn ɔrkəlɪŋ]
/ø/ - Snoozing	[snusɪŋ]	[snoʊziŋ]	[sn ɔθɪŋ]

/sl/ Clusters

	Participant 1	Participant 2	Participant 3 .
/i/ - many slang	[menislɑŋ]	[mɛnislaŋ]	[menislang]
/eɪ/ - They sleep	[deɪslip]	[deɪslip]	[deɪslip]
/oʊ/ - Jo slowly	[dʒoʊ + sloʊli]	[dʒoʊsloʊli]	[dʒoʊəsloʊli]
/u/ - Sue slapped	[su + slapɪd]	[suslɛpt]	[su + slapt]
/ɔɪ/ - boy sliced	[bɔɪslaɪs]	[bɔɪslaɪst]	[bɔɪəslaɪs]
/k/ - black sleeping	[blakəsli:pɪŋ]	[blɛksli:pɪŋ]	[blɛksli:pɪŋ]
/f/ - Jeff slandered	[ʃɛfslandərd]	[dʒɛfslɛndərd]	[dʒɛf+slandərəd]
/d/ - Ted sloshed	[tɛdəsl ɔʃt]	[tɛdsl ɔʃt]	[tɛdsl ɔʃt]
/n/ - been sleeping	[binslipɪŋ]	[bɪnəslipɪŋ]	[bɪnəslipɪŋ]
/dʒ/ - huge slammer	[hju + əslɑmər]	[hjugəslɛmər]	[hʌgsləmər]
/ø/ - Slim	[sli:m]	[sli:m]	[sli:m]
/ø/ - Slight	[slaɪt]	[slaɪt]	[slaɪg]
/ø/ - Slippery	[sli:peri]	[sli:peri]	[sli:peri]

/spr/ Clusters

	Participant 1	Participant 2	Participant 3 .
/i/ - We sprayed	[wi:spreɪd]	[wi:spreid]	[wi:spreɪd]
/eɪ/ - They sprawled	[deɪsprɔlɪd]	[ðeɪ + spraʊld]	[deɪəsprɔləd]
/oʊ/ - so spry	[soʊspraɪ]	[soʊəspraɪ]	[soʊspraɪ]
/ɔɪ/- enjoy springtime	[ɪndʒɔɪəsprɪŋtaɪm]	[əndʒɔɪsprɪŋtaɪm]	[ɪndʒɔɪ+sprɪŋtaɪm]
/ju/ - you spread	[jusprɛd]	[jusprɛd]	[jusprɛd]
/k/ - Jack sprained	[dʒaksprainɪd]	[dʒɛkəspreind]	[dʒɛkəsprein]
/g/ - Meg sprinted	[mɛg + spritɪd]	[mɛg + sprɪnt]	[mɛgəsprɪntɪd]
/m/ - Jim sprinkled	[dʒɪmsprinkl]	[dʒɪməsprinkləd]	[dʒɪməsprint]
/tʃ/ - Each spring	[itʃsprɪŋ]	[itʃəsprɪŋ]	[itʃsprɪŋ]
/dʒ/-village sprawled	[vɪlɪdʒəsprold]	[vɪlɪdʒsəsprɔld]	[vɪlɪdʒsəspraʊləd]
/ø/ - Spread	[əsprɛd]	[sprɛd]	[sprɛd]
/ø/ - Sprinters	[sprɪntərs]	[sprinters]	[sprinter]
/ø/ - Spring	[sprɪŋ]	[sprɪŋ]	[sprɪŋ]

/spl/ **Clusters**

	Participant 1	Participant 2	Participant 3 .
/i/ - She splashed	[ʃiəsplaʃt]	[ʃisplaʃt]	[ʃi+splɛʃt]
/eɪ/ - motorway splits	[motorweɪsplit]	[mɔtorweɪsplits]	[mɔtorweɪslips]*
/a/ - Tina splurged	[tina + splərgɪd]	[tinaəsplərgd]	[tinaəsplərgəd]
/oʊ/ - so splenetic	[soʊsplənɛtik]	[soʊəsplənɛtɪk]	[soʊəsplentɪk]
/u/ - do splendid	[dusplendɪd]	[dusplɛndɪd]	[duəsplɛndɪd]
/t/ - wrote splendid	[roʊtsplɛndɪd]	[roʊtsplɛndɪd]	[roʊtəsplendɪd]
/b/ - bib split	[bibspilt]*	[bib + əsplit]	[bibslip]*
/n/ - Brian spliced	[braɪənsplaɪs]	[braɪənsplaɪst]	[braɪənəsplaɪst]
/tʃ/ - Which split	[witʃəspli:t]	[witʃspli:t]	[witʃspli:t]
/dʒ/ - huge split	[hjuspild]*	[hjusplɪt]	[hʌgsplaɪt]
/ø/ - Splitting	[sli:tɪŋ]*	[spli:tɪŋ]	[spli:tɪŋ]
/ø/ - Splendid	[splendɪd]	[splendəd]	[splendɪd]
/ø/ - Splashy	[splaʃi]	[splɛʃi]	[sflɛʃi]*

/str/ **Clusters**

	Participant 1	Participant 2	Participant 3 .
/eɪ/ - say strange	[steɪəstraŋ]	[seɪstrɛŋ]	[steɪstrɛndʒ]
/oʊ/ - go straight	[goʊəstreid]	[goʊ + streɪt]	[goʊ straɪt]
/oʊ/ - Jo struggles	[dʒoʊstriglɪs]	[dʒoʊstrʌgləs]	[dʒoʊəstugləs]*
/u/ - too strangely	[tuəstrʌŋgli]	[tʃustrɛndʒli]	[tuəstradʒəli]
/aɪ/ - My strategy	[maɪstrətədʒi]	[maɪstratedʒi]	[maɪstratədʒi]
/t/ - Eight streets	[eɪtstri:ts]	[eitstri:ts]	[eɪt+stri:ts]
/s/ - Loose strands	[lusəstrʌns]	[lus+əstrands]	[lusəstrands]
/d/ - bed straight	[bɛdəstreit]	[bɛdstreit]	[bɛdəstraɪg]
/n/ - Brendon strode	[bridənəstroʊd]	[brendonstroʊd]	[brendonəstroʊd]
/tʃ/- such stress	[sʌtʃəstrɛs]	[sʌtʃstrɛs]	[sʌtʃstrɛs]
/ø/ - Strawberries	[strɔbəris]	[strɔbɛris]	[əstrɔbəris]
/ø/ - Strict	[stri:k]	[strɪk]	[əstrɪkt]
/ø/ - Stray	[streɪ]	[streɪ]	[əstreɪ]

/skw/ Clusters

	Participant 1	Participant 2	Participant 3 .
/i/ - He squashed	[hi:əskwɑʃt]	[hi:skwɑʃt]	[hi:əskwaʃt]
/oʊ/ - No squads	[noʊskwɔds]	[noʊəskwɔds]	[noʊəskwads]
/u/ - blue square	[bluskwɛr]	[bluskwɑr]	[bluəskwər]
/aɪ/ - guy squeezed	[gaɪskwitz]	[guɪ + skwizd]	[geɪskwizd]
/ɔɪ/ - enjoy squalid	[ədʒɔɪəskwalɪd]	[əndʒɔɪəskwɔlɪʃ]	[əndʒɔɪəskwɑlɪʃ]
/t/ - eat squash	[i:təskwɔʃ]	[i:tskwɔʃ]	[i:təskwoʃ]
/d/ - hundred square	[hʌndrədskwɛrs]	[hʌndrəd + skwɛr]	[hʌndrəd+skwɛr]
/ŋ/ - strong squall	[strɔŋskwɔl]	[strɔŋ skwɔl]	[strɔŋ əskwɑl]
/tʃ/ - peach squash	[pitʃskwɔʃ]	[pitʃskwɔʃ]	[spitʃskwoʃ]
/dʒ/-Village squatters	[vɪlɪdʒ +skwɔrtərs]	[vɪlɪdʒəskwɔtərs]	[vɪlɪʒəskwʌtərs]
/ø/ - Squirrels	[skwils]	[skwərls]	[skwirəls]
/ø/ - Squeeze	[skwiz]	[skwiz]	[skis]*
/ø/ - Squid	[skid]*	[skwid]	[skwid]

/skr/ Clusters

	Participant 1	Participant 2	Participant 3 .
/i/ - me scratch	[miskratʃ]	[miskrɛtʃ]	[miskrɛtʃ]
/oʊ/ - low scrub	[loʊskrʌb]	[loʊəskrʌb]	[loʊəskrʌb]
/aɪ/ - I scrabbled	[aɪəskrɛbl]	*not recorded	[aɪskrabəld]
/aʊ/- how scrupulous	[haʊskrubuloʊs]	[haʊskropələs]	[haʊəskrupəloʊs]
/ɔɪ/ - boy screamed	[bɔɪ + skrim]	[bɔɪskrimd]	[bɔɪəskram]
/p - hope screenwriters	[hopəskri:nwintərs]	[hoʊpskri:nraɪtərs]	[hoʊpskri:nraɪtər]
/d/ - should scram	[ʃʊd + scram]	[ʃudskram]	[ʃʊdskram]
/n/ - been scraped	[bɪnəskreɪpt]	[binskreɪpt]	[bɪnəskræpt]
/tʃ/ - such screening	[sʌtʃskrinɪŋ]	[sʌtʃskrinɪŋ]	[sʌtʃskrinɪŋ]
/dz/ -huge scrapbook	[hjuəskrabu]	[hju+scrap+buk]	[hʌgəskræpbʊk]
/ø/ - Scratch	[skratʃ]	[skrɛtʃ]	[əskrætʃ]
/ø/ - Scrambled	[skramblɪd]	[skramd]	[skramblәd]
/ø/ - Scrawny	[skraʊni]	[skrani]	[skraʊni]

Sentences produced by Argentine participants 4, 5 and 6.

/sp/ Clusters

	Participant 4	Participant 5	Participant 6 .
/i/ - He speaks	[hi:spi:ks]	[hi:spi:ks]	[hi:spi:ks]
/eɪ/ - They spoilt	[deɪspɔil]	[deɪspɔid]*	[ðeɪəspɔilt]
/oʊ/ - No spitting	[noʊspitɪŋ]	[noʊspintɪŋ]	[noʊpɪtɪŋ]*
/aɪ/ - my spouse	* not recorded	[maɪspaʊs]	[miəspoʊs]
/ju/ - you spell	[juspɛl]	[juspɛl]	[juspɛl]
/t/ - not speed	[n ɔtspid]	[n ɔtspid]	[n ɔtspid]
/s/ - famous speech	[feɪməspitʃ]	[feɪməspitʃ]	[feɪmʌsəspitʃ]
/d/ - David specially	[deɪbɪdspeʃəli]	[deɪvəspɛʃəli]	[deɪvəspiʃəli]
/ŋ/ - sang spectacular	[saŋspektɛkjulər]	[saŋspektakulər]	[saŋəspektikjulər]
/dʒ/ - huge spider	[hjudʒspidər]	[hjuspaɪdər]	[udʒəspaɪdər]
/ø/ - Speak	[spik]	[spik]	[əspik]
/ø/ - Sports	[spɔrts]	[spɔrt]	[spɔrt]
/ø/ - Spaghetti	[spagɛti]	[əspəgɛti]	[əspəgɛti]

/st/ Clusters

	Participant 4	Participant 5	Participant 6 .
/eɪ/ - may stay	* not recorded	[meɪəsteɪ]	[meɪəsteɪ]
/oʊ/ - No standing	[noʊəstandɪŋ]	[noʊəstændɪŋ]	[noʊəstandɪŋ]
/u/ - too stubborn	[tʃustubɔrn]	[tʃustʌrbɔrn]	[tuəstʌbən]
/ə/ - to study	[tustʌdi]	[tʃustʌdi]	[tustʌdi]
/aɪ/ - My staff	[maɪstaf]	[maɪstaf]	[maɪstaf]
/t/ - get stuck	[gɛtstʌk]	[gɛtstʌk]	[gɛtəstʌk]
/b/ - Bob steals	[bɔbstils]	[bɔbstils]	[bobstil]
/m/ - I'm starving	[aɪmstɑrbɪŋ]	[aɪməstarvɪŋ]	[aɪməstɑrvɪŋ]
/tʃ/ - such still	[sʌtʃəstɪl]	[sʌtʃstil]	[sʌtʃəstɪl]
/dʒ/ - judge stood	[dʒʌdʒəstud]	[dʒʌdʒstud]	[dʒʌdʒəstud]
/ø/ - Students	[stjudənts]	[studənts]	[əstjudənts]
/ø/ - Stains	[steɪns]	[streɪns]*	[əsteɪns]
/ø/ - Stop	[stɔp]	[stɔp]	[əstɔp]

/sk/ Clusters

	Participant 4	Participant 5	Participant 6 .
/u/- do skateboarding	[duskeɪtbɔrdɪŋ]	[juskeɪtbɔrdɪŋ]	[duskeɪtbɔrdɪŋ]
/ə/ - the sky	[dəskaɪ]	[dəskaɪ]	[deskaɪ]
/ə/ - A skunk	[e+skʌnk]	[asʌnk]*	[əskʌnk]
/aɪ/ - guy skin	[gaɪ+skin]	[guɪəskɪn]	[gaɪskɪn]
/aʊ/ - cow skipped	[kaʊskipt]	[kaʊskipəd]	[koʊkɪpt]*
/k/ - bike skidded	[baɪkski:d]	[baikəski:dəd]	[baɪkəskaɪd]
/b/ - Bob skimps	[bɔbskimps]	[bɔbskims]	[bɔbəskɪmps]
/m/ - Sam skinned	[samskind]	[saməskinəd]	[samkɪnd]*
/tʃ/ - Which ski	[witʃəski:]	[witʃski:]	[wɪtʃəskaɪ]
/dʒ/ - huge skirt	[hjudʒskirt]	[hjuskərt]	[ʌdʒəskirt]
/ø/ - Skiing	[ski:ŋ]	[əski:ŋ]	[əski:ŋ]
/ø/ - Skates	[skeɪt]	[skeɪtəs]	[əskeɪts]
/ø/ - Skirts	[skirts]	[skərts]	[skərts]

/sw/ Clusters

	Participant 4	Participant 5	Participant 6 .
/i/ - He sweats	[hi:swɛts]	[hi:swɛts]	[hi:swɛts]
/ə/ - A swear	[ɛswɛr]	[əswɛr]	[əswɛr]
/aɪ/ - My sweets	[maɪswi:ts]	[maɪswi:ts]	[maɪswi:ts]
/aʊ/ - now swear	[naʊswɛr]	[naʊswɛr]	[naʊswɛr]
/ɔɪ/ - boy swept	[bɔɪswɛpt]	[bɔɪswɛpt]	[bɔɪswɛpt]
/p/ - Stop swanking	[stɔpsnɔkɪŋ]*	[stɔpsweɪŋkɪŋ]	* not recorded
/f/ - wife swept	[waɪfswɛpt]	[waɪfəswɛpt]	[waɪfswept]
/b/ - Bob swims	[bɔbswɪms]	[bɔbəswims]	[bɔbəswims]
/ŋ/ - long swallow	[lɔŋʃaloʊ]*	[lɔŋswaloʊd]	[lɔŋwɔloʊ]*
/tʃ/ - Which sweater	[witʃswɛtər]	[witʃswɛtər]	[witʃswi:tər]
/ø/ - Sweets	[swi:ts]	[swi:ts]	[swi:ts]
/ø/ - Swampy	[swʌmpi]	[swampi]	[swampi]
/ø/ - Switch	[switʃ]	[switʃ]	[switʃ]

/sm/ **Clusters**

	Participant 4	Participant 5	Participant 6 .
/i/ - see smugglers	[si:əsmʌglərs]	[si:smʌglərs]	[si:əsmʌglərs]
/i/ - She smashed	[ʃismaʃt]	[ʃismaʃəd]	[ʃiʃmaɪld]*
/oʊ/ - No smoking	[noʊəsmoʊkɪŋ]	[noʊsmoʊkɪŋ]	[noʊsmoʊkɪŋ]
/ə/ - a small	[əsmɔl]	[əsmɔl]	[əsmɔl]
/ɔɪ/ - coy smile	[kɔɪəsmaɪl]	[kɔɪsmaɪl]	[kɔɪəsmaɪl]
/k/ - look smart	[lʊkəsmɑrt]	[luksmɑrt]	[lʊkəsmɑrt]
/s/ - its smog	[ɪtsmɔg]	[ɪtsmɔg]	[ɪtsəsmog]
/d/ - dad smacked	[dɛdsmɛkt]	[dædəsmægd]	[dɛdəsmeɪkt]
/ŋ/ - making small	[meɪkɪŋsmɔl]	[meɪkɪŋəsmɔl]	[meɪkɪŋəsmɔl]
/dʒ/ - huge smudges	[hjudʒ+smʌdʒ]	[hjusmʌgərts]	[ʌdʒəsmʌdʒ]
/ø/ - Smart	[smart]	[smart]	[əsmart]
/ø/ - Smile	[smail]	[smail]	[smail]
/ø/ - Smoking	[smoʊkɪŋ]	[smoʊkɪŋ]	[smoʊkɪŋ]

/sn/ **Clusters**

	Participant 4	Participant 5	Participant 6 .
/i/ - Lee snores	[li:əsn ɔrs]	[li:sn ɔrs]	[li:əsn ɔrs]
/eɪ/ - They sneezed	[deɪsni:d]	[ðeɪsi:nəs]*	[ðeɪni:zəd]*
/aɪ/ - My snake's	[maɪsneɪks]	[maɪsneɪks]	[maɪəsneɪks]
/aʊ/ - How snobbish	[haʊsn ɔbɪʃ]	[haʊsn ɔbɪʃ]	[haʊsən ɔbɪ]*
/ɔɪ/ - enjoy snuggling	[ɪndʒɔɪsnuglɪŋ]	[əndʒɔɪsnʌglɪŋ]	[əndʒɔɪəsnʌglɪŋ]
/p/ - stop snowing	[tɔpsnoʊɪŋ]	[stɔpsnoʊɪŋ]	[stɔpɪŋsnoʊɪŋ]
/s/ - delicious snacks	[deliʃus+snaks]	[deliʃioʊsnæks]	[deliʃioʊsnɛk]*
/b/ - Bob sneaked	[bɔbsnikt]	[bɔbsneɪkt]	[bɔbəsnikt]
/m/ - game snakes	[geɪm+snaɪks]	[geɪmsneɪks]	[geɪməsneɪk]
/dʒ/ - huge snack	[hjudʒəsnʌk]	[hjusnɛk]	[dʒʌgəsnɛk]
/ø/ - Snobbish	[sn ɔbɪʃ]	[sn ɔbɪʃ]	[əsn ɔbɪʃ]
/ø/ - Snorkeling	[sn ɔrklɪŋ]	[sn ɔrklɪŋ]	[əsn ɔrklɪŋ]
/ø/ - Snoozing	[snoʊsiŋ]	[snoʊθiŋ]	[snuθiŋ]

/sl/ Clusters

	Participant 4	Participant 5	Participant 6 .
/i/ - many slang	[mɛnislaŋ]	[mɛnislæŋ]	[menislæŋ]
/eɪ/ - They sleep	[deɪsli:p]	[deɪsli:p]	[ˈðeɪsli:p]
/oʊ/ - Jo slowly	[dʒoʊəsloʊli]	[dʒoʊsloʊli]	[dʒoʊsloʊli]
/u/ - Sue slapped	[suslapəd]	[suslapt]	[ʃuslipt]
/ɔɪ/ - boy sliced	[bɔɪslaɪst]	[bɔɪslaɪst]	[bɔɪslaɪs]
/k/ - black sleeping	[blaksli:pɪŋ]	[blaksli:pɪŋ]	[blɛksli:pɪŋ]
/f/ - Jeff slandered	[dʒɛfslandərs]	[dʒɛfəslandərd]	[dʒɛfʃʌndlərd]*
/d/ - Ted sloshed	[tɛdsl ɔʃəd]	[tɛdsl ɔʃt]	[tɛdʃɔʃt]*
/n/ - been sleeping	[bɪnəsli:pɪŋ]	[bɪnəsli:pɪŋ]	[binsli:pɪŋ]
/dʒ/ - huge slammer	[hjuəslamər]	[hjudʒslamər]	[hjʌdʒslamər]
/ø/ - Slim	[slim]	[slim]	[slim]
/ø/ - Slight	[slaɪt]	[slaɪt]	[slaɪt]
/ø/ - Slippery	[slipers]	[sliperi]	[slaɪpəri]

/spr/ Clusters

	Participant 4	Participant 5	Participant 6 .
/i/ - We sprayed	[wi:spreid]	[wi:preiəd]*	[wi:spreid]
/eɪ/ - They sprawled	[deɪsprɑʊdəd]	[ðeɪəsprɔləd]	[teɪəsprɔd]
/oʊ/ - so spry	[soʊspraɪ]	[soʊəspraɪ]	[soʊspraɪ]
/ɔɪ/- enjoy springtime	[ɪndʒɔɪsprɪŋtaɪm]	[əndʒɔɪsprɪŋtaɪm]	[əndʒɔɪsprɪŋtaɪm]
/ju/ - you spread	[jusprɛd]	[jusprɛd]	[jusprɛd]
/k/ - Jack sprained	[dʒak+spreind]	[dʒækəspreinəd]	[dʒækəspreind]
/g/ - Meg sprinted	[mɛgsprint]	[mɛgsprɪntəd]	[mɛgəsprɪnt]
/m/ - Jim sprinkled	[dʒɪmsprinkləd]	[dʒɪməsprinkləd]	[dʒɪməskrɪŋk]*
/tʃ/ - Each spring	[i:tʃsprɪŋ]	[i:tʃsprɪŋ]	[i:tʃəsprɪŋ]
/dʒ/-village sprawled	[bɪlɪdʒs+sprɑʊld]	[vɪlɪdʒsəsprɑʊəld]	[bilɪdʒsəsprɔd]
/ø/ - Spread	[sprɛd]	[sprɛd]	[əspreɪ]
/ø/ - Sprinters	[sprinters]	[sprintərs]	[əspraɪntər]
/ø/ - Spring	[spriŋ]	[spriŋ]	[sprɪŋ]

/spl/ **Clusters**

	Participant 4	Participant 5	Participant 6 .
/i/ - She splashed	[ʃi:əsplæʃt]	[ʃi:əslɛpəʃ]*	[ʃi:əpleʃt]*
/eɪ/ - motorway splits	[motorweɪ+splits]	[motorweɪsplits]	[motorweɪsplits]
/a/ - Tina splurged	[tinasprʊgd]*	[tinaspərgled]*	[tinaəsprʌgl]*
/oʊ/ - so splenetic	[soʊsplenɪt]	[soʊsplentɪk]	[soʊəsplinɪt]
/u/ - do splendid	[dusplendɪd]	[dusplɛndəd]	[duəsplendɪd]
/t/ - wrote splendid	[roʊtsplendɪd]	[roʊtsplendɪd]	[roʊtəsplɛndɪd]
/b/ - bib split	[bi:bsplit]	[bi:bsplit]	[bi:bs+plit]
/n/ - Brian spliced	[braɪənsplis]	[braɪənsplisəd]	[braɪənəsplaɪst]
/tʃ/ - Which split	[witʃslipt]*	[witʃsplit]	[witʃslip]*
/dʒ/ - huge split	[hjudʒsplit]	[hjusplit]	[udʒslip]*
/ø/ - Splitting	[splitɪŋ]	[splitɪŋ]	[əsplitɪŋ]
/ø/ - Splendid	[splɛndɪd]	[splendəd]	* not recorded.
/ø/ - Splashy	[splaʃi]	[əsplæʃi]	[əspleʃi]

/str/ **Clusters**

	Participant 4	Participant 5	Participant 6 .
/eɪ/ - say strange	[seɪ+strɛdʒ]	[seɪəstrænds]	[seɪəstrændʒ]
/oʊ/ - go straight	[goʊəstraɪt]	[goʊstreɪt]	[goʊəstreɪ]
/oʊ/ - Jo struggles	[dʒoʊstrʌgəls]	[dʒoʊstrʌgəls]	[dʒoʊəstraglɪs]
/u/ - too strangely	[tustreŋgli]	[tʃu+strendʒli]	[tʃuəstrandʒəli]
/aɪ/ - My strategy	[maɪstratedʒi]	[maɪstratedʒi]	[maɪəstrɛtedʒi]
/t/ - Eight streets	[eitəstri:ts]	[eitstri:ts]	[eitəstri:ts]
/s/ - Loose strands	[lusəstrands]	[lusəstrendʒ]	[lusəstrands]
/d/ - bed straight	[bɛdstraɪt]	[bɛdstreit]	[beɪəstreit]
/n/ - Brendon strode	[brendonstrod]	[brendənstroʊd]	[brendənəstroʊd]
/tʃ/- such stress	[sʌtʃstrɛs]	[sʌtʃstrɛs]	[sʌtʃstres]
/ø/ - Strawberries	[strɔbəris]	[strɔbəris]	[əstrɔbəris]
/ø/ - Strict	[əstrɪkt]	[straɪkt]	[əstrɪk]
/ø/ - Stray	[streɪ]	[əstreɪ]	[əstreɪ]

/skw/ Clusters

	Participant 4	Participant 5	Participant 6 .
/i/ - He squashed	[hi:skwaʃəs]	[hi:əskwɑʃəd]	[hi:əskwɑʃ]
/oʊ/ - No squads	[noʊskwads]	[noʊskwɛds]	[noʊəkwaɪs]*
/u/ - blue square	[bluskwɛr]	[bluəskwɛr]	[bluəskwɑr]
/aɪ/ - guy squeezed	[gaɪskwi:zd]	[gaɪskwisəs]	[gaɪəskwi:z]
/ɔɪ/ - enjoy squalid	[əndʒɔɪ+skwaɪld]	[endʒɔɪskwalɪd]	[əndʒɔɪəskwɑlɪd]
/t/ - eat squash	[i:tskwaʃ]	[i:təskwɑʃ]	[i:təskwɑʃ]
/d/ - hundred square	[hʌndrədəskwɛr]	[hʌndrədəskwɛrs]	[hʌndrəskwɛr]
/ŋ/ - strong squall	[strɔŋ skwal]	[strɔŋ skwɔl]	[strɔŋ əskwɔl]
/tʃ/ - peach squash	[pitʃskwatʃ]	[pitʃskwaʃ]	[pitʃəskwɑʃ]
/dʒ/-Village squatters	[bɪlɪdʒskwʌtərs]	[vɪlədʒəskwatərs]	[vɪleɪdʒskwɔtər]
/ø/ - Squirrels	[skwərels]	[skwərəls]	[skwɪrəls]
/ø/ - Squeeze	[skwisi]	[skwis]	[əskwi:s]
/ø/ - Squid	[skwid]	[skwid]	[əskwaɪ]

/skr/ Clusters

	Participant 4	Participant 5	Participant 6 .
/i/ - me scratch	[mi:skratʃ]	[mi:skratʃ]	[mi:skrɛtʃ]
/oʊ/ - low scrub	[loʊskrʌb]	[loʊskrʌb]	[loʊskrʌb]
/aɪ/ - I scrabbled	[aɪskrabəl]	[aɪskrabled]	[aɪəskrɛb]
/aʊ/- how scrupulous	[haʊskrupələs]	[haʊskrʌpələs]	[haʊəskrʌpuləs]
/ɔɪ/ - boy screamed	[bɔɪskri:m]	[bɔɪskri:m]	[bɔɪəskrəm]
/p/-hope screenwriters	[hoʊpskrinraɪtərs]	[hoʊpəskrinraɪtərs]	[hɔpəskrinraɪtərs]
/d/ - should scram	[ʃʊdskrʌm]	[ʃʊdskri:m]	[ʃoʊəskrɑm]
/n/ - been scraped	[binskrapt]	[binəskrɑpəd]	[bɪnəskreɪpt]
/tʃ/ - such screening	[sʌtʃskri:nɪŋ]	[sʌtʃskri:nɪŋ]	[sʌtʃəskri:nɪŋ]
/dz/- huge scrapbook	[hjudʒəskrapbuk]	[hjuskrapbʊk]	[udʒəskrɛpbʊk]
/ø/ - Scratch	[skratʃ]	[skɑts]*	[əskrɛtʃ]
/ø/ - Scrambled	[skramb]	[skrembled]	[əskrɛmbd]
/ø/ - Scrawny	[skraʊni]	[skrɔnɪŋ]	[əskroʊni]

Sentences produced by Argentine participants 7, 8 and 9.

/sp/ Clusters

	Participant 7	Participant 8	Participant 9 .
/i/ - He speaks	[hi:spi:ks]	[hi:spi:ks]	[hi:spi:ks]
/eɪ/ - They spoilt	[deɪspɔilt]	[deɪspɔilt]	[ðeɪəspɔilt]
/oʊ/ - No spitting	[noʊspaɪtɪŋ]	[noʊspi:tɪŋ]	[noʊəspi:tɪŋ]
/aɪ/ - my spouse	[maɪspoʊs]	[maɪspaʊs]	[maɪspoʊs]
/ju/ - you spell	[juspɛl]	[juspɛl]	[juspɛl]
/t/ - not speed	[n ɔtspi:d]	[n ɔtspi:d]	[n ɔtspi:d]
/s/ - famous speech	[feɪməspi:tʃ]	[feɪmusəspi:tʃ]	[feɪməspi:tʃ]
/d/ - David specially	[deɪvɪdəspɛʃəli]	[deɪvɪdspɛʃəli]	[deɪvɪdəspɛʃɪəli]
/ŋ/ - sang spectacular	[saŋspektɛkjular]	[sɛŋəspɛktɛkjular]	[sɛŋspɛktɛkjular]
/dʒ/ - huge spider	[hjudʒspaɪdər]	[hjudʒspaɪdər]	[hjudʒspaɪdər]
/ø/ - Speak	[spi:k]	[spi:k]	[spi:k]
/ø/ - Sports	[əspɔrts]	[spɔrts]	[spɔrts]
/ø/ - Spaghetti	[spagɛti]	[spagɛti]	[əspagɛɾi]

/st/ Clusters

	Participant 7	Participant 8	Participant 9 .
/eɪ/ - may stay	[meɪsteɪ]	[meɪsteɪ]	[meɪsteɪ]
/oʊ/ - No standing	[noʊsɛndɪŋ]*	[noʊstɛndɪŋ]	[noʊsɛndɪŋ]*
/u/ - too stubborn	[tʃuəstʌbɔrn]	[tʃustʌbɔrn]	[tʃuəstʌbɔrn]
/ə/ - to study	[tʃustʌdi]	[tʃustʌdi]	[tʃustʌdi]
/aɪ/ - My staff	[maɪstaf]	[maɪstaf]	[maɪəstɑf]
/t/ - get stuck	[gɛtəstʌk]	[gɛtstʌk]	[gɛtstʌk]
/b/ - Bob steals	[bɔbsti:ls]	[bɔbəsti:ls]	[bɔbəsti:ls]
/m/ - I'm starving	[aɪməstɑrvɪŋ]	[aɪmstɑrvɪŋ]	[aɪməstɑrvɪŋ]
/tʃ/ - such still	[sʌtʃsti:l]	[sʌtʃəsti:l]	[sʌtʃəsti:l]
/dʒ/ - judge stood	[dʒudʒəstʊd]	[dʒʌdʒəstud]	[dʒʌdʒstʊd]
/ø/ - Students	[stjudənts]	[stjudənts]	[əstjudənts]
/ø/ - Stains	[steɪns]	[steɪns]	[əsteɪns]
/ø/ - Stop	[stɔp]	[əstɔp]	[stɔp]

/sk/ Clusters

	Participant 7	Participant 8	Participant 9 .
/u/- do skateboarding	[duskeɪtbɔrdɪŋ]	[duəskeɪtbɔrdɪŋ]	[duskeɪtbɔrdɪŋ]
/ə/ - the sky	[deskaɪ]	[ðəskaɪ]	[ðəskaɪ]
/ə/ - A skunk	[ɛskʌnk]	[eɪəskʌnk]	[əskʌnk]
/aɪ/ - guy skin	[gaɪskin]	[guɪəskin]	[gaɪskin]
/aʊ/ - cow skipped	[kaʊəskaɪpt]	[kaʊəskipt]	[kaʊəskipt]
/k/ - bike skidded	[baikskɪdəd]	[baikəskɪd]	[baikskɪdəd]
/b/ - Bob skimps	[bɔbəskɪmps]	[bɔbəskɪmps]	[bɔbskɪmps]
/m/ - Sam skinned	[saməski:n]	[sɛməskind]	[sɛmski:nd]
/tʃ/ - Which ski	[witʃskaɪ]	[witʃkaɪ]*	[witʃski:]
/dʒ/ - huge skirt	[hjudʒskərt]	[hjudʒskərt]	[hjudʒskərt]
/ø/ - Skiing	[əski:ŋ]	[ski:ŋ]	[ski:ŋ]
/ø/ - Skates	[skeɪts]	[skeɪts]	[əskeɪts]
/ø/ - Skirts	[skərts]	[skərts]	[skərts]

/sw/ Clusters

	Participant 7	Participant 8	Participant 9 .
/i/ - He sweats	[hi:swɛts]	[hi:swɛts]	[hi:swɛts]
/ə/ - A swear	[ɛswɛr]	[əswɛr]	[əswɛr]
/aɪ/ - My sweets	[maɪswi:ts]	[maɪswi:ts]	[maɪswi:ts]
/aʊ/ - now swear	[naʊswɛr]	[naʊswɛr]	[naʊswɛr]
/ɔɪ/ - boy swept	[bɔɪswɛpt]	[bɔɪswɛpt]	[bɔɪswɛpt]
/p/ - Stop swanking	[stopswankɪŋ]	[stɔpswankɪŋ]	[stɔpswankɪŋ]
/f/ - wife swept	[waɪfswɛpt]	[waɪfswɛpt]	[waɪfswɛpt]
/b/ - Bob swims	[bɔbswims]	[bɔbswims]	[bɔbswɪms]
/ŋ/ - long swallow	[loŋswɔloʊ]	[loŋswaloʊ]	[loŋswaloʊ]
/tʃ/ - Which sweater	[witʃswɛtər]	[witʃswɛtər]	[witʃswɛtər]
/ø/ - Sweets	[swi:ts]	[swi:ts]	[swi:ts]
/ø/ - Swampy	[swʌmpi]	[swampi]	[swampi]
/ø/ - Switch	[switʃ]	[switʃ]	[swɪtʃ]

/sm/ **Clusters**

	Participant 7	Participant 8	Participant 9 .
/i/ - see smugglers	[si:smʌglərs]	[si:smʌglərs]	[si:smʌglər]
/i/ - She smashed	[ʃi:smaʃt]	[ʃi:smɛʃt]	[ʃi:smɛʃt]
/oʊ/ - No smoking	[noʊsmoʊkɪŋ]	[noʊsmoʊkɪŋ]	[noʊsmoʊkɪŋ]
/ə/ - a small	[əsmɔl]	[əsmɔl]	[əsmɔl]
/ɔɪ/ - coy smile	[kɔɪəsmaɪl]	[kɔɪsmaɪl]	[kɔɪsmaɪl]
/k/ - look smart	[luksmɑrt]	[lʊkəsmɑrt]	[lʊkəsmɑrt]
/s/ - its smog	[ɪtsmɔg]	[ɪtsəsmɔg]	[ɪtsmɔg]
/d/ - dad smacked	[dædəsmækt]	[dɛdəsmɛkt]	[dædsmɛkt]
/ŋ/ - making small	[meɪkɪŋsmol]	[meɪkɪŋəsmɔl]	[meɪkɪŋsmɔl]
/dʒ/ - huge smudges	[hjudʒsmʌdʒəs]	[hjudʒsmʌdʒəs]	[hjudʒsmʌdʒəs]
/ø/ - Smart	[smart]	[smart]	[əsmart]
/ø/ - Smile	[smail]	[smail]	[smail]
/ø/ - Smoking	[smoʊkɪŋ]	[smoʊkɪŋ]	[smoʊkɪŋ]

/sn/ **Clusters**

	Participant 7	Participant 8	Participant 9 .
/i/ - Lee snores	[li:sn ɔrs]	[li:n ɔrs]*	[li:əsn ɔrs]
/eɪ/ - They sneezed	[ðeɪsni:zd]	[ðeɪsni:st]	[ðeɪəsni:zd]
/aɪ/ - My snake's	[maɪəsneɪks]	[maɪsneɪks]	[maɪəsneɪks]
/aʊ/ - How snobbish	[haʊsnobɪʃ]	[haʊsn ɔbɪʃ]	[haʊəsn ɔbɪʃ]
/ɔɪ/ - enjoy snuggling	[əndʒɔɪsnʌglɪŋ]	[əndʒɔɪsnʌglɪŋ]	[əndʒɔɪsnʌglɪŋ]
/p/ - stop snowing	[stɔpsnoʊɪŋ]	[stɔpsnoʊɪŋ]	[stɔpsnoʊɪŋ]
/s/ - delicious snacks	[deliʃəsəsnæks]	[deliʃəsnæks]	[deliʃəs+əsnæks]
/b/ - Bob sneaked	[bɔbəsni:kt]	[bɔbsni:kt]	[bɔbsni:kt]
/m/ - game snakes	[geɪmsneɪks]	[geɪmsneɪks]	[geɪməsneɪk]
/dʒ/ - huge snack	[hjudʒsnak]	[hjudʒsnɛk]	[hjudʒsnɛk]
/ø/ - Snobbish	[snobɪʃ]	[sn ɔbɪʃ]	[sn ɔbɪʃ]
/ø/ - Snorkeling	[sn ɔrkəlɪŋ]	[sn ɔrkəlɪŋ]	[sn ɔrkəlɪŋ]
/ø/ - Snoozing	[snusiŋ]	[snusɪŋ]	[snusɪŋ]

/sl/ Clusters

	Participant 7	Participant 8	Participant 9 .
/i/ - many slang	[mɛnislaŋ]	[mɛnislaŋ]	[mɛnislɛŋ]
/eɪ/ - They sleep	[deɪsli:p]	[deɪsli:p]	[deɪəsli:p]
/oʊ/ - Jo slowly	[dʒoʊsloʊli]	[dʒoʊsloʊli]	[dʒoʊsloʊli]
/u/ - Sue slapped	[suəslæpt]	[suəslɛpt]	[sueslɛpt]
/ɔɪ/ - boy sliced	[bɔɪslaɪst]	[bɔɪslaɪst]	[bɔɪslaɪst]
/k/ - black sleeping	[blaksli:pɪŋ]	[blɛksli:pɪŋ]	[blɛksli:pɪŋ]
/f/ - Jeff slandered	[dʒɛfəslandər]	[dʒɛfəslʌndərd]	[dʒɛfslandərɪd]
/d/ - Ted sloshed	[tɛdsl oʃt]	[tɛdl ɔʃt]*	[tɛdsl ɔʃt]
/n/ - been sleeping	[bɪnəsli:pɪŋ]	[bɪnsli:pɪŋ]	[bɪnəsli:pɪŋ]
/dʒ/ - huge slammer	[hjudʒslamər]	[hjudʒslɛmər]	[hjudʒlɑmər]*
/ø/ - Slim	[əslɪm]	[slɪm]	[slɪm]
/ø/ - Slight	[slaɪt]	[slaɪt]	[slaɪt]
/ø/ - Slippery	[slɪperi]	[slɪpəri]	[slɪpəri]

/spr/ Clusters

	Participant 7	Participant 8	Participant 9 .
/i/ - We sprayed	[wi:spreid]	[wi:spreid]	[wi:spreid]
/eɪ/ - They sprawled	[ðeɪsproled]	[ðeɪsprɔld]	[ðeɪsprɔld]
/oʊ/ - so spry	[soʊspri:]	[soʊspraɪ]	[soʊəspraɪ]
/ɔɪ/- enjoy springtime	[əndʒɔɪsprɪŋtaɪm]	[əndʒɔɪsprɪŋtaɪm]	[ɪndʒɔɪəsprɪŋtaɪm]
/ju/ - you spread	[jusprɛd]	[jusprɛd]	[jusprɛd]
/k/ - Jack sprained	[dʒækspreind]	[dʒɛkspreind]	[dʒɛkəspreind]
/g/ - Meg sprinted	[megsprɪntəd]	[mɛgəsprɪntəd]	[mɛgəsprɪntəd]
/m/ - Jim sprinkled	[dʒɪməspri:nkləd]	[dʒɪmsprinkəld]	[dʒɪmsprinkəld]
/tʃ/ - Each spring	[i:tʃspri:ŋ]	[i:tʃsprɪŋ]	[i:tʃəsprɪŋ]
/dʒ/-village sprawled	[vɪlɪdʒsprold]	[vɪlɪdʒsəsprɔld]	[vɪlɪdʒspɔld]*
/ø/ - Spread	[sprɛd]	[sprɛd]	[sprɛd]
/ø/ - Sprinters	[əsprɪnters]	[sprɪnters]	[sprɪnters]
/ø/ - Spring	[əsprɪŋ]	[sprɪŋ]	[əsprɪŋ]

/spl/ **Clusters**

	Participant 7	Participant 8	Participant 9 .
/i/ - She splashed	[ʃi:splaʃt]	[ʃi:splɛʃt]	[ʃi:splɛʃt]
/eɪ/ - motorway splits	[motorweɪsplɪts]	[mɔtorweɪsplɪts]	[mɔtorweɪəsplɪts]
/a/ - Tina splurged	[tinasplərdʒed]	[tinasplərdʒd]	[tinasplərdʒd]
/oʊ/ - so splenetic	[soʊsplenetɪk]	[soʊsplənɛtɪk]	[soʊsplənɛtɪk]
/u/ - do splendid	[dusplendɪd]	[duəsplendɪd]	[duəsplendɪd]
/t/ - wrote splendid	[roʊtəsplɛndɪd]	[roʊtəsplɛndɪd]	[roʊtsplɛndɪd]
/b/ - bib split	[bi:bspli:t]	[bi:bsplɪt]	[bi:bsplɪt]
/n/ - Brian spliced	[braɪənsplaɪst]	[braɪənsplɪst]	[braɪənsplaɪst]
/tʃ/ - Which split	[witʃspli:t]	[witʃspli:t]	[witʃəspli:t]
/dʒ/ - huge split	[hjudʒsplɪt]	[hjudʒplɪtʃ]*	[hjudʒəsplɪt]
/ø/ - Splitting	[s+pli:tɪŋ]	[spli:tɪŋ]	[spli:tɪŋ]
/ø/ - Splendid	[splendɪd]	[splendɪd]	[splendɪd]
/ø/ - Splashy	[əsplɛʃi]	[splɛʃi]	[splɛʃi]

/str/ **Clusters**

	Participant 7	Participant 8	Participant 9 .
/eɪ/ - say strange	[seɪstreŋ]	[seɪəstrɛŋ]	[seɪstrɛndʒ]
/oʊ/ - go straight	[goʊstreɪt]	[goʊstreɪt]	[goʊstreɪt]
/oʊ/ - Jo struggles	[dʒoʊəstrʌgls]	[dʒoʊəstrʌgəls]	[dʒoʊstrʌgəls]
/u/ - too strangely	[tuəstrændʒəli]	[tuəstrendʒli]	[tuəstreɪndʒli]
/aɪ/ - My strategy	[maɪstrɛtədʒi]	[maɪstrɛtedʒi]	[maɪstrɛtedʒi]
/t/ - Eight streets	[eitəstri:t]	[eitstri:ts]	[eitəstri:ts]
/s/ - Loose strands	[lusəstrænds]	[lustrɛnds]*	[lusəstrands]
/d/ - bed straight	[bɛdəstreit]	[bɛdəstreit]	[bɛdstrei]
/n/ - Brendon strode	[brendonəstroʊd]	[brendonstroʊd]	[brendənstroʊd]
/tʃ/- such stress	[sʌtʃstrɛs]	[sʌtʃstrɛs]	[sʌtʃstrɛs]
/ø/ - Strawberries	[strɔbɛris]	[strɔbɛris]	[strɔbɛris]
/ø/ - Strict	[strɪk]	[strɪk]	[əstrɪkt]
/ø/ - Stray	[straɪ]	[əstreɪ]	[streɪ]

/skw/ Clusters

	Participant 7	Participant 8	Participant 9 .
/i/ - He squashed	[hi:əskwɔʃt]	[hi:skwɑʃt]	[hi:əskwæʃt]
/oʊ/ - No squads	[soʊskwads]	[noʊskwɔds]	[noʊəskwɑds]
/u/ - blue square	[bluəskwɛr]	[bluskwɛr]	[bluəskwɑr]
/aɪ/ - guy squeezed	[guɪəskwi:zd]	[gaɪəskwi:zd]	[gaɪskwi:zd]
/ɔɪ/ - enjoy squalid	[əndʒɔɪəskwalɪd]	[əndʒɔɪskwɔlɪd]	[əndʒɔɪskwɔlɪd]
/t/ - eat squash	[i:təskwʌʃ]	[i:təskwɑʃ]	[i:tskwɑʃ]
/d/ - hundred square	[hʌndrədəskwɛr]	[hʌndrədskwɛr]	[hʌndrədskwɛr]
/ŋ/ - strong squall	[strɔŋəskwɑl]	[strɔŋ skwɔl]	[strɔŋ skwɔl]
/tʃ/ - peach squash	[pitʃskwaʃ]	[pi:tʃəskwɑʃ]	[pi:tʃskwɑʃ]
/dʒ/-Village squatters	[vɪlɪdʒ+skwʌtərs]	[vɪlɪdʒskwɔtərs]	[vɪlɪdʒkwɔtər]*
/ø/ - Squirrels	[skwɪrəls]	[skwərls]	[skwɪrls]
/ø/ - Squeeze	[skwi:z]	[əskwi:z]	[skwi:z]
/ø/ - Squid	[əskwi:d]	[əskwɪd]	[əski:]*

/skr/ Clusters

	Participant 7	Participant 8	Participant 9 .
/i/ - me scratch	[mi:skratʃ]	[mi:skrɛtʃ]	[mi:əskrɑtʃ]
/oʊ/ - low scrub	[loʊskrʌb]	[loʊskrʌb]	[loʊskrʌb]
/aɪ/ - I scrabbled	[aɪəskrɛbəld]	[aɪskrɛbəld]	[aɪskrɛbəld]
/aʊ/-how scrupulous	[haʊskrupələs]	[haʊskupələs]*	[haʊskrupələs]
/ɔɪ/ - boy screamed	[bɔɪskri:md]	[bɔɪskri:md]	[bɔɪskri:md]
/p/-hope screenwriters	[hoʊpəskri:nraɪtərs]	[hoʊpəskri:nraɪtərs]	[hoʊpskri:nraɪtərs]
/d/ - should scram	[ʃʊdskram]	[ʃʊdskram]	[ʃʊdəskrɑm]
/n/ - been scraped	[bɪnskrɛpt]	[bɪnskræpt]	[bɪnskreɪpt]
/tʃ/ - such screening	[sʌtʃskri:nɪŋ]	[sʌtʃəskri:nɪŋ]	[sʌtʃskri:nɪŋ]
/dz/-huge scrapbook	[hjudʒskrɛpbʊk]	[hjudʒskræpbʊk]	[hjudʒəskræpbʊk]
/ø/ - Scratch	[skratʃ]	[skrætʃ]	[skrætʃ]
/ø/ - Scrambled	[skrambd]	[skrɛmbləd]	[skrɛmbəld]
/ø/ - Scrawny	[skrɔni]	[skrɔni]	[skrɔni]

Sentences produced by Brazilian participants 1, 2 and 3.

/sp/ Clusters

	Participant 1	Participant 2	Participant 3 .
/i/ - He speaks	[hi:spi:ks]	[hi:ɪspi:ks]	[hi:spi:ks]
/eɪ/ - They spoilt	[ðeɪəspoilt]	[ðeɪəsplɪt]*	[deɪspoilt]
/oʊ/ - No spitting	[noʊəspaɪtɪŋ]	[noʊɪspi:tɪŋ]	[noʊɪspi:tɪŋ]
/aɪ/ - my spouse	[maɪspaʊz]	[maɪzpaʊz]	[maɪspaʊz]
/ju/ - you spell	[juspɛl]	[juspɛl]	[juspɛl]
/t/ - not speed	[n ɔtspi:d]	[n ɔtspi:d]	[n ɔtspi:d]
/s/ - famous speech	[feɪməspi:tʃ]	[feɪməsɪspi:tʃ]	[feɪməspi:tʃ]
/d/ - David specially	[deɪvɪdspɛʃɪəli]	[deɪvɪdspɛʃɪəli]	[deɪvɪdspɛʃɪəli]
/ŋ/ - sang spectacular	[sæŋspəktɛkjulər]	[sɛŋəspetɛkulər]	[sɛŋspəktɛkjulər]
/dʒ/ - huge spider	[hjugspaɪdər]	[hʌʒɪspaɪɾər]	[hjudʒspaɪdər]
/ø/ - Speak	[spi:k]	[spi:k]	[spi:k]
/ø/ - Sports	[spɔrts]	[ɪspɔrts]	[spɔrts]
/ø/ - Spaghetti	[spagɛɾi]	[spagɛɾi]	[əspagɛɾi]

/st/ Clusters

	Participant 1	Participant 2	Participant 3 .
/eɪ/ - may stay	[meɪsteɪ]	[meɪsteɪ]	[meɪsteɪ]
/oʊ/ - No standing	[noʊɪstændɪŋ]	[noʊɪstʌndɪŋ]	[noʊɪstɛndɪŋ]
/u/ - too stubborn	[tuəstərbɔrn]	[tʃuəstʌbərd]	[tʃustʌbərn]
/ə/ - to study	[təstʌdi]	[təstʌdi]	[tʃustʌdi]
/aɪ/ - My staff	[maɪstæf]	[maɪstaf]	[maɪstɛf]
/t/ - get stuck	[gɛtstʌk]	[gɛtəstʌk]	[gɛtəstʌk]
/b/ - Bob steals	[bɔbəsti:uz]	[bɔbɪsti:lz]	[bɔbsti:lz]
/m/ - I'm starving	[aɪmstɑrvɪŋ]	[aɪməstɑrvɪŋ]	[aɪməstɛrvɪŋ]
/tʃ/ - such still	[sʌtʃstʃɪu]	[sʌtʃɪstɪu]	[sʌtʃstɪu]
/dʒ/ - judge stood	[dʒʌdʒstʌd]	[dʒʌdʒəstʊd]	[dʒʌdʒəstud]
/ø/ - Students	[studənts]	[əstudən]	[stʃudənts]
/ø/ - Stains	[steins]	[əsteins]	[ɪsteins]
/ø/ - Stop	[stɔp]	[stɔp]	[stɔp]

/sk/ Clusters

	Participant 1	Participant 2	Participant 3 .
/u/- do skateboarding	[duskeitbɔrdɪŋ]	[duəskeitbɔrdɪŋ]	[duəskeitbɔrdɪŋ]
/ə/ - the sky	[deskaɪ]	[deskiː]	[deskaɪ]
/ə/ - A skunk	[anunk]*	[asʌnk]*	[əɪəskʌnk]
/aɪ/ - guy skin	[gaɪəskiːn]	[gaɪəskiːn]	[gaɪskiːn]
/aʊ/ - cow skipped	[koʊskɪpt]	[kaʊəskiːpəd]	[kaʊskiːped]
/k/ - bike skidded	[baikskiːdəd]	[baikəskiːdəd]	[baikskaɪdəd]
/b/ - Bob skimps	[bɔbskɪmps]	[bɔbəskɪmps]	[bɔbskɪmps]
/m/ - Sam skinned	[sʌmskɪnd]	[sãɪskɪn]	[samskɪned]
/tʃ/ - Which ski	[wɪtʃskaɪ]	[wɪtʃskiː]	[wɪtʃskaɪ]
/dʒ/ - huge skirt	[hjudʒskiːrt]	[hʌdʒskərt]	[hjudʒskərt]
/ø/ - Skiing	[skiːŋ]	[əskiːŋ]	[əskiːŋ]
/ø/ - Skates	[skeɪts]	[əskeɪts]	[skeɪts]
/ø/ - Skirts	[skiːrts]	[əskərts]	[skərts]

/sw/ Clusters

	Participant 1	Participant 2	Participant 3 .
/i/ - He sweats	[hiːswɛts]	[ʃiːweɪz]*	[hiːswiːts]
/ə/ - A swear	[əswɛr]	[əwɛr]*	[əswɛr]
/aɪ/ - My sweets	[maɪswiːts]	[maɪswiːts]	[maɪswiːts]
/aʊ/ - now swear	[noʊswiːr]	[noʊswɛr]	[naʊswɛr]
/ɔɪ/ - boy swept	[bɔɪswɛpt]	[bɔɪswɛpt]	[bɔɪswɛpt]
/p/ - Stop swanking	[stɔpswʌkɪŋ]	[stɔpzmoʊkɪŋ]*	[stɔpswɛŋkɪŋ]
/f/ - wife swept	[waɪfswɛpt]	[waɪfswɛpt]	[waɪfswɛptə]
/b/ - Bob swims	[bɔbswiːms]	[bɔbswiːñs]	[bɔbswiːms]
/ŋ/ - long swallow	[lɔŋswɔloʊ]	[lɔŋzweɪloʊ]	[lɔŋswɛloʊ]
/tʃ/ - Which sweater	[wɪtʃswiːɾər]	[wɪtʃswɛɾər]	[wɪtʃswɛɾər]
/ø/ - Sweets	[swiːts]	[swiːts]	[swiːts]
/ø/ - Swampy	[swʌmpi]	[swʌpi]	[swɛmpi]
/ø/ - Switch	[swɪtʃ]	[swɪtʃ]	[swɪtʃ]

/sm/ **Clusters**

	Participant 1	Participant 2	Participant 3 .
/i/ - see smugglers	[si:əzmʌgləz]	[si:ənɛngərs]*	[si:əsmʌglərz]
/i/ - She smashed	[ʃi:smɛʃt]	[ʃi:ɪzmɛʃəd]	[ʃi:smɛʃed]
/oʊ/ - No smoking	[noʊəzmoʊkɪŋg]	[noʊəzmoʊkɪŋg]	[noʊsmoʊkɪŋ]
/ə/ - a small	[əsmɔʊ]	[əzmɔʊ]	[əsmɔʊ]
/ɔɪ/ - coy smile	[kɔɪzmaɪəʊ]	[kɔɪəzmaʊ]	[kɔɪsmaɪəl]
/k/ - look smart	[lʊksmɑrt]	[lʊkəzmɑrt]	[lʊksmɑrt]
/s/ - its smog	[ɪtsmɔg]	[ɪts+sɔŋgs]*	[ɪtsmɔg]
/d/ - dad smacked	[dɛdsmeɪked]	[dædəznɛkəd]*	[dɛdsmɛked]
/ŋ/ - making small	[meɪkɪŋsmɔʊ]	[meɪkɪŋzmɔlə]	[meɪkɪŋsmɔʊ]
/dʒ/ - huge smudges	[hʌgəsmʌdʒəz]	[hʌdʒəsmʌdʒəz]	[hjudʒsmʌdʒəz]
/ø/ - Smart	[smart]	[əzmɑrt]	[əsmɑrt]
/ø/ - Smile	[smaɪəl]	[zmaɪəl]	[əzmaɪəl]
/ø/ - Smoking	[smoʊkɪŋ]	[əzmoʊk]	[smoʊkɪŋ]

/sn/ **Clusters**

	Participant 1	Participant 2	Participant 3 .
/i/ - Lee snores	[li:snɔrz]	[li:ɪznɔrz]	[li:snɔrz]
/eɪ/ - They sneezed	[ðeɪəsni:zd]	[ðeɪəzni:zəd]	[ðeɪəsni:zɪd]
/aɪ/ - My snake's	[maɪzneɪks]	[maɪəzneɪks]	[maɪsneɪks]
/aʊ/ - How snobbish	[haʊəsnɔbɪʃ]	[haʊəzn ɔbɪʃ]	[haʊsn ɔbɪʃ]
/ɔɪ/ - enjoy snuggling	[əndʒɔɪznʌglɪŋ]	[əndʒɔɪəznuglɪŋ]	[əndʒɔɪsnʌglɪŋ]
/p/ - stop snowing	[stɔpsnoʊɪŋ]	[stɔpəzmoʊkɪŋ]*	[əstɔpsnoʊɪŋ]
/s/ - delicious snacks	[delɪʃəsznæks]	[delɪʃəsəznæks]	[delɪʃəsəznæks]
/b/ - Bob sneaked	[bɔbsni:kt]	[bɔbəznɛkəd]	[bɔbsni:ked]
/m/ - game snakes	[geɪmsneɪks]	[geɪmɪznɛkəs]	[geɪmsneɪks]
/dʒ/ - huge snack	[hugsnɛk]	[rʌdʒəznɛk]	[hʌdʒsnɛk]
/ø/ - Snobbish	[sn ɔbɪʃ]	[n ɔbɪʃə]*	[sn ɔbɪʃ]
/ø/ - Snorkeling	[sn ɔrkɛlɪŋ]	[əzn ɔrkəlɪŋ]	[sn ɔrklɪŋ]
/ø/ - Snoozing	[znuzɪŋ]	[əznuzɪŋ]	[snuzɪŋ]

/sl/ **Clusters**

	Participant 1	Participant 2	Participant 3 .
/i/ - many slang	[mɛnizlæŋgz]	[mɛnizlæŋg]	[mɛnizlæŋg]
/eɪ/ - They sleep	[ðeɪzli:p]	[ðeɪəzlɛp]	[ðeɪzli:p]
/oʊ/ - Jo slowly	[dʒoʊəsloʊli]	[dʒoʊəzloʊli]	[dʒoʊəsloʊli]
/u/ - Sue slapped	[suəzlæpəd]	[suəleɪpəd]*	[suəslɛpɪd]
/ɔɪ/ - boy sliced	[bɔɪəzlaɪsəd]	[bɔɪəzlaɪsəd]	[bɔɪslaɪsədə]
/k/ - black sleeping	[blækslæpɪŋ]	[blækəzli:pɪŋ]	[blækəsli:pɪŋ]
/f/ - Jeff slandered	[dʒɛfslɛndərd]	[dʒɛfæzərd]*	[dʒɛfslɛndərəd]
/d/ - Ted sloshed	[tɛdsl ɔʃt]	[tɛdzlʌʃəd]	[tɛdsl ɔʃed]
/n/ - been sleeping	[bɪnsli:pɪŋ]	[bɪnəzli:pɪŋ]	[bɪnzli:pɪŋ]
/dʒ/ - huge slammer	[hʌgəzlʌmər]	[hʌdʒəzlɛmər]	[hjudʒslæmər]
/ø/ - Slim	[slɪm]	[ɪzli:m]	[əslɪm]
/ø/ - Slight	[slaɪt]	[əzlaɪt]	[slaɪt]
/ø/ - Slippery	[slɪpəri]	[əzlaɪpəri]	[slɪpəri]

/spr/ **Clusters**

	Participant 1	Participant 2	Participant 3 .
/i/ - We sprayed	[wi:spreɪd]	[wi:spreɪd]	[wi:spreɪed]
/eɪ/ - They sprawled	[ðeɪsprɔld]	[ðeɪəspreɪəld]	[deɪəsprɔlɪd]
/oʊ/ - so spry	[soʊəspreɪ]	[soʊəspraɪ]	[soʊəspraɪ]
/ɔɪ/- enjoy springtime	[endʒɔɪsprɪŋtaɪm]	[endʒɔɪsprɪŋtaɪm]	[endʒɔɪsprɪŋtaɪm]
/ju/ - you spread	[juəsprɛd]	[juəsprɛd]	[jusprɛd]
/k/ - Jack sprained	[dʒækspreɪnd]	[dʒækspreɪned]	[dʒækspreɪnəd]
/g/ - Meg sprinted	[mɛgsprɪntəd]	[mɛgəsprɪntəd]	[mɛgsprɪntəd]
/m/ - Jim sprinkled	[dʒi:mskri:mbled]*	[dʒɪməsprɪŋkəd]	[dʒɪmsprɪŋkəld]
/tʃ/ - Each spring	[i:tʃsprɪŋ]	[i:tʃəsprɪŋ]	[i:tʃsprɪŋ]
/dʒ/-village sprawled	[vɪlɪdʒəsprɔləd]	[vɪlɪdʒəsprɔwə]	[vɪlɪdʒsprɔləd]
/ø/ - Spread	[spri:dəd]	[əsprɛd]	[sprɛd]
/ø/ - Sprinters	[sprɪntərz]	[əsprɪntərz]	[sprɪntəz]
/ø/ - Spring	[sprɪŋ]	[əsprɪŋ]	[sprɪŋgə]

/spl/ **Clusters**

	Participant 1	Participant 2	Participant 3 .
/i/ - She splashed	[ʃi:splæʃt]	[ʃi:ʃplɛʃəd]*	[ʃi:splæʃəd]
/eɪ/ - motorway splits	[mɔtərweɪspli:ts]	[motorweɪsplɪts]	[motorweɪəsplɪts]
/a/ - Tina splurged	[tʃi:nasplərdʒ]	[tinasplurʒəd]	[taɪnaəsplʌrdʒ]
/oʊ/ - so splenetic	[soʊsplənɛtɪk]	[soʊəsplɛnətʃɪk]	[soʊəsplənɛtɪk]
/u/ - do splendid	[duəsplɛndɪd]	[ðeɪəspreɪdəd]*	[duəsplɛndɪd]
/t/ - wrote splendid	[roʊtsplɛndɪd]	[roʊtəsplɛndɪd]	[roʊtəsplɛndɪd]
/b/ - bib split	[bi:bspli:tə]	[bɪbəsplɪt]	[bi:bəspli:t]
/n/ - Brian spliced	[braɪənsplaɪst]	[braɪənspli:səd]	[braɪənsplaɪsed]
/tʃ/ - Which split	[witʃspli:t]	[witʃəspli:ts]	[witʃspli:t]
/dʒ/ - huge split	[hjugsplɪt]	[hʌʒəspli:t]	[hjudʒsplɪt]
/ø/ - Splitting	[splaɪtɪŋ]	[əsplɪntɪŋ]	[splɪɾɪŋ]
/ø/ - Splendid	[splendɪd]	[əsplɛndɪd]	[splɛndɪd]
/ø/ - Splashy	[splɛʃi:]	[əsplɛʃ]	[əsplɛʃi]

/str/ **Clusters**

	Participant 1	Participant 2	Participant 3 .
/eɪ/ - say strange	[seiəstrændʒ]	[seiəstrɛŋʒ]	[seistreɪndʒ]
/oʊ/ - go straight	[goʊəstreɪt]	[goʊəstreɪt]	[goʊstreɪt]
/oʊ/ - Jo struggles	[dʒoʊəstrʌgləz]	[soʊəstrʌŋgləz]	[dʒoʊstrʌgləz]
/u/ - too strangely	[tʃuəstrʌndʒəli]	[tʃuəstrɛŋgli]	[tʃustrɛndʒəli]
/aɪ/ - My strategy	[maɪstrɛtədʒi]	[maɪəstrɛtədʒi]	[maɪstrɛtədʒi]
/t/ - Eight streets	[eɪtstri:ts]	[eɪtəstri:ts]	[eɪtstri:ts]
/s/ - Loose strands	[lu:zstrɛndz]	[lu:səstrɛndz]	[lu:zstrɛndz]
/d/ - bed straight	[bɛdstreɪt]	[bɛdəstreɪt]	[bɛdstreɪt]
/n/ - Brendon strode	[brɛndənstroʊd]	[brɛndənəstroʊd]	[brɛndənəstroʊd]
/tʃ/- such stress	[sʌtʃstrɛs]	[sʌtʃstrɛs]	[sʌtʃstrɛs]
/ø/ - Strawberries	[strɔbɛri:z]	[əstrɔbəri:z]	[əstrɔbəri:z]
/ø/ - Strict	[strɪkt]	[əstrɪkt]	[strɪkt]
/ø/ - Stray	[streɪ]	[əstreɪ]	[streɪ]

/skw/ **Clusters**

	Participant 1	Participant 2	Participant 3 .
/i/ - He squashed	[hi:əskwɛʃt]	[ʃi:ʃkwɛʃəd]*	[hi:əskwɛʃɪd]
/oʊ/ - No squads	[noʊəskwædz]	[noʊəskwadz]	[noʊəskwɛdz]
/u/ - blue square	[bluəskwɛr]	[bluskwɛr]	[bluskwɛr]
/aɪ/ - guy squeezed	[gaɪskwi:zd]	[gaɪəskwi:zəd]	[gaɪskwi:zəd]
/ɔɪ/ - enjoy squalid	[əndʒɔɪskwɑlɪd]	[əndʒɔɪəskwalɪd]	[əndʒɔɪəskwɛlɪd]
/t/ - eat squash	[i:tsplæʃ]*	[i:təskwɛʃ]	[i:tskwɛʃ]
/d/ - hundred square	[hʌndrədskwɛr]	[hʌndrədəskwɛr]	[hʌndrədskwɛr]
/ŋ/ - strong squall	[strɔŋskwɔʊ]	[strɔŋgəskwɛʊ]	[strɔŋskwɔʊ]
/tʃ/ - peach squash	[pi:tʃskwɛʃ]	[pi:tʃəskwɛʃ]	[pi:tʃəskwɛʃ]
/dʒ/-Village squatters	[vɪlɪdʒəskwɛɾərz]	[vɪlɪdʒəskwatərz]	[vɪlɪdʒskweɪtərz]
/ø/ - Squirrels	[skwɪrəʊz]	[skwi:reʊz]	[skwɪrəʊz]
/ø/ - Squeeze	[skwi:z]	[əskwi:z]	[skwi:z]
/ø/ - Squid	[skwɪd]	[əskwi:d]	[skwɪd]

/skr/ **Clusters**

	Participant 1	Participant 2	Participant 3 .
/i/ - me scratch	[mi:skrɛtʃ]	[mi:əzkrɛʃ]	[mi:skrɛtʃ]
/oʊ/ - low scrub	[loʊəskrʌmb]	[lɔəskrʌb]	[loʊəskrʌb]
/aɪ/ - I scrabbled	[aɪskrɛbəld]	[aɪəskreɪbəld]	[aɪskrɛbəld]
/aʊ/- how scrupulous	[haʊəskrupəloʊz]	[haʊəskrupəluz]	[haʊəskrʌpələz]
/ɔɪ/ - boy screamed	[bɔɪəskri:md]	[bɔɪəskri:məd]	[bɔɪəskri:md]
/p/-hope screenwriters	[hoʊpskri:nraɪtərz]	[hoʊpəskri:nraɪtərz]	[hoʊpskri:nraɪtəz]
/d/ - should scram	[sʊdkræm]*	[ʃudskri:m]	[ʃudskrɛm]
/n/ - been scraped	[bɪnskrɛpt]	[bɪnəskreɪpəd]	[bɪnskrɛped]
/tʃ/ - such screening	[sʌʃəskri:mɪŋ]	[sʌtʃəskri:nɪŋ]	[sʌtʃskri:nɪŋ]
/dz/ - huge scrapbook	[hjudʒskrɛpbʊk]	[hʌdʒəskreɪpbʊk]	[hjudʒəskræpbʊk]
/ø/ - Scratch	[skrætʃ]	[əskratʃ]	[skrætʃ]
/ø/ - Scrambled	[skrʌmbəld]	[əskrɛmbəld]	[skrɛmbəld]
/ø/ - Scrawny	[skrɔni]	[əskrʌni]	[skrɔni]

Sentences produced by Brazilian participants 4, 5 and 6.

/sp/ Clusters

	Participant 4	Participant 5	Participant 6 .
/i/ - He speaks	[hi:spi:ks]	[hi:əspi:ks]	[hi:spi:ks]
/eɪ/ - They spoilt	[deɪspoɪt]	[ðeɪəspɔləd]	[ðeɪspɔɪəlt]
/oʊ/ - No spitting	[noʊɪspi:tɪŋ]	[noʊɪsplɪtɪŋ]*	[noʊəspɪtɪŋ]
/aɪ/ - my spouse	[maɪspoʊz]	[maɪspoʊz]	[maɪspaʊz]
/ju/ - you spell	[juspɛl]	[juspɛl]	[juspɛl]
/t/ - not speed	[n ɔtspi:d]	[n ɔtspi:d]	[n ɔtspi:d]
/s/ - famous speech	[feɪməspi:tʃ]	[feɪməspi:tʃ]	[feɪməspi:ʃ]
/d/ - David specially	[deɪvədəspɛʃɪəli]	[deɪvədispɛʃəli]	[deɪvədəspɛʃəli]
/ŋ/ - sang spectacular	[sʌŋəspetakulər]	[sɛŋəspəktakular]	[sɛŋəspektɛkular]
/dʒ/ - huge spider	[rʌdʒspaɪdər]	[hjudʒspi:dər]	[hjuʒspaɪdər]
/ø/ - Speak	[spi:k]	[əspi:k]	[spi:k]
/ø/ - Sports	[spɔrts]	[spɔrts]	[spɔrts]
/ø/ - Spaghetti	[spəgɛɾi]	[spəgɛɾi]	[spəgɛɾi]

/st/ Clusters

	Participant 4	Participant 5	Participant 6 .
/eɪ/ - may stay	[meɪsteɪ]	[meɪsteɪ]	[meɪəsteɪ]
/oʊ/ - No standing	[noʊəstænd]	[noʊəstɛndɪŋ]	[noʊəstændɪŋ]
/u/ - too stubborn	[tʃustʌbərn]	[tʃuəstʌmbɔrn]	[tʃustʌbərn]
/ə/ - to study	[tʃəstʌdi]	[tʃəstʌdi]	[tʃustʌdi]
/aɪ/ - My staff	[maɪstɛf]	[maɪstʌf]	[maɪstʌf]
/t/ - get stuck	[gɛtəstʌk]	[gɛtstʌk]	[gɛtstʌk]
/b/ - Bob steals	[bɔbsti:uz]	[bɔbəsti:ʊz]	[bɔbəsti:ʊz]
/m/ - I'm starving	[aɪæməstɑrvɪŋ]	[aɪmstɑrvɪŋ]	[aɪmstɑrvɪŋ]
/tʃ/ - such still	[sʌtʃəstɪu]	[sʌtʃəstɪu]	[sʌtʃəstɪu]
/dʒ/ - judge stood	[dʒʌdʒəstud]	[dʒʌdʒəstʌd]	[dʒʌdʒəstud]
/ø/ - Students	[studənts]	[stʌdənts]	[əstʃudənts]
/ø/ - Stains	[steins]	[ɪsteins]	[ɪstɛins]
/ø/ - Stop	[stɔp]	[stɔp]	[stɔp]

/sk/ Clusters

	Participant 4	Participant 5	Participant 6 .
/u/- do skateboarding	[duskweitbɔrdɪŋ]*	[duəskeitbɔrdɪŋ]	[duəskeitbɔrdɪŋ]
/ə/ - the sky	[deskaɪ]	[dəskaɪ]	[deskaɪ]
/ə/ - A skunk	[əɪəskʌnk]	[aʃʌk]*	[aɪskʌnk]
/aɪ/ - guy skin	[gaɪskɪn]	[gaɪəski:n]	[gaɪskɪn]
/aʊ/ - cow skipped	[kaʊskɪped]	[kaʊskɪped]	[kaʊəski:pt]
/k/ - bike skidded	[baikskɪdəd]	[baikəski:dəd]	[baikskwaɪdəd]*
/b/ - Bob skimps	[bɔbskɪmps]	[bɔbəskri:mp]*	[bɔbəskwɪmps]*
/m/ - Sam skinned	[sɛmskɪned]	[sɛmsni:ked]*	[sæməskɪnd]
/tʃ/ - Which ski	[wɪtʃski:]	[wɪtʃski:]	[wɪtʃɪskaɪ]
/dʒ/ - huge skirt	[rʌdʒstʃərtʃ]*	[hjudʒəskərt]	[hjuʒskərt]
/ø/ - Skiing	[ski:ŋ]	[si:kɪŋ]*	[ski:ŋ]
/ø/ - Skates	[skeɪts]	[əskeɪts]	[skeɪts]
/ø/ - Skirts	[ʃərts]*	[əskərts]	[skərts]

/sw/ Clusters

	Participant 4	Participant 5	Participant 6 .
/i/ - He sweats	[hi:swi:ts]	[hi:swi:ts]	[hi:swi:ts]
/ə/ - A swear	[əswi:r]	[əswɛr]	[əswɛr]
/aɪ/ - My sweets	[maɪswɛts]	[maɪswi:ts]	[maɪswi:ts]
/aʊ/ - now swear	[naʊswɛr]	[naʊswɛr]	[noʊswɛr]
/ɔɪ/ - boy swept	[bɔɪswɛpt]	[bɔɪswɛpt]	[bɔɪswɛpt]
/p/ - Stop swanking	[stɔpsweɪkɪŋ]	[stɔpsweɪkɪŋ]	[stɔpsweɪŋkɪŋ]
/f/ - wife swept	[waɪfsɛpt]*	[waɪfswɛpt]	[waɪfswɛpt]
/b/ - Bob swims	[bɔbswɪms]	[bɔbswɪms]	[bɔbswɪms]
/ŋ/ - long swallow	[lɔŋzwɔloʊ]	[lɔŋswɛloʊ]	[lɔŋswɛloʊ]
/tʃ/ - Which sweater	[wɪtʃswi:ɾər]	[wɪtʃswɛɾər]	[wɪʃswɛɾər]
/ø/ - Sweets	[swi:ts]	[swi:ts]	[swi:ts]
/ø/ - Swampy	[swɛmpi]	[swʌmpi]	[sweɪmpi]
/ø/ - Switch	[swɪtʃ]	[swɪtʃ]	[swɪtʃ]

/sm/ **Clusters**

	Participant 4	Participant 5	Participant 6 .
/i/ - see smugglers	[si:əzmʌglərz]	[si:ɪzmʌgərɪz]	[si:zmʌgəlz]
/i/ - She smashed	[ʃi:əzmɛʃed]	[ʃi:əzmɛtʃez]	[ʃi:zmɛʃ]
/oʊ/ - No smoking	[noʊəzmoʊkɪŋ]	[noʊəzmoʊkɪŋ]	[noʊzmoʊkɪŋ]
/ə/ - a small	[əzmɔʊ]	[əzmɔʊ]	[əzmɔʊ]
/ɔɪ/ - coy smile	[kɔpsmaɪəu]	[kɔɪɪzmaɪəl]	[kɔɪzmaɪəu]
/k/ - look smart	[lʊksmɑrt]	[lʊksmɑrt]	[lʊkzmɑrt]
/s/ - its smog	[ɪtsmɔg]	[ɪtsmɔg]	[ɪtsmɔg]
/d/ - dad smacked	[dædzmeɪked]	[dɛdsmɛtʃəd]	[dædzmɛked]
/ŋ/ - making small	[meɪkɪŋzmɔʊ]	[meɪkɪŋsmɔʊ]	[meɪkɪŋsmɔʊ]
/dʒ/ - huge smudges	[rʌdʒəzmʌdʒəz]	[hʌdʒəsdʌdʒoʊ]*	[hjuʒəzmʌgəlz]
/ø/ - Smart	[smɑrt]	[əzmɑrt]	[smɑrt]
/ø/ - Smile	[zmaɪəu]	[əzmaɪəl]	[smaɪəu]
/ø/ - Smoking	[smoʊkɪŋ]	[əzmoʊkɪŋ]	[zmoʊkɪŋ]

/sn/ **Clusters**

	Participant 4	Participant 5	Participant 6 .
/i/ - Lee snores	[li:zn ɔrz]	[li:əzn ɔrɪz]	[li:ɪzn ɔrz]
/eɪ/ - They sneezed	[ðeɪəzni:zəd]	[ðeɪəzni:zd]	[deɪzni:zɪd]
/aɪ/ - My snake's	[maɪəzneɪks]	[maɪsneɪks]	[maɪzneɪks]
/aʊ/ - How snobbish	[haʊəzn ɔbɪʃ]	[haʊɪzn ɔbɪʃ]	[haʊzn ɔbɪʃ]
/ɔɪ/ - enjoy snuggling	[əndʒɔɪznʌglɪŋ]	[endʒɔɪɪzmʌglɪŋ]*	[əndʒɔɪznʌglɪŋ]
/p/ - stop snowing	[stɔpsnoʊɪŋ]	[əstɔpznoʊɪŋ]	[stɔpsnoʊɪŋ]
/s/ - delicious snacks	[dəlɪʃəznæks]	[delɪʃəszmæks]*	[delɪʃəsznɛks]
/b/ - Bob sneaked	[bɔbəzneɪk]	[bɔbɪzni:kt]	[bɔbznɛkt]
/m/ - game snakes	[geɪməzneɪks]	[geɪməzneɪks]	[geɪmzneɪks]
/dʒ/ - huge snack	[rʌdʒznæk]	[hjudʒznæk]	[hjudʒəsnæk]
/ø/ - Snobbish	[əzn ɔbɪʃ]	[əzn ɔbɪʃ]	[zsnoʊbɪʃ]
/ø/ - Snorkeling	[sn ɔrklɪŋ]	[əsnoʊkəlɪŋ]	[ɪzn ɔrklɪŋ]
/ø/ - Snoozing	[snoʊzɪŋ]	[əznoʊzɪŋ]	[əznuzɪŋ]

/sl/ Clusters

	Participant 4	Participant 5	Participant 6 .
/i/ - many slang	[mɛnislɛŋg]	[mɛnizlæŋg]	[mɛnizlæŋg]
/eɪ/ - They sleep	[ðeɪzli:p]	[ðeɪsli:p]	[ðeɪsli:p]
/oʊ/ - Jo slowly	[dʒoʊzloʊli]	[dʒoʊɪzloʊli]	[dʒoʊzloʊli]
/u/ - Sue slapped	[suəzlɛpəd]	[suəzlɛpəd]	[suəzleɪpt]
/ɔɪ/ - boy sliced	[bɔɪslaɪsed]	[bɔɪəzlaɪs]	[bɔɪzlaɪst]
/k/ - black sleeping	[blækzli:pɪŋ]	[blækəzli:pɪŋ]	[blɛksli:pɪŋ]
/f/ - Jeff slandered	[dʒɛfzlɛndərd]	[dʒɛfɪzlɛndərəd]	[dʒɛfəzlændərd]
/d/ - Ted sloshed	[tɛdsl ɔʃed]	[tɛdəzloʊəʃ]	[tɛdzl ɔʃ]
/n/ - been sleeping	[bi:nzli:pɪŋ]	[bɪnəzli:pɪŋ]	[bɪnsli:pɪŋ]
/dʒ/ - huge slammer	[rʌdʒəzlɛmər]	[hjudʒəzlemər]	[hjuʒzlɛmər]
/ø/ - Slim	[slɪm]	[əzlɪm]	[slɪm]
/ø/ - Slight	[zlaɪt]	[saɪt]*	[zlaɪt]
/ø/ - Slippery	[splaɪpəri]*	[ɪzlɪpər]	[slɪpəri]

/spr/ Clusters

	Participant 4	Participant 5	Participant 6 .
/i/ - We sprayed	[wi:spreɪed]	[wi:spreɪd]	[wi:spreɪd]
/eɪ/ - They sprawled	[deɪsprjuləd]	[deɪspreud]	[deɪspraʊd]
/oʊ/ - so spry	[soʊspraɪ]	[soʊspraɪ]	[soʊəspraɪ]
/ɔɪ/- enjoy springtime	[endʒɔɪsprɪŋtaɪm]	[əndʒɔɪsprɪŋtaɪm]	[endʒɔɪsprɪŋtaɪm]
/ju/ - you spread	[juəsprɛd]	[juəsprɛd]	[jusprɛd]
/k/ - Jack sprained	[dʒækspreɪned]	[dʒækspreɪnəd]	[dʒæksprɛnd]
/g/ - Meg sprinted	[mɛgəspraɪntəd]	[mɛgəsprɪntəd]	[mɛgəsprɪntəd]
/m/ - Jim sprinkled	[dʒɪməsprɪŋkləd]	[dʒɪməsprɪŋkləd]	[dʒɪməsprɪŋkəld]
/tʃ/ - Each spring	[i:tʃsprɪŋ]	[i:tʃsprɪŋ]	[i:tʃsprɪŋ]
/dʒ/-village sprawled	[vɪlɪdʒəspreɪləd]	[vɪlɪdʒəspreɪləd]	[vɪlɪʒəsprɔl]
/ø/ - Spread	[sprɛd]	[sprɛd]	[sprɛd]
/ø/ - Sprinters	[spraɪntərz]	[əspri:ntərz]	[əsprɪntərz]
/ø/ - Spring	[sprɪŋg]	[əsprɪŋgə]	[sprɪŋg]

/spl/ **Clusters**

	Participant 4	Participant 5	Participant 6 .
/i/ - She splashed	[ʃi:əsplæʃəd]	[ʃi:əsplæʃəd]	[ʃi:əsplɛʃt]
/eɪ/ - motorway splits	[motorweɪsplɪts]	[motorweɪəsplɪts]	[motorwaɪəsplɪts]
/a/ - Tina splurged	[tɪnasplurʒəd]	[tɪnaəsprəgəd]*	[tɪnaəsplərdʒəd]
/oʊ/ - so splenetic	[soʊəsplɛnət]	[soʊəsplənɛtɪk]	[soʊsplənɛtɪk]
/u/ - do splendid	[duəsplɛndɪd]	[duəspleɪndɪd]	[dusplendɪd]
/t/ - wrote splendid	[roʊtsplɛndɪd]	[roʊtəsplɛndɪd]	[roʊtəsplɛndəd]
/b/ - bib split	[bɪbspli:t]	[bi:bəspli:t]	[bɪb+splɪt]
/n/ - Brian spliced	[braɪnsplaɪsed]	[braɪənspli:st]	[braɪənsplaɪst]
/tʃ/ - Which split	[witʃspli:t]	[witʃsplɪt]	[wiʃəspli:t]
/dʒ/ - huge split	[rʌdʒsplɪt]	[hjudʒsplɪt]	[hjudʒsplɪt]
/ø/ - Splitting	[splɪtɪŋ]	[spli:ptɪŋ]	[splɪtɪŋ]
/ø/ - Splendid	[splɛndɪd]	[əspleɪndɪd]	[əsplɛndɪd]
/ø/ - Splashy	[splɛʃi]	[splɛʃi]	[splɛʃi]

/str/ **Clusters**

	Participant 4	Participant 5	Participant 6 .
/eɪ/ - say strange	[seɪstreɪndʒ]	[seɪəstrɛndʒ]	[seɪəstrændʒ]
/oʊ/ - go straight	[goʊəstreɪt]	[goʊəstreɪt]	[goʊəstreɪt]
/oʊ/ - Jo struggles	[dʒustrʌgəlz]	[dʒoʊəstrʌgləz]	[dʒoʊəstrʌgləz]
/u/ - too strangely	[tʃuəstrændʒəli]	[tuəstrɛŋgli]	[tʃuəstrɛndʒli]
/aɪ/ - My strategy	[maɪistrətɛdʒi]	[maɪstrɛtədʒi]	[maɪstrɛtədʒi]
/t/ - Eight streets	[eɪtstri:ts]	[eɪtstri:ts]	[eɪtstri:ts]
/s/ - Loose strands	[luzstrɛndz]	[lu:zəstrɛndz]	[lusəstrɛndz]
/d/ - bed straight	[bɛdstreɪt]	[bɛdəstreɪt]	[bɛdstreɪt]
/n/ - Brendon strode	[brɛndənstroʊd]	[brɛndənəstroʊd]	[brɛndənəstroʊd]
/tʃ/- such stress	[sʌtʃstrɛs]	[sʌtʃstrɛs]	[sʌtʃstrɛs]
/ø/ - Strawberries	[strɔbɛri:z]	[stroʊbɛri:z]	[stroʊbɛri:z]
/ø/ - Strict	[strɪktə]	[strɪktə]	[əstrɪkt]
/ø/ - Stray	[streɪ]	[streɪ]	[streɪ]

/skw/ Clusters

	Participant 4	Participant 5	Participant 6 .
/i/ - He squashed	[hi:skwɛʃəd]	[hi:əskwɛʃt]	[hi:skwɛʃed]
/oʊ/ - No squads	[noʊskwɛdz]	[noʊəskwɛd]	[noʊəskwɛdz]
/u/ - blue square	[bluəskwɛr]	[bluəskwɛr]	[bluskwɛr]
/aɪ/ - guy squeezed	[gaɪskwi:zd]	[gaɪskwi:zd]	[gaɪəskwi:zd]
/ɔɪ/ - enjoy squalid	[əndʒɔɪskwɑlɪdə]	[əndʒɔɪskwɑlɪd]	[əndʒɔɪəskwɛlɪd]
/t/ - eat squash	[i:tskwɛʃ]	[i:tskwɛʃt]	[i:tskwɛʃ]
/d/ - hundred square	[hʌndrədskwɛr]	[hʌndrəskɛrz]*	[hʌndrədəskwɛr]
/ŋ/ - strong squall	[strɔŋskwɔʊ]	[strɔŋgəskwɔʊ]	[strɔŋgəskwɔʊ]
/tʃ/ - peach squash	[pi:tʃəskwɛʃ]	[pi:ʃəskwɛʃt]	[pi:əʃskwɛʃ]
/dʒ/-Village squatters	[vɪlɪdʒəskwɔtərz]	[vɪlɪdʒəskərtərz]*	[vɪlɪdʒəskwɑtərz]
/ø/ - Squirrels	[skwərəʊz]	[skwɪrəʊz]	[skwɪrəʊz]
/ø/ - Squeeze	[skwi:z]	[əskwi:z]	[skwi:z]
/ø/ - Squid	[skwɪd]	[əskwi:d]	[ski:d]*

/skr/ Clusters

	Participant 4	Participant 5	Participant 6 .
/i/ - me scratch	[mi:əskrætʃ]	[mi:skɛtʃ]*	[mi:skrɛtʃ]
/oʊ/ - low scrub	[laʊskrʌb]	[loʊəskrʌb]	[loʊəskrʌbə]
/aɪ/ - I scrabbled	[aɪskreɪbəd]	[aɪskreɪbəld]	[aɪskrɛbəld]
/aʊ/- how scrupulous	[haʊəskrʌpələz]	[haʊəskrʌpəloʊz]	[haʊəskrupələz]
/ɔɪ/ - boy screamed	[bɔɪskri:med]	* not read.	[bɔɪskreɪmd]
/p/-hope screenwriters	[hoʊpskri:nraɪtərz]	[hoʊpskri:nraɪtərz]	[hoʊpəskri:nraɪtərz]
/d/ - should scram	[ʃʊdskrɛm]	[ʃudskrɛm]	[ʃʊdskræm]
/n/ - been scraped	[bɪnskreɪped]	[bɪnskrɛpt]	[bi:nəskrɛpt]
/tʃ/ - such screening	[sʌtʃəskri:nɪŋ]	[sʌtʃskri:nɪŋ]	[sʌtʃəskri:nɪŋ]
/dz/ - huge scrapbook	[rʌdʒskreɪpbʊk]	[hjudʒəskrɛpbʊk]	[hjudʒəskræpbʊk]
/ø/ - Scratch	[skrætʃ]	[skrɛtʃ]	[skrætʃ]
/ø/ - Scrambled	[skræmbəld]	[əskrɛmbəld]	[skrɛmbəld]
/ø/ - Scrawny	[skreɪni]	* not read.	[skreɪni]

Sentences produced by Brazilian participants 7, 8 and 9.

/sp/ Clusters

	Participant 7	Participant 8	Participant 9 .
/i/ - He speaks	[hi:spi:ks]	[hi:spi:ks]	[hi:spi:ks]
/eɪ/ - They spoilt	[deɪspoilt]	[deɪspɔɪlt]	[deɪəspɔɪlt]
/oʊ/ - No spitting	[noʊəspi:tɪŋ]	[noʊɪspɪt]	[noʊpɪtɪŋ]*
/aɪ/ - my spouse	[maɪəspaʊz]	[maɪspoʊz]	[maɪspoʊz]
/ju/ - you spell	[jəspɛl]	[jəspɛl]	[juspi:l]
/t/ - not speed	[n ɔtspi:d]	[n ɔtspi:d]	[n ɔtspi:d]
/s/ - famous speech	[feɪməsəspi:tʃ]	[feɪməspi:tʃ]	[feɪməspi:tʃ]
/d/ - David specially	[deɪvɪdʃpɛʃəli]*	[deɪvɪdəspɛʃəli]	[deɪvədspeʃəli]
/ŋ/ - sang spectacular	[sɛŋgəspɛtɛkulər]	[sɛŋspɛktɛkjulər]	[sʌŋəspətakulər]
/dʒ/ - huge spider	[hjudʒəspaɪdər]	[hjudʒspaɪdər]	[juʒəspaɪdər]
/ø/ - Speak	[spi:k]	[spi:k]	[spi:k]
/ø/ - Sports	[spɔrts]	[spɔrts]	[spɔrts]
/ø/ - Spaghetti	[spagɛɾi]	[spagɛɾi]	[spagɛti]

/st/ Clusters

	Participant 7	Participant 8	Participant 9 .
/eɪ/ - may stay	[meɪsteɪ]	[maɪsteɪ]	[meɪsteɪ]
/oʊ/ - No standing	[noʊəstɛndɪŋ]	[noʊəstændɪŋ]	[noʊəstɛndɪŋ]
/u/ - too stubborn	[tuəstʌbbərn]	[tʃuəstərb ɔrn]	[tustʌbɔrn]
/ə/ - to study	[tʃustʌɾi]	[tʃustʌdi]	[tʃustʌdi]
/aɪ/ - My staff	[maɪstɛf]	[maɪstʌf]	[maɪstaf]
/t/ - get stuck	[gɛtəstʌk]	[gɛtstʌk]	[gɛtstuk]
/b/ - Bob steals	[bɔbsti:uz]	[bɔbsti:lz]	[bɔbəsti:l]
/m/ - I'm starving	[aɪmstɑrvɪŋ]	[aɪmstɑrvɪŋ]	[aɪmstarvɪŋ]
/tʃ/ - such still	[sʌtʃəstɪu]	[sʌtʃstɪu]	[sʌtʃstɪl]
/dʒ/ - judge stood	[dʒudʒəstud]	[dʒʌdʒstud]	[dʒʌdʒəstud]
/ø/ - Students	[əstʃudənts]	[stʃudənts]	[studənts]
/ø/ - Stains	[steins]	[stein]	[steins]
/ø/ - Stop	[stɔp]	[stɔp]	[stɔp]

/sk/ **Clusters**

	Participant 7	Participant 8	Participant 9 .
/u/- do skateboarding	[duskeitbɔrdɪŋ]	[duskeitbɔrdɪŋ]	[duskeitebɔrdɪŋ]
/ə/ - the sky	[dəskaɪ]	[deskaɪ]	[deskaɪ]
/ə/ - A skunk	[eɪskʌnk]	[əθrʌnk]*	[aʃʌnk]*
/aɪ/ - guy skin	[gaɪskɪn]	[gaɪskɪn]	[gaɪəski:n]
/aʊ/ - cow skipped	[kaʊəski:ped]	[kɔʊski:ped]	[kaʊəski:ped]
/k/ - bike skidded	[baikskɪdəd]	[baikskaɪdəd]	[baikski:dəd]
/b/ - Bob skimps	[bɔbskɪmps]	[bɔbəskɪmps]	[bɔbski:mps]
/m/ - Sam skinned	[sæməski:ned]	[sæmskɪnd]	[sʌməski:nəd]
/tʃ/ - Which ski	[wɪtʃskaɪ]	[wɪtʃski:]	[wɪtʃskaɪ]
/dʒ/ - huge skirt	[hjudʒskərt]	[hjudʒəskərt]	[hjudʒskərt]
/ø/ - Skiing	[ski:ŋ]	[ski:ŋ]	[ski:ŋ]
/ø/ - Skates	[skeɪts]	[əskeɪts]	[steɪtəs]*
/ø/ - Skirts	[skərts]	[skərts]	[skərts]

/sw/ **Clusters**

	Participant 7	Participant 8	Participant 9 .
/i/ - He sweats	[hi:swɛts]	[hi:swɛts]	[hi:swɛts]
/ə/ - A swear	[eɪswɛr]	[əswɛr]	[əswɛr]
/aɪ/ - My sweets	[maɪswi:ts]	[maɪswi:ts]	[maɪswi:ts]
/aʊ/ - now swear	[naʊswɛr]	[naʊswɛr]	[naʊswɛr]
/ɔɪ/ - boy swept	[bɔɪsept]*	[bɔɪswɛpt]	[bɔɪswɛpt]
/p/ - Stop swanking	[stɔpswʌŋkɪŋ]	[stɔpswɔŋkɪŋ]	[stɔpswɛŋkɪŋ]
/f/ - wife swept	[waɪfswɛpt]	[waɪfswɛpt]	[waɪfswɛpt]
/b/ - Bob swims	[bɔbswɪms]	[bɔbswɪms]	[bɔbswɪms]
/ŋ/ - long swallow	[lɔŋswɔloʊ]	[lɔŋswɔloʊ]	[lɔŋswɔloʊ]
/tʃ/ - Which sweater	[wɪtʃswɛɾər]	[wɪtʃswɛɾər]	[wɪtʃswɛɾər]
/ø/ - Sweets	[swi:ts]	[swi:ts]	[swi:ts]
/ø/ - Swampy	[swʌmpi]	[swɛmpi]	[swɛmpi]
/ø/ - Switch	[swɪtʃ]	[swɪtʃ]	[swɪtʃ]

/sm/ **Clusters**

	Participant 7	Participant 8	Participant 9 .
/i/ - see smugglers	[si:smʌglərz]	[si:smʌglərz]	[si:zmuglərz]
/i/ - She smashed	[ʃi:əzmɛʃed]	[ʃi:smɛʃt]	[ʃi:əzmæʃed]
/oʊ/ - No smoking	[noʊəzmoʊkɪŋ]	[noʊəsmoʊkɪŋ]	[noʊzmoʊkɪŋ]
/ə/ - a small	[əzmɔʊ]	[əsmɔu]	[əmɔl]*
/ɔɪ/ - coy smile	[kɔ+ɪzmaɪəu]	[koʊzmaɪəu]	[kɔɪzmaɪəl]
/k/ - look smart	[lʊksmɑrt]	[lʊksmɑrt]	[lʊkzmɑrt]
/s/ - its smog	[ɪtsəsmɔg]	[ɪtsmɔg]	[ɪtsmɔg]
/d/ - dad smacked	[dɛdəzmɛked]	[dɛdsmɛkt]	[dɛdzmɛked]
/ŋ/ - making small	[meɪkɪŋsmɔʊ]	[meɪkɪŋzmɔu]	[meɪkɪŋzmɔl]
/dʒ/ - huge smudges	[hudʒəsmʌdʒəz]	[hjudʒsmʌdʒz]	[judʒəzmudʒəz]
/ø/ - Smart	[zmɑrt]	[smart]	[zmɑrt]
/ø/ - Smile	[smaɪəl]	[smaɪəu]	[əzmaɪəl]
/ø/ - Smoking	[əzmoʊkɪŋ]	[smoʊkɪŋ]	[smoʊkɪŋ]

/sn/ **Clusters**

	Participant 7	Participant 8	Participant 9 .
/i/ - Lee snores	[li:znɔrz]	[li:znoʊrz]	[li:zn ɔr]
/eɪ/ - They sneezed	[deɪəsni:zəd]	[ðeɪəzni:z]	[ðeɪəzni:zd]
/aɪ/ - My snake's	[maɪəzneɪks]	[maɪsneɪks]	[maɪəzneɪks]
/aʊ/ - How snobbish	[haʊəzn ɔbɪʃ]	[haʊəsn ɔbɪʃ]	[haʊzn ɔbɪʃ]
/ɔɪ/ - enjoy snuggling	[əndʒɔɪznʌglɪŋ]	[əndʒɔɪɪznʌglɪŋ]	[əndʒɔɪsnuglɪŋ]
/p/ - stop snowing	[əstɔpsnoʊɪŋ]	[stɔpsnoʊɪŋ]	[stɔpznoʊɪŋ]
/s/ - delicious snacks	[deli:ʃəsəznɛks]	[delɪʃəsnæks]	[delɪʃəsznɛks]
/b/ - Bob sneaked	[bɔbəzni:kəd]	[bɔbsni:kt]	[bɔbəzni:kəd]
/m/ - game snakes	[geɪm+əzneɪks]	[geɪmsneɪks]	[geɪm+sneɪks]
/dʒ/ - huge snack	[hjudʒznɛk]	[hjudʒsnɛk]	[hjudʒsnɛk]
/ø/ - Snobbish	[zn ɔbɪʃ]	[sn ɔbɪʃ]	[zn ɔbɪʃ]
/ø/ - Snorkeling	[əzmoʊkərɪŋ]*	[əzn ɔrkəlɪŋ]	[zn ɔrkəlɪŋ]
/ø/ - Snoozing	[əsnuzɪŋ]	[snuzɪŋ]	[znuzɪŋ]

/sl/ Clusters

	Participant 7	Participant 8	Participant 9 .
/i/ - many slang	[mɛnizlɛŋ]	[mɛnislæŋgs]	[mɛnizlʌŋg]
/eɪ/ - They sleep	[ðeɪzli:p]	[ðeɪsli:p]	[ðeɪzli:p]
/oʊ/ - Jo slowly	[dʒoʊəzloʊli]	[dʒoʊəzloʊli]	[dʒuzloʊli]
/u/ - Sue slapped	[suəzlɛpəd]	[suəsplɛndɪd]*	[ʃi:əzlɛpt]
/ɔɪ/ - boy sliced	[bɔɪslaɪsed]	[bɔɪslaɪst]	[bɔɪzlaɪt]
/k/ - black sleeping	[blæksli:pɪŋ]	[blæksli:pɪŋ]	[blækəzli:pɪŋ]
/f/ - Jeff slandered	[dʒɛfəzlɛndərə]	[dʒɛfslɛndərd]	[dʒɛfzlɛndərəd]
/d/ - Ted sloshed	[tɛdsl ɔʃed]	[tɛdsl ɔʃed]	[tɛdəzl ɔʃt]
/n/ - been sleeping	[bɪnəzli:pɪŋ]	[bɪnsli:pɪŋ]	[bɪnəzli:p]
/dʒ/ - huge slammer	[hjudʒzlæmər]	[hjudʒslɛmər]	[hjudʒəzlɑmər]
/ø/ - Slim	[zlɪm]	[slɪm]	[slɪm]
/ø/ - Slight	[zlaɪt]	[slaɪt]	[laɪt]*
/ø/ - Slippery	[əzli:pəri]	[slɪpəri]	[zli:pəri]

/spr/ Clusters

	Participant 7	Participant 8	Participant 9 .
/i/ - We sprayed	[wi:spreɪ]	[wi:spreɪd]	[wi:spreɪed]
/eɪ/ - They sprawled	[deɪəsprʌləd]	[deɪsprɛd]	[deɪəspreɪləd]
/oʊ/ - so spry	[soʊspri:]	[soʊəspraɪ]	[soʊspraɪ]
/ɔɪ/- enjoy springtime	[əndʒɔɪsprɪŋtaɪm]	[əndʒɔɪsprɪŋtaɪm]	[ɪndʒɔɪ+sprɪŋtaɪm]
/ju/ - you spread	[juspri:d]	[jusprɛd]	[jusprɛd]
/k/ - Jack sprained	[dʒækʃpreɪnd]*	[dʒækspreɪned]	[dʒækəspreɪnəd]
/g/ - Meg sprinted	[mɛgəspri:ntəd]	[mɛgəsprɪntəd]	[mɛgsprɪntəd]
/m/ - Jim sprinkled	[dɔŋəspri:ŋkəld]	[dʒɪməspri:ŋkəld]	[dʒɪməsprɪŋklə]
/tʃ/ - Each spring	[i:tʃsprɪŋ]	[i:tʃsprɪŋ]	[i:tʃsprɪŋ]
/dʒ/-village sprawled	[vɪladʒəsproʊləd]	[vɪlɪdʒəsprɔld]	[vɪlɪdʒprɛrləd]*
/ø/ - Spread	[spri:də]	[sprɛd]	[sprɛd]
/ø/ - Sprinters	[sprɪntərz]	[sprɪntər]	[sprɪntər]
/ø/ - Spring	[sprɪŋ]	[sprɪŋ]	[sprɪŋ]

/spl/ **Clusters**

	Participant 7	Participant 8	Participant 9 .
/i/ - She splashed	[ʃi:ʃplɛʃəd]*	[ʃi:splæʃt]	[ʃi:splɛʃt]
/eɪ/ - motorway splits	[motorweɪəsplɪts]	[mɔtorweɪsplɪts]	[motorweɪəspli:t]
/a/ - Tina splurged	[tɪnaəsplərgərəd]	[tɪnaəsplərgəd]	[taɪnasplurdʒəd]
/oʊ/ - so splenetic	[soʊəsplənɛtɪk]	[soʊsplənɛtɪk]	[soʊsplɛnətɪk]
/u/ - do splendid	[duəsplɛndɪd]	[duəsplɛndɪd]	[dusplɛndɪd]
/t/ - wrote splendid	[roʊtəsplɛndɪd]	[roʊtsplɛndɪd]	[roʊtsplɛndɪd]
/b/ - bib split	[bɪbsplɪt]	[baɪbəspli:t]	[bɪbəsplɪt]
/n/ - Brian spliced	[braɪənəspli:sed]	[braɪənsplaɪst]	[braɪənsplaɪsəd]
/tʃ/ - Which split	[witʃsplɪt]	[witʃsplɪt]	[wɪtʃsplɪt]
/dʒ/ - huge split	[hjudʒsplɪt]	[hjudʒsplɪt]	[luzəsprɪt]*
/ø/ - Splitting	[əspli:tɪŋ]	[sli:nə]*	[splɪtɪŋ]
/ø/ - Splendid	[əsplɛndɪd]	[splɛndɪd]	[splɛndɪd]
/ø/ - Splashy	[əsplɛʃi]	[splɛʃi]	[splɛʃi]

/str/ **Clusters**

	Participant 7	Participant 8	Participant 9 .
/eɪ/ - say strange	[seɪstreɪndʒ]	[seɪəstrændʒə]	[seɪəstrɛndʒə]
/oʊ/ - go straight	[goʊstreɪt]	[goʊəstreɪt]	[goʊəstreɪt]
/oʊ/ - Jo struggles	[dʒoʊəstrʌgəlz]	[dʒoʊdʒʌŋgəlz]*	[dʒoʊstrugəlz]
/u/ - too strangely	[tuəstrɛŋgli]	[tʃuəstrændʒəli]	[tʃustrəndʒeli]
/aɪ/ - My strategy	[maɪstrətɛdʒi]	[maɪstrɛtədʒi]	[maɪstrɛtədʒi]
/t/ - Eight streets	[eɪtstri:ts]	[eɪtstri:ts]	[eɪtstri:ts]
/s/ - Loose strands	[lu:zəstrɛndz]	[lu:səstrɛndz]	[lu:səstrɛndz]
/d/ - bed straight	[bɛdstreɪt]	[bɛdstreɪt]	[bɛdstreɪt]
/n/ - Brendon strode	[brɛndənstroʊk]	[brɛndənstroʊd]	[brendonstroʊd]
/tʃ/- such stress	[sʌtʃstrɛs]	[sʌtʃstrɛs]	[sʌtʃstrɛs]
/ø/ - Strawberries	[strɔbɛri:z]	[stroʊbɛri:z]	[strɔbɛri:z]
/ø/ - Strict	[strɪktə]	[əstrɪkt]	[strɪktə]
/ø/ - Stray	[streɪ]	[streɪ]	[streɪ]

/skw/ **Clusters**

	Participant 7	Participant 8	Participant 9 .
/i/ - He squashed	[ʃi:skwɛʃed]	[hi:skwɛʃed]	[ʃi:skwaʃed]
/oʊ/ - No squads	[noʊəskwɛd]	[noʊəskwɛdz]	[noʊəskwɑd]
/u/ - blue square	[bluəskwɛr]	[bluəskwɛr]	[bluskwɛr]
/aɪ/ - guy squeezed	[gaɪəskwi:zəd]	[gaɪəskwi:zəd]	[gaɪzkwi:zəd]
/ɔɪ/ - enjoy squalid	[əndʒɔɪskwɛlɪd]	[əndʒɔɪskwɑlɪd]	[əndʒɔɪkwɑlɪd]*
/t/ - eat squash	[i:tskwɛʃ]	[i:tskwɑʃ]	[i:tskwɛʃ]
/d/ - hundred square	[hʌndrədskwɛr]	[hʌndrədəskwɛr]	[hʌndrədskwɛr]
/ŋ/ - strong squall	[strɔŋgəskwɔu]	[strɔŋskwɛʊ]	[strɔŋskwɔʊ]
/tʃ/ - peach squash	[pi:tʃskwɛʃ]	[pi:tʃskwɛʃ]	[pi:tʃəskwɛʃ]
/dʒ/-Village squatters	[vɪladʒəskwetərz]	[vɪlɪdʒəskwɑɾərz]	[vɪlɪdʒəskwɛtərz]
/ø/ - Squirrels	[skwɪreuz]	[skwɪrəʊz]	[skwi:relz]
/ø/ - Squeeze	[əskwi:z]	[skwi:z]	[skwi:z]
/ø/ - Squid	[skwɪd]	[skwɪd]	[skwɪd]

/skr/ **Clusters**

	Participant 7	Participant 8	Participant 9 .
/i/ - me scratch	[mi:skrɛʃ]	[mi:skrɛtʃ]	[mi:skrɛtʃ]
/oʊ/ - low scrub	[loʊskrʌb]	[loʊəskrʌb]	[loʊskrʌb]
/aɪ/ - I scrabbled	[aɪskrʌmbəl]	[aɪskrʌbəld]	[øskrɛbəl]
/aʊ/- how scrupulous	[haʊskrʌpələz]	[haʊəskrʌpələz]	[haʊəskrupələz]
/ɔɪ/ - boy screamed	[bɔɪəskri:məd]	[bɔɪəskri:məd]	[bɔɪəskri:məd]
/p/-hope screenwriters	[hoʊpskri:nraɪtərz]	[hoʊpskri:nraɪɾərz]	[hoʊpskri:nraɪtərz]
/d/ - should scram	[ʃʊdskrɛm]	[ʃudəskræm]	[ʃudskri:m]
/n/ - been scraped	[bɪnskrɛped]	[bɪnskrɛpt]	[bɪnəskrɛped]
/tʃ/ - such screening	[sʌtʃskri:nɪŋ]	[sʌtʃskri:nɪŋ]	[sʌtʃskri:nɪŋ]
/dz/ - huge scrapbook	[hjudʒəskrɛpbuk]	[hjudʒskræpbʊk]	[hjuʒəskrɛpbuk]
/ø/ - Scratch	[skrɛtʃ]	[skrætʃ]	[skrɛtʃ]
/ø/ - Scrambled	[skrɛmbəld]	[skrɛmbəld]	[skrʌmblәd]
/ø/ - Scrawny	[skrɔni]	[skrɔni]	[skrɛni]

Sentences produced by participant 10.

/sp/ Clusters

	Participant 10
/i/ - He speaks	[hi:spi:d]
/eɪ/ - They spoilt	[ðeɪspɔɪəl]
/oʊ/ - No spitting	[noʊəspɪtɪŋ]
/aɪ/ - my spouse	[maɪspoʊz]
/ju/ - you spell	[juspɛl]
/t/ - not speed	[nɔtəspi:d]
/s/ - famous speech	[feɪməspi:tʃ]
/d/ - David specially	[deɪvspɛʃəli]
/ŋ/ - sang spectacular	[sɛŋspɛktulər]
/dʒ/ - huge spider	[hjudʒspaɪdər]
/ø/ - Speak	[spi:k]
/ø/ - Sports	[spɔrts]
/ø/ - Spaghetti	[spəgɛɾi]

/st/ Clusters

	Participant 10 .
/eɪ/ - may stay	[meisteɪ]
/oʊ/ - No standing	[noʊstɛndɪŋ]
/u/ - too stubborn	[tuəstʌbɔrn]
/ə/ - to study	[tʃustʌdi]
/aɪ/ - My staff	[maɪstɛf]
/t/ - get stuck	[gɛtəstʌk]
/b/ - Bob steals	[bɔbsti:lz]
/m/ - I'm starving	[aɪmstɑrvɪŋ]
/tʃ/ - such still	[sʌtʃstɪl]
/dʒ/ - judge stood	[dʒʌdʒstʊd]
/ø/ - Students	[stʃudənts]
/ø/ - Stains	[steɪnz]
/ø/ - Stop	[stɔp]

/sk/ Clusters

	Participant 10
/u/- do skateboarding	[duskeɪtbɔrdɪŋ]
/ə/ - the sky	[deskaɪ]
/ə/ - A skunk	[əskʌŋk]
/aɪ/ - guy skin	[gaɪəskɪn]
/aʊ/ - cow skipped	[kaʊskɪpt]
/k/ - bike skidded	[baɪkskɪɾəd]
/b/ - Bob skimps	[bɔbskɪmps]
/m/ - Sam skinned	[sæmskɪn]
/tʃ/ - Which ski	[wɪtʃski:]
/dʒ/ - huge skirt	[hjudʒskərt]
/ø/ - Skiing	[ski:ŋ]
/ø/ - Skates	[skeɪts]
/ø/ - Skirts	[skərts]

/sw/ Clusters

	Participant 10 .
/i/ - He sweats	[hi:swi:ts]
/ə/ - A swear	[əswɛr]
/aɪ/ - My sweets	[maɪswi:ts]
/aʊ/ - now swear	[naʊswɛr]
/ɔɪ/ - boy swept	[bɔɪswɛpt]
/p/ - Stop swanking	[stɔpswɛnkɪŋ]
/f/ - wife swept	[waɪfswɛpt]
/b/ - Bob swims	[bɔbswɪmz]
/ŋ/ - long swallow	[lɔŋswɛloʊ]
/tʃ/ - Which sweater	[wɪtʃswɛɾər]
/ø/ - Sweets	[swi:ts]
/ø/ - Swampy	[swɛmpi]
/ø/ - Switch	[swɪtʃ]

/sm/ Clusters

	Participant 10
/i/ - see smugglers	[si:zmʌglərz]
/i/ - She smashed	[ʃi:smæʃ]
/oʊ/ - No smoking	[noʊəzmoʊkɪŋ]
/ə/ - a small	[əsmɔl]
/ɔɪ/ - coy smile	[kɔɪzmaɪəl]
/k/ - look smart	[lʊksmɑrt]
/s/ - its smog	[ɪtsmog]
/d/ - dad smacked	[dædzmɛk]
/ŋ/ - making small	[meɪkɪŋəzmɔl]
/dʒ/ - huge smudges	[hjudʒəsmʌdʒəz]
/ø/ - Smart	[smɑrt]
/ø/ - Smile	[smaɪəʊ]
/ø/ - Smoking	[smoʊkɪŋ]

/sn/ Clusters

	Participant 10 .
/i/ - Lee snores	[li:znɔrz]
/eɪ/ - They sneezed	[deɪəzni:z]
/aɪ/ - My snake's	[maɪəzneɪks]
/aʊ/ - How snobbish	[haʊəsnɔbɪʃ]
/ɔɪ/ - enjoy snuggling	[əndʒɔɪəznʌglɪŋ]
/p/ - stop snowing	[stɔpsnoʊɪŋ]
/s/ - delicious snacks	[dəlɪʃəsznæks]
/b/ - Bob sneaked	[bɔbsni:kəd]
/m/ - game snakes	[geɪmsneɪks]
/dʒ/ - huge snack	[hjudʒsnæk]
/ø/ - Snobbish	[snɔbɪʃ]
/ø/ - Snorkeling	[əznɔrklɪŋ]
/ø/ - Snoozing	[əznuzɪŋ]

/sl/ Clusters

	Participant 10
/i/ - many slang	[mɛnizlæŋ]
/eɪ/ - They sleep	[ðeɪzli:p]
/oʊ/ - Jo slowly	[dʒoʊzloʊli]
/u/ - Sue slapped	[suəzlæp]
/ɔɪ/ - boy sliced	[bɔɪəzlaɪzd]
/k/ - black sleeping	[blæksli:pɪŋ]
/f/ - Jeff slandered	[dʒɛfslændər]
/d/ - Ted sloshed	[tɛdslɔʃt]
/n/ - been sleeping	[bɪnəsli:pɪŋ]
/dʒ/ - huge slammer	[hjudʒzlæmər]
/ø/ - Slim	[slɪm]
/ø/ - Slight	[slaɪt]
/ø/ - Slippery	[slɪpəri]

/spr/ Clusters

	Participant 10 .
/i/ - We sprayed	[wi:spreɪd]
/eɪ/ - They sprawled	[ðeɪsprɔ]
/oʊ/ - so spry	[soʊspraɪ]
/ɔɪ/-enjoy springtime	[əndʒɔɪəsprɪŋtaɪm]
/ju/ - you spread	[juəsprɛd]
/k/ - Jack sprained	[dʒækspreɪn]
/g/ - Meg sprinted	[mɛgsprɪnɾəd]
/m/ - Jim sprinkled	[dʒɪməsprɪŋkəld]
/tʃ/ - Each spring	[i:tʃsprɪŋ]
/dʒ/-village sprawled	[vɪlɪdʒəsprɔld]
/ø/ - Spread	[sprɛd]
/ø/ - Sprinters	[sprɪntərz]
/ø/ - Spring	[sprɪŋ]

/spl/ Clusters

	Participant 10
/i/ - She splashed	[ʃi:splæʃt]
/eɪ/ - motorway splits	[motorweɪsplɪts]
/a/ - Tina splurged	[tinaəsplər]
/oʊ/ - so splenetic	[soʊəsplənɛtɪk]
/u/ - do splendid	[duəsplɛndəd]
/t/ - wrote splendid	[roʊtsplɛndɪd]
/b/ - bib split	[bɪbsplɪt]
/n/ - Brian spliced	[braɪənsplaɪst]
/tʃ/ - Which split	[wɪtʃsplɪt]
/dʒ/ - huge split	[hjudʒəsplɪt]
/ø/ - Splitting	[splɪɾɪŋ]
/ø/ - Splendid	[splɛndɪd]
/ø/ - Splashy	[splɛʃi]

/str/ Clusters

	Participant 10 .
/eɪ/ - say strange	[steɪstrændʒ]
/oʊ/ - go straight	[goʊəstreɪt]
/oʊ/ - Jo struggles	[dʒoʊəstrʌgəlz]
/u/ - too strangely	[tʃuəstrændʒəli]
/aɪ/ - My strategy	[maistrətɛdʒi]
/t/ - Eight streets	[eɪtstri:ts]
/s/ - Loose strands	[lusəstrændz]
/d/ - bed straight	[bɛdstreɪt]
/n/ - Brendon strode	[brɛndənstroʊd]
/tʃ/- such stress	[sʌtʃstrɛs]
/ø/ - Strawberries	[strɔbɛri:z]
/ø/ - Strict	[strɪt]
/ø/ - Stray	[streɪ]

/skw/ Clusters

	Participant 10
/i/ - He squashed	[hi:skwɛʃ]
/oʊ/ - No squads	[noʊəskwɛdz]
/u/ - blue square	[bluskwɛr]
/aɪ/ - guy squeezed	[gaɪskwi:zd]
/ɔɪ/ - enjoy squalid	[ənʤɔɪəskwɑlɪd]
/t/ - eat squash	[i:tskwɛʃ]
/d/ - hundred square	[hʌndrədskwɛr]
/ŋ/ - strong squall	[stroŋskwɔl]
/tʃ/ - peach squash	[pi:tʃskwɛʃ]
/dʒ/-Village squatters	[vɪlɪdʒskwɛɾərz]
/ø/ - Squirrels	[skwərəlz]
/ø/ - Squeeze	[skwi:z]
/ø/ - Squid	[əskwɪd]

/skr/ Clusters

	Participant 10 .
/i/ - me scratch	[mi:skrætʃ]
/oʊ/ - low scrub	[loʊəskrʌb]
/aɪ/ - I scrabbled	[aɪskrɛbəl]
/aʊ/- how scrupulous	[haʊəskrupələz]
/ɔɪ/ - boy screamed	[bɔɪəskri:m]
/p/-hope screenwriters	[hoʊpskrɪnraɪtərz]
/d/ - should scram	[ʃʊdskræm]
/n/ - been scraped	[bɪnəskræpt]
/tʃ/ - such screening	[sʌtʃskri:nɪŋ]
/dz/ - huge scrapbook	[hjudʒskræpbʊk]
/ø/ - Scratch	[skrætʃ]
/ø/ - Scrambled	[skrɛmbəld]
/ø/ - Scrawny	[skraʊni]