Carlos Felipe Mendes

THE PERCEPTION OF THE ENGLISH –S MORPHEME BY BRAZILIAN EFL LEARNERS

Dissertação submetida ao Programa de Pós-Graduação em Inglês da Universidade Federal de Santa Catarina para a obtenção do Grau de Mestre em Inglês: Estudos Linguísticos e Literários.
Orientadora: Prof. Dr. Rosane Silveira

Florianópolis
2017

Ficha de identificação da obra elaborada pelo autor,
através do Programa de Geração Automática da Biblioteca Universitária da UFSC.

Mendes, Carlos Felipe
The Perception of the English -*s* Morpheme by Brazilian EFL Learners / Carlos Felipe Mendes ; orientadora, Rosane Silveira - Florianópolis, SC, 2017.
143 p.

Dissertação (mestrado) - Universidade Federal de Santa Catarina, Centro de Comunicação e Expressão. Programa de Pós Graduação em Inglês: Estudos Linguísticos e Literários.

Inclui referências

1. Inglês: Estudos Linguísticos e Literários. 2. Percepção da fala. 3. Alomorfes. 4. Fricativas. 5. Inglês. I. Silveira, Rosane. II. Universidade Federal de Santa Catarina. Programa de Pós-Graduação em Inglês: Estudos Linguísticos e Literários. III. Título.

Carlos Felipe Mendes

THE PERCEPTION OF THE ENGLISH –S MORPHEME BY BRAZILIAN EFL LEARNERS

Esta Dissertação foi julgada adequada para obtenção do Título de "Mestre em Inglês: Estudos Linguísticos e Literários", e aprovada em sua forma final pelo Programa de Pós-Graduação em Inglês

Florianópolis, 06 de março de 2017.

_____
Prof. ª Dr. ª Anelise R. Corseuil,
Coordenadora do Curso

Banca Examinadora:

_____
Prof.ª, Dr.ª Rosane Silveira,
Orientadora
Universidade Federal de Santa Catarina

_____
Prof.ª, Dr.ª Denise Cristina Kluge,
Universidade Federal do Paraná

_____
Prof. ª, Dr. ª Hanna Kivisto de Souza,
Universidade Federal de Santa Catarina

_____
Prof. ª, Dr. ª Izabel Christine Seara,
Universidade Federal de Santa Catarina

To my family and friends.

ACKNOWLEDGEMENTS

I would like to thank my parents for all the encouragement and support they have given me in my life, as well as other relatives that have done similar. I would like to thank my friends for assisting me in several different manners in several different times. I would like to thank my professors, specially my advisor, for the guidance and assistance throughout the program. Lastly, I would like to thank my partner that stood by myside during the entire process.

Pursuing the Master's degree proved to be a lifetime experience that has driven me to develop myself as a better learner, reader, writer, a better person. In other words, it has pushed me to unfold a better version of myself. Therefore, I hope to bring all the experience acquired here to my professional career, and likewise to my personal life. Along these lines, I would like conclude acknowledging that even though it was an incredible journey, there is still much to seek and to grow.

Science has not yet taught us if madness is or is not the sublimity of the intelligence.
(Edgar Allan Poe)

RESUMO

O presente estudo investigou a percepção do morfema –s do inglês por falantes de português brasileiros aprendizes de inglês como uma língua estrangeira. Foi levado em consideração o fato de que o contraste ([s-z]) é fonológico em posição de coda em inglês, enquanto é apenas fonético na língua materna dos aprendizes. Conjuntamente, a investigação examinou os papéis do contexto fonológico seguinte, o tempo de tarefa e o nível de confiança, assim como o nível de proficiência dos participantes e suas possíveis influências na percepção dos estímulos de fala. A pesquisa também inspecionou o sinal acústico dos sons fricativos específicos. O material de áudio foi gravado por um falante nativo de inglês, consistindo de 120 frases, cada uma com uma palavra-alvo, incidindo as três diferentes realizações alomórficas: [s], [z], e [ɪz]. Os dados de percepção foram coletados através de um teste de percepção de identificação, sendo aplicado para 33 brasileiros aprendizes de inglês como uma língua estrangeira de três diferentes níveis do curso de inglês Extracurricular da Universidade Federal de Santa Catarina (UFSC). Ademais, o teste também foi aplicado para sete ouvintes nativos de inglês que funcionaram como um grupo controle. Os dados obtidos através dos procedimentos de coleta foram então estatisticamente analisados a fim de responder as quatro perguntas de pesquisa que foram estabelecidas para o estudo, além de análises individuais de casos específicos. Em geral, os resultados demonstraram que os aprendizes de inglês encontram dificuldades em identificar o alomorfe alvo [z], e que o contexto fonológico parece desempenhar um papel importante na percepção para esta realização do morfema –s. Além do mais, os valores de confiança e do nível de proficiência também produziram resultados significativos. Por conseguinte, as descobertas parcialmente corroboraram com as hipóteses propostas neste estudo.

Palavras-chave: Percepção da fala. Alomorfes. Fricativas.

ABSTRACT

The present study investigated the perception of the English –s morpheme by Brazilian Portuguese (BP) learners of English as a foreign language (EFL). It considered the fact that one of the target contrast is phonological in coda position in English; meanwhile it is only phonetic in the learners' mother tongue. Conjointly, the investigation examined the roles of the following phonological context, time on task and confidence level, as well as the proficiency level of the participants and their alleged influence on the speech perception of the stimuli. Furthermore, the research also inspected the acoustic signal of the target fricative sounds. The audio material was recorded from an English native talker and consisted of 120 tokens, comprising the three different allomorph realizations: [s], [z], and [ɪz]. The perception data were gathered through an identification perception test, and it was administered to 33 Brazilian EFL learners from three different levels of the *Extracurricular* English course from *Universidade Federal de Santa Catarina* (UFSC). In addition, the test was administered to seven English native listeners that performed as a control group. The data obtained through the collection procedures were then statistically analyzed in order to answer the four research questions that were stablished for the study, besides the individual analysis of specific cases. In general, the results portrayed that Brazilian EFL learners face difficulties identifying the target [z] allomorph, and that the phonological context seems to play an important role for perception in the same –s morpheme realization. Moreover, confidence rate and proficiency level also yielded significant results. Thus, the findings partially corroborate the hypotheses proposed in this study.

Keywords: Speech perception. Allomorphs. Fricatives.

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

TABLE OF CONTENTS

CHAPTER I

1 INTRODUCTION

Speech perception research aims at understanding and predicting how listeners perceive and recognize speech sounds, whether through a linguistic approach (e.g. Flege, 1995; Best &Tyler, 2007) or through a neurobiological/psychological standpoint, or even interconnected approaches at times (e.g. Kluender & Kiefte, 2006; Poeppel & Monahan, 2008). In the case of the present investigation, speech perception is explored through the linguistic lens, making use of theoretical frameworks proposed by other researchers and attempting to comprehend the perception of the different phonetic realizations of the English –s morpheme.

Investigators of speech perception attempt to explain how listeners perceive sounds. Borrowing Kluender and Kiefte's (2006) words: "how listeners perceive the spoken acoustic signal as a sequence of consonants and vowels, collectively referred to as phonetic segments or units" (p. 153). Thus, this sequence of speech sounds form coarticulated speech, which "is the spatial and temporal overlap of adjacent articulatory activities" (p. 161) that can modify the phonetic segments attributes, consequently affecting speech itself and its perception. Therefore, investigating specific units of a language and how they can be modified and perceived by its users might reveal relevant information about the language itself, as well as its teaching and learning.

Studying speech sounds includes the possibility of analyzing sounds that are not familiar to the listener. That is, the opportunity of investigating speech characteristics of a language that is not the listeners' mother tongue. Through this perspective, speech perception encompasses not only the first language (L1), but also a second language (L2), or even a foreign language, which is commonly referred to as non-native speech perception. The latter is the focus of the present research considering English as a Foreign Language (EFL) for Brazilians learners.

One of the recurrent aspects discussed about non-native speech perception is age. Archila-Suerte, Zevin, Bunta, and Hernandez (2012) initiate their article depicting the sensorimotor hypothesis, which states that the Age of Acquisition (AOA) of a certain sensorimotor skill, such as music or a foreign language, will influence the overall performance of such activity. "Thus, an early acquired skill leads to a better performance than a late acquired skill" (p. 190). Notwithstanding, the boundaries regarding the AOA and performance are not clear, which requires more

research, since it plays an important role in the language learning process as a whole.

When we consider an L2, or a foreign language perception, other factors in addition to age come into play. First, the learner's L1 sound inventory is an important source of information and may interfere with the learning of the L2 sound inventory. As Flege (1995) explains, the L1 system may work as a sieve through which the L2 sounds are processed. We should also consider that when learning an L2 that is widely spoken such as English, the learner is likely to be exposed to a number of varieties, which can provide them with additional pronunciation models. An interesting question is how learners deal with these different models and how they contribute to the development of the L2 phonological system.

Nowadays, the fact that the English language is considered a Lingua Franca (ELF) has been raising several questions regarding its teaching and learning. More recently, non-native-speakers outnumber native speakers, consequently changing the scenario in which the English language is used (Jenkins, 2005). It is possible to affirm that non-native-speakers are shaping, adapting and modifying the language as much as native speakers do (Seidlhofer, 2005). Thus, issues related to pronunciation seem to be relevant to analyze in order to better understand how those supposed changes occur, and how this information can be applied to enhance the language teaching and learning.

ELF also highlights the discussion of accent in L2 speech, which is "when the variation between two groups of users is restricted to pronunciation […]" (Walker, 2010, p. 12). It seems to be crucial to develop tolerance towards variation given the current scenario, as long as they do not prevent communication from happening. Walker (2010) argues that "[…] although ELF encourages accent variation in order to allow speakers to express their identity, this cannot be at the expense of intelligibility[1]" (p. 15). Although this study does not address accent, nor intelligibility directly, the results might demonstrate a feature of the English language that can be discussed within the field and possibly stablish some guidelines for the teaching and learning.

[1] Becker and Kluge (2014) portray that the term 'intelligibility' does not possess a unanimous definition concerning EFL, therefore, there are several possible interpretations. Following the authors' description, which in turn follows the one from Munro and Derwing (1995), it is here interpreted that "Intelligibility refers to the extent to which an utterance is actually understood" (as cited in Becker and Kluge, 2014, p. 53).

1.1 RELEVANCE OF THE STUDY

Undoubtedly, there are many issues surrounding the English language and its status, providing extensive room for research. As widely known, it is not possible to approach numerous matters in one single piece. For this reason, the present research delimitates its objectives into investigating the perception of the target language by a particular sample of the English speaking population.

The present research investigates the perception of English by Brazilian learners. More specifically, their perception of the different realizations of the English –s morpheme in plural words, along with possible influencing factors. That is, the perception of the allomorphs that derive from the inflection rules for plurality in the target language (likewise employed for the third person inflection), which are described in detail in the following section. Therefore, the study also examines the information from the following phonological context of the target sounds, the confidence rate and time on task[2] of the participants, as well as their proficiency level in the attempt of finding possible correlations among these elements. Conjointly, the study also provides a brief analysis of the acoustic signal of the data set proposed with the intention of substantiating the results and succeeding analysis.

Although much research has already been done in the perception of Brazilian learners/speakers of English (e.g. Kluge, 2009; Perozzo, 2013; Reis, 2006; Silveira, 2004; Koerich, 2002), to the best of my knowledge, none has seem to prioritize the perception of the –s morpheme. Studies conducted on the production of such trait are more likely to be found (e.g. Pereira, 1994; Zanfra, 2013) as further reviewed in section 2.7, together with other studies on the perception and production of English fricatives. Hence, targeting the perception of the –s morpheme in coda position by Brazilian EFL learners appears to outset a niche for the research field.

The motivation that has driven the researcher to carry out a study in this specific subject lies predominantly on his path as an academic student of the language, as well as a Brazilian English speaker himself, besides the fact of having worked as an English teacher. This constitutes an entire world of linguistic information that is fruitful for research.

[2] The present study investigates time on task rather than reaction time. Further explanation in section 2.7.1.

Therefore, based on such experiences and observations that this investigation topic has come to be developed.

1.2 THE PRONUNCIATION OF THE –S MORPHEME

Considering that the L1 interferes with the L2, or with a foreign language, it is important to study the characteristics of different mother tongues and predict which aspects might influence what is relevant to be taught, and consequently practiced regarding the L2 sound system. In the case of Brazilian speakers, the Portuguese language will influence numerous aspects on both perception and production of English. Bearing in mind the objectives of this study, two phonemes (alveolar fricatives) and their respective descriptions are presented below, taken from Walker (2010).

> /s/: Portuguese /s/ is the same as in English. However, spellings with the letters 's' may cause confusion, and lead learners to pronunciation errors, since in Portuguese an 's' between vowels is always pronounced /z/. Make learners aware of this fact and be alert to the mispronunciation of words like 'basic', 'buses', and 'case'.
> /z/: Although Portuguese /z/ is the same as in English, it is important to make learners aware of its use in plural endings, as most tend to use /s/ or even /ʃ/, following Portuguese pronunciation patterns. (p. 125).

The author portrays that both sounds (/s/ and /z/) are the same in both languages. Nonetheless, the patterns of the written language and their sound correspondence are not. In addition, the patterns of sound combination are not the same either. That is, although the languages share the same sounds, they might not occur in the same position or combination with others. In other words, the sounds arise in different coarticulation patterns.

Therefore, within the explanation given to the sound /z/, it is clear that the English –s morpheme consists in a pronunciation issue for Brazilian speakers of English. It is important to highlight that although the two languages mostly use the –s morpheme to mark plurality, they have different rules for its pronunciation. Whereas in Portuguese the rule consists in regressive assimilation, in English it follows the opposite, the progressive assimilation.

Strictly speaking, according to Silva (2002), in BP it is found a phonemic contrast between the sounds /s, z, ʃ, ʒ/. Nonetheless, this phonemic contrast only happens when these sounds are placed whether in initial position, or in a intervocalic position, such as in '*assa*', '*aza*', '*acha*', '*haja*' (Silva, 2002, p157). In other words, when one of these sounds is replaced with one of the other sibilants there is a change in meaning, which does not occur when these sounds are found in coda position. This is because in coda position, the pronunciation patterns for the BP –s morpheme will vary according to dialect and/or to the following context. For instance, the –s morpheme in the word '*dias'* (days) could be pronounced either with [s], [ʃ], [z] or [ʒ] depending on the dialect, and on the following phonological context. By way of illustration, '*dias'* can be pronounced as [s or ʃ] depending or the dialect, or if it is followed by a pause, or a voiceless following context, as in an utterance like '*dias tristes'* (sad days), but as [z] or [ʒ] if the following word begins with a voiced sound (e.g., '*dias voláteis'*: volatile days).

Silva (2007) explains that assimilation is characterized when a sound incorporates the feature of another adjacent sound. For instance, when a sound acquires a voiceless feature considering its succeeding voiceless sound, it is qualified as regressive assimilation, which is the case of Brazilian Portuguese (BP) in a word like '*rosto'* (face) or the sequence '*duas partes'* (two parts), in which the <s> is pronounced as [s]. Conversely, in '*mesmo'* (same) and '*duas mãos'* (two hands), the grapheme <s> is pronounced as [z] considering the voiced quality of the succeeding vowel and the consonant [m] respectively.

In English the process is reverted, therefore it is called progressive assimilation. Thus, a sound will acquire the feature of its preceding one. The plural of words such as '*seed*' and '*step*' are illustrations of the rule. The word '*seed*' ends in a voiced consonant sound ([d]), hence, in 'seeds' the <s> grapheme that is used to mark plurality should be pronounced as [z]. On the other hand, the word '*step*' ends in a voiceless consonant sound ([p]), consequently, the <s> in its plural form '*steps*' will be pronounced as [s].

Different from BP, English marks present third-person singular by also adding the –s morpheme to the verbs. The pronunciation of this verb suffix follows the same rules employed for the –s morpheme in the plural form. Hence, while regarding the plural marker as the research focus, it also concerns this other language aspect directly, since they share the same patterns. Besides, there is the fact that one single word might be a plural noun, and at the same time a verb conjugated in the third person of

the present tense in the English language, as in the case of the word '*drinks*'.

Thus, in the sentence '*He collects cards*', the <s> grapheme of the verb '*collects*' will be pronounced as [s] considering the voiceless feature of the sound /t/. While in the sentence '*He plays cards*', the <s> grapheme of the verb '*plays*' will be pronounced as [z] considering the voiced feature of the vowel /eɪ/. Furthermore, words ending in fricative sounds like [s], [z], [ʃ], [ʒ], [tʃ], and [dʒ] have a different pronunciation for the –s morpheme, which should be pronounced as [ɪz] or [əz], as in the examples '*washes*' and '*cases*' (Celce-Murcia et al., 2010).

In BP, the <s> grapheme is also added to the end of most nouns to make the plural form. As this morpheme is in coda position, it can be pronounced as [s or [ʃ] (*dois*, 'two' [dois]), [z or ʒ] (*dois meses*, 'two months' [doiz]), or [is or iz] (países 'countries' [paizis]; *países livres* 'free countries' [paiziz]). Considering the information above, it can be noticed that Brazilian learners may have difficulties with the English –s morpheme given the differences in the spelling and sound correspondence between English and BP. Although the sounds themselves depicted above do not present difficulties for Brazilian speakers to produce them, seeing that they are sounds found in their L1 inventory, learners may not be aware of its phonotactics, that is, the combination of sounds in a sequence that happens in a language and how it differs from the sequences of their mother tongue.

The different realizations of the English –s morpheme might impose difficulty at the perception level as well[3]. It is expected that this difficulty in perceiving the different realizations of the –s morpheme leads BP learners of English to rely on the assimilation rules of their L1 when producing this morpheme in English words. Therefore, investigating such aspect might provide a better understanding of how it affects pronunciation in general.

Regarding the perception of non-native sounds, there are three main theoretical frameworks that intend to describe the relations between the native language and the target language sound system. They are the Speech Learning Model (SLM) by Flege (1995), the Perceptual Assimilation Model (PAM) (Best, 1995), and the Perceptual Assimilation Model for Second Language (PAM – L2) (Best & Tyler, 2007).

[3] Apparently, most studies investigating inflectional endings focus on production (e.g., Delatorre, 2006, Gomes, 2009).

Moreover, there is also the Native Language Magnet (NLM) by Kuhl (1993) which focuses on the acquisition of L1 sounds.

As aforementioned, the first three models aim to identify connections between L1 and L2 concerning perception. Even though the focus of the research lies on the sound perception of a foreign language, an understanding on how it works on the native language seems important, mainly considering that the frameworks dialogue among them. Therefore, Chapter II will start briefly reviewing the NLM with the purpose of laying theoretical background informing the present study. Subsequently, the reviews of the non-native speech perception models are presented building the literature core of the study.

In the following sections of this introductory chapter, the general objectives are stated as well as the Research Questions and Hypotheses elaborated to carry out the research. The second chapter brings the review of literature on speech perception, and it depicts the perception models to be considered for further analysis, along with a comprehensive description of the sounds investigated. In addition, the method chapter describes the instruments developed by the researcher to conduct the study. Finally, Chapter IV brings the results and analysis of the data gathered, together with the discussion, and is followed by Chapter V, which summarizes the study findings and discusses limitations, suggestions for further research and pedagogical implications.

1.3 OBJECTIVES

The primary objective of this research is to investigate the perception of the –s morpheme in the English language by Brazilian EFL learners. That is, their ability to identify the different realizations of the morpheme in the target language. The sounds studied are the three allomorphs of the –s morpheme, which are the alveolar fricatives, [s], [z], and the last variations [ɪz] (or [əz]) in coda position, which can be found whether in plural forms, or in the present form of the third person in English words. This study takes into consideration the perceptual models proposed by other researchers (e.g., Flege, 1995; Best & Tyler, 2007) in order to identify the aspects that influence such phenomenon, such as morphophonology, and L1 transfer. The study administered an identification perception test elaborated with a computer software as one of the main instruments for conducting the research. Moreover, with a quantitative nature, it employs statistical analysis in order to attempt to establish generalizability concerning the results.

1.3.1 Research questions and hypotheses

With the purpose of carrying out the research, four research questions (RQs) and their respective hypotheses (Hs) are proposed below. Further information about the theoretical framework and empirical studies that offer support to the research hypotheses are presented in Chapter II.

RQ1 – Do Brazilian learners identify the different allophonic realizations of the English –s morpheme: [s], [z], and [ɪz]?

H1 – Based on the Speech Learning Model's (Flege, 1995) first hypothesis of the 'position sensitive allophone', Brazilian learners of English are expected to face difficulties in identifying the different realizations of the –s morpheme in the target language. This is due to the fact that in Portuguese, the /s - z/ contrast is not phonological in codas as it is in English. Therefore, the contrasting sounds in word-final position are likely to be overlooked, which is also in accordance with the Perceptual Assimilation Model for Second Language 'attunement' concept (Best & Tyler, 2007).

RQ2 – Do the acoustic cues from the following phonological context of the English –s morpheme influence its perception?

H2 – Given studies conducted on the production of the English –s morpheme (e.g., Pereira, 1994; Zanfra, 2013) by Brazilian learners, and the different assimilation patterns in Brazilian Portuguese and English (progressive vs. regressive), learners are expected to carry over L1 processes into the L2 production of the –s morpheme. Similar results are expected at the perception level considering the acoustic cues from the following phonological context. Although the present study tests words in isolation, the stimuli were recorded by inserting the carrier words in utterances with different phonological contexts following the –s morpheme. Thus, the acoustic quality of the plural allomorphs might have incorporated acoustic characteristics from these different contexts, which could influence the listeners' performance on the identification test.

RQ3 – Is there a correlation between the participants' accuracy in the perception test, their time on task, and their level of confidence in their responses?

H3 – Following Pisoni and Tash's (2012) patterns on reaction time measurements in speech perception, a positive correlation between the informants' correct responses and their time on task, as well as their level

of confidence in the identification test is expected. It seems that learners with more difficulty to identify the –s morpheme realizations will take longer to reply and will be more unsure about their responses.

RQ4 – How is the target language proficiency of the participants related to their perception ability of the allophonic variations of the English –s morpheme?

H4 – Both Speech Learning Model and Perceptual Assimilation Model for Second Language posit that experience greatly influences the perception of non-native speech. Thus, it is expected that the higher the proficiency level of a learner, the higher is the ability to identify the realizations of the target sounds.

With the Research Questions and Hypotheses stated above, it is presented in the next chapter the review of literature, which offers theoretical support for the inquiries of this piece of research.

CHAPTER II

2 REVIEW OF LITERATURE

In the following sections, the speech perception models are reviewed in this sequence: 1) The Native Language Magnet; 2) the Speech Learning Model; 3) The Perceptual Assimilation Model; and the 4) Perceptual Assimilation Model – L2. The reason for portraying them in this fashion, as previously mentioned, lies on the transition from native sound perception to non-native sound perception, as it shapes the fundamental literature structuring the study. Furthermore, there is a subsequent substantial description of the sounds investigated in this piece of research informing the focused segments attributes, including the acoustic signal information. Lastly, there is a considerable review of previous studies carried out within the production and perception of the English fricative sounds, including studies with BP learners.

2.1 THE NATIVE LANGUAGE MAGNET (NLM)

Regarding age and language acquisition, the Native Language Magnet (NLM) proposed by Kuhl and Iverson (1995), discusses how these two aspects are strongly related. The authors posit that "language experience alters the mechanisms underlying speech perception, and thus, the mind of the listener" (p. 121). In other words, the amount of language input received by a listener will modify the way s/he perceives language as a whole, and according to this theory, this modification occurs very early in life (around 6 months old).

Kuhl and Iverson (1995) explain that, "At birth infants hear differences among all of the sounds of human language. However, by the time we reach adulthood, our abilities to differentiate the sounds of the world's languages is greatly reduced" (p. 121). It is not new that adults have difficulties in learning a foreign language, mainly at identifying, or discriminating sounds of the target language; therefore, the question lies in what changes in the time range from childhood to adulthood.

The NLM does not focus on non-native speech perception, although its principles may be redirected in order to attempt to explain the occurrences of certain phenomena in a foreign language learning. Kuhl and Iverson's interest (1995) is in proposing a model that demonstrates the alteration in one's acoustic space between the time listeners are able

to differentiate all of the sounds of human language and the time this (innate) ability is significantly diminished as previously mentioned.

Hence, according to the NLM, such modification is based on language experience. It "argues that exposure to language early in life produces a change in perceived distances in the acoustic space underlying phonetic distinctions, and this subsequently alters both the perception of spoken language and its production" (Kuhl & Iverson, 1995 p. 122). That is, learning a language (L1) modifies the listener's perceptual mechanisms, which in turn modifies the perception and production of the language itself.

As its name suggests, the NLM works as a luring mechanism in the acoustic space, the so called 'perceptual magnet effect'. Such effect "shows that exposure to a particular language results in a distortion of the perceived distances between stimuli; in a sense, language experience warps the acoustic space underlying phonetic perception" (Kuhl & Iverson 1995, p. 121). Strictly speaking, the perceptual magnet effect will pull surrounding acoustic information to itself, making the discrimination of such pulled instances harder.

Kuhl and Iverson (1995) make use of the terms 'prototype' and 'nonprototype' to exemplify their theory. They describe prototypes as good instances of a phonetic category; meanwhile nonprototypes are poor instances of the same phonetic category. Therefore, phonetic prototypes "function as "perceptual magnets" for other sounds in the category" (p. 123). Their first study contemplated vowel sounds, in which over 100 /i/ English vowels were synthesized and rated by adults whether the sound was an excellent exemplar (prototype) of the vowel, or a poor exemplar (nonprototype).

From the results, they obtained two vowels, being one considered a prototype and another as a nonprotoype. These two vowels had their first and second formant frequencies altered, creating 32 (equally distant) variants for each one, in order to test the adults' and infants' ability to differentiate the prototype and its variants and the nonprototype and its variants. Thus, according to the theory, "the magnet effect predicts that the prototype vowel will sound more similar to its variants than the nonprototype will sound in relation to its variants, even though acoustic distance is equated." (Kuhl & Iverson, 1995, p. 125).

The tests were administered to adults and to six-month-old infants with slight age-appropriate differences in technique. "The results showed that both adults and infants demonstrated a strong magnet effect" (Kuhl & Iverson, 1995, p. 126). With such results, and others gathered through a species specific, cross-linguistic and additional experiments (see Kuhl,

1994), the researchers support their proposal of a NLM that perceptually changes the listener's acoustic space (phonetic perception), and that it happens very early in life based on the exposure to ambient language. According to Kuhl and Iverson,

> The theory accounts for the early period of speech perception covering roughly the first year of life, prior to the time that infants acquire word meaning and contrastive phonology. The theory holds that infants' early exposure to language spoken by their caretakers results in the formation of speech representations that constitute the beginnings of language-specific speech perception**. These early speech representations are argued to play a critical role in infants' perception of native- and foreign-language sounds** and also to play a critical role in guiding their initial attempts at speech production. (my emphasis) (Kuhl & Iverson 1995, p. 139).

As portrayed above, acquiring the native language will alter the perception of differences in the acoustic space. The NLM holds that infants have the innate ability to separate categories with natural boundaries, and that these boundaries will be somehow distorted with the acquisition of the mother tongue. Interestingly, Kuhl and Iverson (1995) reveal that these boundaries are not specific to human beings, and that it is "attributable to general auditory processing mechanisms." (p. 140).

Along these lines, six-month-old infants already show perceptual magnet effects, while 'monkeys do not' (See Kuhl, 1991). As a consequence of the phenomenon, "magnets cause certain boundaries to "recede" as the perceptual space is reconfigured to incorporate a language's particular magnet placement." (Kuhl & Iverson 1995 p. 142). Therefore, perceiving a category in a foreign language that is similar to the listener's native language becomes a problematic task, since the magnet is pulling and altering the phonetic categories (highlight in the quote above).

Conforming to the theory, the level of difficulty faced by the listener is predicated upon cross-linguistic aspects. In general lines, the distance between the target contrast is used to predict the difficulty, that is, how far or close the phonetic category is to the magnet in the native language. Importantly, the authors depict that research suggests that the boundaries do not disappear completely in adults, and that improvement

in the performance of discrimination of foreign sounds can be achieved with training (experience), although it would require a different process involving memory and attention. In addition, Kuhl and Iverson (1995) portray that "infants aged 10-12 months exhibit a failure to discriminate foreign-language sounds that they had discriminated earlier." (p. 142). Thus, once more, there is the statement that the phonological space is 'configured' very early in life, although it can be 'reconfigured' throughout one's lifetime.

Moving forward in a more biological standpoint, implicit and explicit knowledge, which are developed in infancy, and later years of life consecutively, involve different cognitive developments (Archila-Suerte et al, 2012). Therefore, young children make use of implicit knowledge, while "older children and adult learners use explicit rules to learn L2 phonemes" (p. 191), such as orthographic information for instance (see Cutler, 2015). These dissimilar processes will activate different brain regions, based in neuroimaging studies, which possibly explains why AOA is an important variable in L2 speech research. As a result, differences in performance are expected based on the initial period of the target language acquisition.

Having presented the review of the perception model regarding native sounds, the following sections depict non-native models of speech perception.

2.2 THE SPEECH LEARNING MODEL (SLM)

Similar to the NLM, the SLM aims to comprehend the modifications that occur in one's speech learning mechanisms during life. Notwithstanding, unlike the NLM, the focus is on second language, and the attempt is "to explain why "earlier is better" as far as learning to pronounce a second language (L2) is concerned". (Flege, 1995, p. 233). Another important distinguishing characteristic between the linguistic models is that the SLM assumes that the phonetic system "remain adaptive over the life span". That is, there is a certain reorganization of the acoustic space along with L2 encounter, rather than a distortion caused by a magnet placement, as proposed by the NLM. Even though the latter admits that better discrimination performance can be achieved with extensive training, it would be because the magnet has been weakened, and not because of a new acoustic disposition. Furthermore, Flege (1995)

does not believe in a "critical period" [4] for "perfect learning", while Kuhl and Iverson (1995) establish the period of the perceptual magnets placement, modifying the perceptual space from that time forward.

In this standpoint, AOA, or age of learning (AOL), which is the term used in the SLM, turns to the center of attention once more. Flege (1995) posits that although neurological maturation might be true for speech learning (critical period), it "fails to provide insight into how L2 learning differs from L1 acquisition, or what actually *causes* foreign accent" (p. 234). Furthermore, the author states that "adults may be as able as children to imitate foreign sounds" (p. 236), and that results from training studies suggest "that the perceived relation of L1 and L2 sounds may change during naturalistic L2 learning." (p. 237). The extract below, taken from Flege (1995), summarizes the focus of the SLM.

> Flege and his colleagues have developed a speech learning model (SLM) that aims to account for age-related limits on the ability to produce L2 vowels and consonants in a native-like fashion. The SLM is concerned primarily with the ultimate attainment of L2 pronunciation, so work carried out within its framework focuses on bilinguals who have spoken their L2 for many years, not beginners. (Flege, 1995, p. 237*)*.

In other words, the model proposed by Flege regards the foreign accent phenomenon. That is, to understand the nature of the non-native speech of individuals who have been using the L2 consistently (not language learners), as well as why some non-native speakers do not present a foreign accent. For this reason, his framework focuses on adult speakers, who are believed to be proficient speakers of the language. Another relevant piece of information is that an L2 English speaker for the SLM is the speaker who learned the language in an immersion context due to the fact of moving to an English speaking country (USA in this case).

Essentially, the SLM portrays that failure to perceive distinctive differences in the L2 might occur because of L1 characteristics, be it through "assimilation", a term explained in the Perceptual Assimilation Model (Best, 1995), to be presented in section 2.3, or through L1 filters,

[4] The Critical Period is a hypothesis in the field of second language learning depicting age as a determining aspect, in which the ideal period for language learning ends at puberty. (Abello-Contesse, 2008).

a concept that can be linked to the NLM theory. Importantly, Flege does not claim that all production errors in the L2 are based on perception. However, “a basic tenet of the model is that many L2 production errors have a perceptual basis.” (Flege, 1995, p. 238).

As aforementioned, the SLM postulates that the mechanisms that are used for learning the L1 stay intact throughout life, and that such mechanisms can be employed for learning an L2. Another postulate depicted in the model is that the characteristics of speech sounds that are phonetic categories in a given language are specified in long-term memory. Moreover, “phonetic categories established in childhood for L1 sounds evolve over the life span to reflect the properties of all Ll or L2 phones identified as a realization of each category” (Flege, 1995, p. 239). Strictly speaking, even the L1 categories that we possess keep evolving over time. As we hear other speakers of our L1, we incorporate new acoustic features to the L1 categories we possess. Also, as we learn new L2s, we change our L1 categories by incorporating acoustic traits of L2 categories that we identify as being similar to L1 categories. Finally, the last postulate of the SLM states that the phonetic categories of both L1 and L2 are stored in a common phonological space, which causes bilinguals to struggle to preserve contrasts between them.

From the postulates and from previous research derived the hypotheses proposed by the SLM, as Flege (1995) portrays. Below I highlight the most important aspects of some of the hypotheses proposed in the SLM.

Since the phonetic categories are present in a common phonological space, the L2 categories are located to the closest L1 categories based on their perceptual relation, and such relation is determined by their position. It means that the position of a target language category within a word is highly relevant to the model, which is referred to as *position-sensitive allophone*. Unlike the NLM, in the SLM new phonetic categories can be established for L2 sounds. Thus, the bigger the perceived distinction between the categories of the L1 and the L2, the bigger is the probability of new category formation.

Notwithstanding, the formation of a new category for an L2 sound can be blocked by the so called “equivalence classification” according to the SLM. This means that a target sound is equated to a previous existing sound of the L1 based on the speaker’s experience. The equation of both sounds is categorized as “diaphones”. Moreover, the SLM also hypothesizes that an L2 category formation by a bilingual may be different from a monolingual’s. It may be due to a discrepancy created by the bilingual between the sounds to retain contrast, or due to a

representation of a different feature between the bilingual and the monolingual. However, if the category matches the native speaker's category, the production of the L2 sound will be accurate.

If we take into consideration the /s - z/ contrast, both English and Portuguese have these sounds, however, for Portuguese, the contrast is phonological (i.e., leads to changes in meaning) in syllable onset position (e.g., *zelo*/*selo* 'zeal/stamp'). Meanwhile, in English, there is also the contrast in the word-final position (e.g. 'place/plays'), which is the case of the plural forms. Thus, the contrast in word-final position for Brazilian learners of English might me blocked according to the SLM.

Finally, concerning age, the SLM hypothesizes that the probability of discerning phonetic differences between L1 and L2 sounds decreases as the AOL increases, as well as discerning phonetic differences between L2 sounds that are not contrastive in the L1, which is in line with the author's attempt to understand why "earlier is better" for learning a second language. The following section describes the last perception model reviewed in this study, the Perceptual Assimilation Model (PAM), and its subsequent extension, the Perceptual Assimilation Model for Second Language (PAM-L2).

2.3 PERCEPTUAL ASSIMILATION MODEL (PAM)

The Perceptual Assimilation Model proposed by Best (1995) differs from the SLM in several ways. First, one of the main contrasting tenets of this model is that the theory that it is based upon is the direct realist approach, which derives from an ecological theoretical perspective, rather than the psychoacoustic approach of the SLM. In Best's words: "Its basic premises are that perceivers gain direct information from the world about its contents […] and that they, therefore, perceive objects, surfaces, and events directly without mediation by inborn knowledge or acquired mental associations." (Best, 1995, p. 174).

Therefore, in the case of speech, the articulatory gestures that produce the speech signal are the perceptual primitives themselves for speech perception, in which all the information is already there, and it is directly given. That is, the perceiver is able to detect/absorb the whole meaning from the 'distal source' itself, hence, it is not necessary to apply cognitive mediations since the information received is considered complete, unlike the psychoacoustic approach in which the input is not meaningful by itself, requiring the perceiver to employ meaning from mental representations.

Another differing aspect of PAM is its target. This model was initially developed to address naïve listeners (non-native speech perception), which are listeners that are not familiar with the target language. That is, perceivers that have never had contact/studied the non-native language, the opposite from the SLM, which aims at investigating experienced listeners. Within this scope, both infants and adults are able to be tested provided that the requirements are fulfilled. In order to address L2 issues, an adaptation of the model was designed preserving the same theoretical rationale that originated PAM. This adaptation became known as the Perceptual Assimilation Model L2 (PAM-L2), which redirects the target to L2 learners, thus, analyzing second language speech perception, which will further be reviewed within this section.

Moreover, regarding the level of analysis of the model, Colantoni, Steele, and Escudero (2015) portray that: "Best's PAM makes predictions concerning the difficulty of TL contrasts rather than individual TL phonemes as is done in the SLM" (p. 40). In other words, the model is always concerned with two sounds (a contrast), and its predictions are made based on the specified contrast of the target language (TL), dissimilar from Flege's model which also focus on separate sounds.

In Best's (1995) work, she exemplifies thoroughly all the principles of the theory that her model is structured upon, as well as clarifies some misconceptions about the direct realist approach, being one of them about learning. For the author, the perceptual learning of language happens through perceptual tuning, that is, the perceptual system attunes to pick up the relevant information and overlook what is irrelevant by means of communication goals. She explains that "Perceptual learning entails discovering the *critically* distinctive features, the most telling differences among objects and events that are of importance to the perceiver. Information that does not serve this purpose tends not to be picked up" (Best, 1995, p. 184).

This 'attunement' concept is of great importance to the model, since it helps to understand how the perception of non-native speech is affected by the experience with the mother tongue. The notion is that an attuned system detects compressed information appraising 'high-order invariants' rather than all the 'lower-order invariants' that are present in speech. A simple way of employing this idea is by considering the English plosive sounds for Brazilians monolinguals. That is, the naïve listeners would not perceive the aspiration characteristic that is commonly present in English plosives since they do not present a clear distinctive feature. Thus, "the naïve perceiver detects […] information that specifies the simple gestures properties that occur in the speech of any language. This

is because he or she has not yet discerned the more complex coordinations among such simple gestures […]" (Best, 1995, p. 186).

As aforementioned, the model's primitive of analysis is the articulatory gesture and its features/patterns of coordination, which leads to 'gestural constellations'. This term refers to the wide range of physically possible combinations of gestures that the human vocal tract is able to produce. Therefore, different languages apply different gestural constellations, although they inevitably share many characteristics due to the physical limits of the vocal tract. Thus, non-native sounds are categorized by the gestural characteristics that do not coincide with the native language (Best, 1995).

Regarding the perception of the non-native segments, PAM's main ground is that the target sounds "tend to be perceived according to their similarities to, and discrepancies from, the native segmental constellations that are in closest proximity to them in native phonological space" (Best, 1995, p. 193). Consider the commonly referred instances of the /θ/ and /ð/ sounds of the English language. They are usually difficult to be perceived and produced by English learners because of their uncommon gestural elements. Hence, according to PAM, it could be predicted that /θ/ and /ð/ will be perceived as /t/ and /d/ (or even /f/ and /v/) for native speakers of Brazilian Portuguese, since they are the closest gestures that are applied in the language (Reis, 2006).

Thus, it is based upon the similarities and discrepancies between the native and non-native elements that PAM predicts how the listener will perceptually 'assimilate' the non-native sounds into native categories. The word 'assimilation' already describes itself, however, it is relevant to clarify that assimilation is not the same as learning for the author. That is, assimilating a phonetic segment does not mean that it has been learned, and for Best (1995), there are different patterns of assimilation that might occur cross-linguistically. Below I describe the types of assimilation that are posed by the model.

Primarily, three assimilation patterns outline the model. The target segment can be 'assimilated to a native category', 'assimilated as uncategorizable speech sound', or 'not assimilated to speech'. The first describes an evident assimilation of the target segment into a native one, which can be considered from good to poor exemplars of such segment in the mother tongue. The second refers to an assimilation that recognizes the segment as a speech sound, even though it is not assimilated as an exemplar of a segment in the native language. Finally, the third pattern is attributed to a non-assimilation, that is, the listener hears the target sound as non-speech.

PAM proposes six types of assimilation from the patterns abovementioned. They are: 1) Two-Category Assimilation (TC Type); 2) Category-Goodness Difference (CG Type); 3) Single-Category Assimilation (SC Type); 4) Both Uncategorizable (UU Type); 5) Uncategorized versus Categorized (UC Type); and 6) Nonassimilable (NA Type). In order to better illustrate the types of assimilation proposed by Best (1995) and their respective discrimination level, I shall make use of her own descriptions in the adapted extract below, followed by a fitting example opposing English and Brazilian Portuguese when conceivable.

> TC Type: each non-native segment is assimilated to a different native category, and discrimination is expected to be excellent.
> CG Type: both non-native sounds are assimilated to the same native category, but they differ in discrepancy from native "ideal" (e.g., one is acceptable, the other deviant). Discrimination is expected to be moderate to very good.
> SC Type: both non-native sounds are assimilated to the same native category, but are equally discrepant from the native "ideal"; that is, both are equally acceptable or both equally deviant. Discrimination is expected to be poor.
> UU Type: both non-native sounds fall within phonetic space but outside of any particular native category, and can vary in their discriminability as uncategorizable speech sounds. Discrimination is expected to range from poor to very good.
> UC Type: one non-native sound assimilated to a native category, the other falls in phonetic space, outside native categories. Discrimination is expected to be very good.
> NA Type: both non-native categories fall outside of speech domain being heard as nonspeech sounds. Discrimination is expected to be good to very good (Best, 1995, p. 195).

A possible instance of the TC Type (Two-Category) is when the English contrast /s - z/ is assimilated as the Portuguese contrast /s - z/. In this way, each segment of the target contrast is assimilated to a different category of the native language, and that is why the prediction anticipates an excellent discrimination for the target contrast. In the CG Type (Category Goodness), the target contrast is assimilated to one single

native category, nonetheless, one segment is considered to be a good exemplar, and the other a poor exemplar of the same native category. It can be portrayed by the English contrast /t - tʃ/, which is a phonemic contrast, and the assimilation by a Brazilian Portuguese listener into the single category /t/ (although Portuguese also presents [tʃ], it is an allophonic variation of /t/, being a phonetic contrast, rather than a phonemic one). The SC Type (Single Category) also defines the assimilation of the target contrast into one single native category, however, this time both segments are considered either good or poor exemplars of the native category it has been assimilated to, and this is the reason for predicting a poor discrimination. For instance, the English vowels /ɪ - i/ being assimilated into the single Portuguese vowel /i/, and being considered as good exemplars of the native category.

The next two types refer to at least one uncategorized sound, that is, a sound that has been perceptually recognized as a speech sound, although not assimilated into any category of the native language as previously depicted. Notably, it does not mean that the discrimination between the target segments will be poor. Thus, in the UU Type (Both Uncategorizable) the contrast is not assimilated into a native category, and discrimination can vary. The UC Type (Uncategorized vs Categorized) is a merge between a contrast in which a segment has been assimilated into a native category, and a segment that has not. Lastly, the NA Type (Nonassimilable) where both segments are not assimilated as speech sounds, for instance, heard as the tic tac from a clock, or the clicks from a computer keyboard/mouse, yet, discrimination is expected to be high. Given that the types of assimilation discussed in this paragraph are not likely to take place when we consider Brazilian learners of English, no examples will be provided, but are available in Colantoni et al. (2015, p. 41)

Since PAM works with contrasts, and posits that the ability to discriminate the target segments are based on how they are assimilated into native language categories, the model requires perceptual assimilation tasks, as well as discrimination tasks in the interest of testing its assumptions. For that reason, the present study does not make use directly from PAM's predictions, given that the sort of test designed for this piece of research is of an identification nature. To conclude the review on the most influential speech perception models, the next subsection portrays PAM-L2, which redirects the focus to L2 learning.

2.3.1 Perceptual Assimilation Model of Second Language (PAM-L2)

The Perceptual Assimilation Model of Second Language (PAM-L2) is an extension of PAM developed by Best and Tyler (2007). Thus, the theoretical background, the direct realist approach, remains as the understructure of the model. Here, instead of focusing on the naïve listeners, the target perceivers are the ones learning a second language, the L2-learning listeners.

Just as in the case of SLM, L2 speakers are the ones who acquire the language in an immersed context; however, PAM aims at listeners in all stages of L2 learning, rather than experienced listeners (fluent), as is the case for the SLM. Another important specification is that the L2 learner for PAM-L2 is the one who has acquired the mother tongue prior to starting learning the L2, that is to say, the learner has not acquired both languages simultaneously (bilingual).

Therefore, as Perozzo and Alves (2016) depict, the authors of PAM-L2 portray that the model regards primarily the perception of L2 in immersion contexts, rather than a foreign language (classroom context), due to the ideal situations for learning standing on the ecological approach. Notwithstanding, this has not prevented research from using PAM-L2 premises, and adapting it to the foreign language contexts as Perozzo and Alves (2016) review in studies conducted in Brazil, mainly using English as the target language.

Best and Tyler (2007) initiate the discussion about speech perception pointing out the importance of experience; they state, "Perception differs in important ways between naïve listeners and those who have experience with the stimulus contrasts as elements of a second language" (p. 14). Furthermore, the authors also state that AOA and amount of L1/L2 usage/exposure are influencing factors on the perception of non-native speech as well.

Before immersing into the particularities of the model, there is still one more noteworthy aspect to be recalled. It is the importance of the native language, which will affect the perception of nonnative speech "systematically by fine-grained phonetic similarities and dissimilarities between native and nonnative phones" (Best & Tyler, 2007, p. 17). That is to say, the characteristics of the native language directly influence the listeners' perception of the L2 depending on the languages' linguistic relationship, and the perceptual learning of some target language segments might depend on such relation.

The assimilation patterns from PAM presented above concern the first contact with the non-native language. Hence, after this first "encounter", Best and Tyler (2007) assume that "a common L1-L2 system will emerge which incorporates phonetic and phonological levels", and that "our goal is to outline how the system changes over the course of L2 development" (p. 27). By way of explanation, from the moment that a listener is not naïve anymore, and is consequently faced with the target language, he or she will incorporate the characteristics of the L2 with the L1, and it is through this path that PAM-L2 forges its theorization.

From this standpoint, the model proposes four hypotheses to predict success at L2 perceptual learning, dealing only with sounds that are assimilated as speech, which are listed below:

> 1) Only one L2 phonological category is perceived as equivalent (perceptually assimilated) to a given L1 phonological category.
> 2) Both L2 phonological categories are perceived as equivalent to the same L1 phonological category, but one is perceived as being more deviant than the other.
> 3) Both L2 phonological categories are perceived as equivalent to the same L1 phonological category, but as equally good or poor instances of that category.
> 4) No L1-L2 phonological assimilation (adapted from Best & Tyler, 2007, p. 28).

Importantly, PAM L2 applies the 'equivalence' term present in the SLM as can be seen in the conjectures above, and not only the 'assimilation' terminology employed for PAM. It is a result of the L2 learning process, in which the target segment(s) is not only assimilated to a native category (naïve listeners), but is now equated to the L1 sound system in behalf of the target language development (L2-learning listeners). Furthermore, it is also identifiable the assimilation types proposed by PAM, which are necessary for interpreting the PAM-L2 predictions.

In the case the first hypothesis is confirmed, the model predicts that the probability of further L2 perceptual learning is remote, and that remaining L2 contrasts would either fit the Two-Category assimilation or Uncategorized vs. Categorized patterns. Henceforth, the discrimination ability is expected to be great. The second hypothesis describes PAM's

Category-Goodness Type, in which discrimination is estimated to be good. It is also estimated that new L2 categories can be formed for the segment that has fallen as the 'deviant' one in the listener's sound system.

The third hypothesis defines the Single-Category assimilation pattern to which discrimination is predicted to be poor. Therefore, the model posits that the perceptual learning, that is, the formation of new categories for the L2 assimilated phones probability is low, and dependent on other phonetic and phonological features. Finally, the last hypothesis refers to the Both Uncategorizable Type. Thus, the model presumes that "one or two new L2 phonological categories may be relatively easy to learn perceptually" (Best & Tyler, 2007, p. 30), and that further discrimination will depend on how the L2 contrast was perceptually assimilated.

As clearly exposed, PAM-L2 makes use of PAM's assimilation patterns that are expected to occur on naïve listeners and extends the predictions for L2 learners and their supposed perceptual development in the target language. Best and Tyler (2007) conclude exposing and fostering other factors that might influence the perception of non-native speech such as input, and context (second language acquisition vs. foreign language acquisition) variation. The authors convey that, "If both the language environment and the individual who is experiencing it are ever-changing, listener and input variations are likely to have substantial impact on perception of nonnative speech, especially if the perceiver is learning an L2" (p. 32).

Once more, this current research does not operate directly with the perception model suppositions here outlined. Nonetheless, I expect to have covered important theoretical background that has driven, and analytically assisted perception (and production) research in the linguistics field. Furthermore, the following section proceeds discussing elements that shape the perception of L2 speech.

2.4 SPEECH PERCEPTION AND PROFICIENCY

Another important aspect taken into consideration in non-native speech perception is the proficiency-level (PL), as experience with the target language may lead to perception improvement of non-native sounds. Based on speech perception theoretical frameworks, such as the NLM and the SLM presented above, Archila-Suerte et al. (2012) investigated "how early and late bilinguals with varying proficiency levels perceive non-native speech syllables" (p. 191).

They investigated early, intermediate and late bilinguals, being Spanish their first language, and English the L2. The researchers used the English vowels /æ/ and /ɛ/ (e.g., *bat* and *bet*), and /ɑ/ and /ʌ/ (e.g., *hot* and *hut*) as tokens, supposing that the first two vowels would be readily discriminated considering Spanish vowels /a/ and /e/ (e.g., *casa* and *leche*), and the second ones would be both perceived as instances of L1 /a/. It was expected that early AOA would result in a native-like performance independent of the proficiency level, proposing that early acquisition would be based on implicit knowledge similar to monolinguals. Moreover, late bilinguals with a high proficiency level would display improved performance because of experience with L2 phonemes.

The results demonstrated that early bilinguals' performance is accurate; meanwhile late bilinguals only obtain correct categorization if the proficiency level is high. These results suggest that children rely on implicit knowledge to learn an L2, and that "adults can make use of high-level cognitive processes like attention and other explicit strategies to learn the acoustic cues that determine the phonemic boundaries of L2" (p. 199). Notwithstanding, Archila-Suerte et al. (2012) highlight the importance of the linguistic background in non-native speech perception studies, since the contrasts between the L1 and L2 may affect the generalizability of the outcome. The idea is to depict that the mother tongue, that is, the non-native background, can greatly influence the results of the target L2 perception.

The fact that "adults **can** make use of high-level cognitive processes […]" (Archila-Suerte et al., p. 199, 2012) (emphasis added) in learning an L2 clearly does not imply that it is their only expertise. This is reinforced by Zimmer, Alves, and Silveira (2006) who explain that "L2 acquisition by an adult speaker is neither purely implicit nor explicit"[5] (p. 9) (my translation) in a connexionist approach of language acquisition. They add that both knowledge systems interact based on the activation of similar brain regions (hippocampus). Nonetheless, input frequency is essential for consolidation.

Insufficient input is believed to be the cause of many issues concerning L2 learning. One of them regards foreign accent, the scope of the SLM (Flege, 1995), which attempts to understand what causes foreign accent by studying the changes in the speech learning processes during

[5] A aquisição da L2 por um falante adulto não é nem puramente implícita nem puramente explícita.

the life span. Flege (1995) adds that the foreign accent phenomenon is complex giving the multiplicity of hypotheses proposed to explain it, such as neurological maturation, inaccurate perception of L2 sounds, or insufficient input as aforementioned.

Having briefly discussed influential perception models for the study of L2 speech, and discussed the role of L2 proficiency, I shall now turn to a more detailed description of the speech sounds being investigated in this study. Then, a brief review of empirical studies concerned with the –s morpheme will follow.

2.5 THE ENGLISH –S MORPHEME

Ladefoged (1996, p.137) explains that "fricative sounds are those in which a turbulent airstream is produced within the vocal tract". Moreover, the fricative sounds are produced when the turbulent airstream strikes the teeth. The English fricatives are /f/, /v/, /θ/, /ð/, /s/, /z/, /ʃ/, /ʒ/, and the affricates /ʧ/ and /ʤ/ that contain a fricative sound as well. Thus, all of the listed sounds are "pairwise matching in voiceless/voiced" as Yavas (2011, p. 62) describes, except for the sound /h/, which he depicts as a voiceless glottal fricative with no counterpart.

Progressing into the sounds' descriptions, "stops and fricatives are the only English consonants that can be either voiced or voiceless" (Ladefoged, 2011, p. 65). Voiced sounds are the ones in which the air makes the vocal folds vibrate when brought together while the air passes through the vocal tract, while a voiceless sound is produced without the vibration of the vocal folds (Kuiper, 2010, p. 127). Thus, the sound [z] is voiced, as in 'zoo', and the sound [s] is voiceless, as in 'sea'. Furthermore, both [s] and [z] are classified as alveolar[6] sounds.

Yavas (2011) also portrays a very important characteristic of connected speech regarding the fricative sounds, mainly considering the purpose of the present study. He states that "although the labels 'voiceless'/'voiced' are commonly used to separate certain fricatives, as with stops, the situation of voicing needs to be looked at carefully". The author further explains that the fricative sounds are fully voiced only when found in an intervocalic position, such as in the word 'Brazil', and that in initial and final positions they are only partially voiced. This way,

[6] Alveolar sounds are produced when the tongue tip or tongue blade touches the alveolar ridge, which is the part of the mouth roof right after the upper teeth (Ladefoged, 2011).

Yavas (2011) introduces the terms ‘fortis vs lenis’ distinction, rather than ‘voiceless vs voiced’, being classified as ‘fortis’ the fricative sounds “produced with louder friction noise than their lenis counterparts” (p. 63). This observation is important for the data analysis procedure of this research, since the focus is on alveolar fricatives in final position, and the fortis/lenis distinction is also examined.

In addition to the categorization of the sounds, Ladefoged (2011) states that “the higher-pitched sounds with a more obvious hiss, such as those in *sigh*, *shy*, are sometimes called **sibilants**” (p. 15). For Yavas (2011), these sibilant sounds are the alveolar and palato-alveolar fricatives /s, z/ and /ʃ, ʒ/ consecutively, which are produced “with a narrow longitudinal groove on the upper surface of the tongue; acoustically, they are identified by noise of relatively high intensity.” (p. 63). Thus, the focus of the present research regards the alveolar fricatives [s] and [z], or the so-called (alveolar) sibilants.

The phonemes that will be analyzed are categorized as fricatives. They are going to be studied in final position of plural noun forms of short words, which could also be interpreted as in the third person present tense verb forms, due to the occurrence of the same word in both word classes as mentioned in the ‘pronunciation of the –s morpheme’ section.

As explained previously, there are three possible pronunciations for the –s morpheme, varying according to the sound preceding the –s morpheme within the word: they are [s], [z] and [ɪz], and there is also a variation of [ɪz] as [əz]. This phenomenon is called allomorphism, that is, when a single morpheme possesses more than one possible pronunciation depending on its context. Therefore, the present research will focus on the perception of alveolar fricatives in plural forms (and third-person singular verb forms).

Another interesting characteristic of alveolar fricatives in final position regards their shaping in connected speech. Yavas (2011) states that [s] and [z] “may undergo palatalization and turn into [ʃ, ʒ] respectively, when they occur before the palatal glide /j/” (p. 64). He exemplifies with the common sentence ‘I miss you’, which might be uttered as [aɪmiʃʲu], in which the alveolar sound [s] is shaped into the palato-alveolar [ʃ]. Furthermore, the author describes that alveolars do not present variation in terms of dialects, however, he has elaborated a list of words that could be either pronounced with the alveolars [s] or [z], when <s> appears in intervocalic position, such as ‘resources’, ‘citizen’, and ‘greasy’. This is another point in which the alveolar fricatives, in middle position in this case, might be confusing for Brazilian English learners,

recalling Walker's (2010) explanation of BP grapheme-phoneme correspondence of such feature (see introduction section) and this topic could be explored in further research.

According to Celce-Murcia et al. (2010), English has eight regular inflections: 1) plural, 2) possessive, 3) third-person singular present tense, 4) past tense, 5) present participle, 6) past participle, 7) comparative degree, and 8) superlative degree (p. 394). The authors also explain that the connection between the inflection and the sound representation, which can be referred to as morphophonology, is closest when related to the regular grammatical inflections (p. 395). In other words, when there is a stable pattern of inflection, the proximity of the letter-sound is bigger.

Celce-Murcia et al. (2010) demonstrate that the pronunciation rules for the –s inflectional ending is applied not only for the regular plural forms, but also for the third-person singular present tense, and possessive inflection, even though there are some differences in spelling and punctuation for the possessive. In what follows, I present the rules for the pronunciation of plural nouns taken from Celce-Murcia et al. (2010, p. 395).

> 1. When the noun or verb ends in a sibilant consonant (i.e., /s, z, ʃ, ʒ, tʃ or dʒ/), the inflection has an epenthetic (i.e., extra) vowel and is realized as unstressed [ɪz] or [əz].
> 2. When the noun or verb ends in a voiced nonsibilant sound, the inflection involves progressive assimilation and is realized as [z].
> 3. When the noun or verb ends in a voiceless nonsibilant consonant, the inflection also involves progressive assimilation and is realized as [s].

With the intention of better illustrating the rules above, I shall now present examples of each one.

As regards to the first rule, an example of a noun ending in a sibilant consonant is the word 'maze', which ends with a [z] sound, thereby, the plural form 'mazes' should be pronounced as [meɪzɪz], ending in [ɪz]. For the second rule, the word 'eye' ends in a nonsibilant voiced sound, thus, it undergoes progressive assimilation, acquiring the feature of a voiced sound from the last phoneme (a vowel), so the plural noun 'eyes' is [aɪz], with [z]. Finally, the word 'map' fits in the third rule, which is the same as the second one. Given that, in this example, the final

sound [p] is a non-sibilant voiceless consonant, hence, the plural form ‘maps’ is realized as [mæps], ending with [s].

Yavas (2011) simplifies such rules with a diagram (Figure 1). Note that he uses only the unstressed /əz/ form for the first rule presented previously, not mentioning the possibility of the production of the other unstressed form [ɪz].

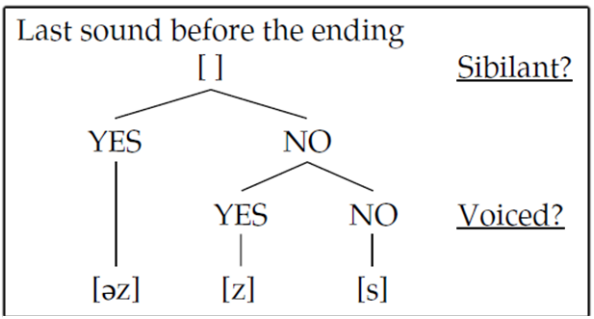


Figure 1. Rule for the -s morpheme pronunciation (Yavas, 2011, p.64).

Another important characteristic regarding the pronunciation of the –s morpheme in English concerns syllables. Whenever the formation of a plural noun or the third-person singular present tense requires the addition of [ɪz], or [əz], it will consequently require an extra syllable as well, since there is a new vowel sound included in the word, and vowels are nucleus of syllables, which is the case of the word ‘maze’ depicted above. The present study will investigate if this feature of an extra syllable helps the listener to perceive the different realizations of the –s inflectional ending[7].

Moving forward, there are several sounds that, when replaced, can form many different words, such as in a minimal pair, which are words that differ in one single phoneme. There are also situations in which the

[7] Up to now, the discussion focused on the regular inflections for plural. However, there are also the irregular plural nouns in the English language (Celce-Murcia et al, 2010). Although it is not the intention of the research to cover the irregular plural forms, there is an interesting characteristic in a set of words inside the category that connects to this study. They are the singular nouns that end in voiceless [f], which forms the plural removing the [f] and adding [vz], such as in wolf [wʊf] to wolves [wʊvz]. Therefore, there is another set of plural words that end in the phoneme [z].

switching of specific sounds or mispronunciation of one does not cause any problem regarding meaning. This phenomenon might happen with the plurals. Consider the word ‘play’, which can be a noun or a verb. When in the plural form, or conjugated in the present simple for the singular third person, it takes the form of ‘plays’ /pleɪz/. If one produces the last sound as [s], it may be perceived as another word: ‘place’ /pleɪs/. Thus, it seems relevant to analyze if the speakers perceive those specific sounds, and what is their relevance for discriminating other words or meanings.

2.6 FRICATIVES IN THE SPECTROGRAM

In order to carry out the research, an understanding of how the physical form of fricatives is depicted in the spectrogram is required to analyze the tokens selected to design the perception test. As mentioned previously, fricative sounds are produced with a turbulent airstream, thus, “such energy appears on a spectrogram as a scribbly pattern, without regular horizontal or vertical lines” (Yavas, 2011, p. 111). This lack of pattern is due to the type of sound wave that fricatives produce in the atmosphere, which is called an aperiodic wave (or a mixture of periodic and aperiodic waves in voiced fricatives). It means that there are no repeated cycles along its duration in time, such as the sound of a TV not tuned, or the alveolar fricative /s/ (Barbosa & Madureira, 2015).

Therefore, differentiating certain fricatives, especially between a voiced and its voiceless counterpart proves to be a complicated task, mainly taking into consideration Yava’s (2011) observation abovementioned regarding the position of the fricative in the target word, bringing back the ‘fortis vs lenis’ distinction, instead of ‘voiced vs voiceless’.

Fricative sounds possess very high frequencies due to their place and manner of articulation. For instance, the palato-alveolar /ʃ/ sound is usually produced, and therefore seen, within the energy concentration of 2,000-7,000 Hz, and the alveolar /s/ is even higher, with a range of 4,000-8,000 Hz (Yavas, 2011, p 113, figure 5.7). Yavas (2011) explains that the reason why such range variation occurs regards the amount of constriction necessary for the production of the sound. Hence, the present research focuses on the highest frequency fricatives, the alveolars, aiming at the range of 4,000-8,000 Hz in the spectrogram.

To the extent of a deeper analysis, voiced and voiceless fricatives demonstrate subtle differences in the spectrogram that need to be

investigated considering the objective of the study. According to Yavas (2011), voiced fricatives are shorter than the voiceless ones. Barbosa and Madureira (2015) corroborate with this view explaining that this difference happens due to part of the energy that is dispersed in the vibration of the vocal folds. The authors also portray that, for this reason (vibration), voiced fricatives are quite hard for the vocal tract, and that several languages present a shorter voiced fricative compared to its voiceless counterpart, which is true for English, Portuguese, German, and French, for example. Thus, stablishing a time parameter for discriminating fricatives between voiced and voiceless fricatives becomes an important criterion.

Barbosa and Madureira (2015) explain that "what defines its [the fricative] duration is the delimitation from the beginning to the end of the frication generated by this sound"[8] (p.70, my translation). In addition, voiced fricatives depict fainter formants due to the vibration of the vocal folds, and more disperse energy, resulting in a relatively low amplitude comparing to the voiceless fricatives. Furthermore, Yavas (2011) adds that such difference in amplitude "contributes to the perception of a voiced fricative (whether it is really voiced or not)" (p. 112). Thus, if the consonantal locus is higher, it might be inferred that it is a voiceless sound, related to a lower one, which would be its voiced counterpart, which seems to be a possible acoustic cue to examine unclear tokens of the present study.

Barbosa and Madureira (2015) propose that the limitation of boundaries among the segments should always be at the same point, be it the glottal cycle, the peak, or at the zero crossing, being the latter the procedure used in the present research for the segmentation of fricatives. Furthermore, regarding the fricatives in detail, Barbosa and Madureira (2015) suggest "to consider the continuous noise interval and the presence (voiced sounds) or absence of the sonority bar (voiceless sounds)"[9] (my translation) (p. 171). That is, to identify in the spectrogram the constant noise that characterizes the fricative sounds. The information presented above was used to select the target sounds from the native speaker's recording, as well as used for aurally analyzing its production to elaborate the perception tests.

---

[8] O que define sua duração [fricativa] é a delimitação do início e do final da fricção gerada por esse som.

[9] Considerar o intervalo de ruído contínuo e a presença (sons vozeados) ou ausência de barra de sonoridade (sons não vozeados).

In the following section, I briefly review studies concerned with both the production and perception of the English fricative sounds by native and non-native speakers.

2.7 PREVIOUS STUDIES

Pereira (1994) conducted an experiment that analyzed the acquisition of morpho-phonological rules by Brazilian speakers of EFL. The study focused on allomorphs involving the pronunciation of -ed endings in past tense or past participle of regular verbs in English, as well as the allomorphs involving the pronunciation of the [s] sound in final position, mainly regarding plural forms.

The participants were forty adult students from the extracurricular courses at *Universidade Federal de Santa Catarina* (UFSC). There were two groups, one of twenty participants from an intermediate level, and another twenty from an advanced level, both chosen randomly. One by one, they were asked to read a set of short sentences, including pseudo words, which were also presented in cards with simple pictures as pictorial stimuli in order to help the participants to produce the forms proposed by the research. This was an adapted version of Berko-Gleason's test of Morphology as cited in Pereira (1994) that the researcher elaborated with the purpose of analyzing data quantitatively and qualitatively to try to discover any possible pattern in the participants' production of allophones and allomorphs.

The researcher found that the participants partially stored the productive morphological rules of English, blocking the complete confirmation of her first hypotheses. Nonetheless, it confirmed her second hypotheses, which predicted that participants applied different strategies in the production of inflections, which rely on the Portuguese morphophonemic rules. Thus, L1 influenced L2 plural, and past tense production. Furthermore, the author states that proficiency appeared to have an impact on the overall results of the research.

Another study conducted by Zanfra (2013) investigated the sounds /s/ and /z/ in word final position. The research analyzed to what extent Brazilian speakers of English would produce the target sounds with a different voicing feature, taking into consideration the fact that the phonological context, proficiency, and spelling could influence their productions. In addition, the investigation was based on the assumption that the Portuguese language characteristics of voicing assimilation would reflect on the production of the English target sounds.

The researcher worked with 27 participants, including 23 native speakers of Brazilian Portuguese, and four native speakers of American English. They were divided into three groups in order to carry out the research. One formed by the native speakers of English as the control group, and two experimental ones separated into intermediate and advanced levels of proficiency. The participants had to record a sentence-reading task individually, consisting of a version with English sentences and another one with Portuguese sentences.

Zanfra's (2013) results showed that L1 played a big role in the production of the L2 target sounds, as predicted by the literature. First, the phonological context of the words tested influenced their production considering the Portuguese language characteristics. Second, spelling also demonstrated speakers' reliance on L1 spelling-sound correspondence rules. Finally, the proficiency variable indicated better performance for the participants in the advanced level, despite the lack of statistical significance when compared to the intermediate level data.

Broersma (2010) studied the perception of final fricative voicing in the L2 based on the perceptual cues from the L1. The aim was to analyze if the listeners' would "transfer" the ability of perceiving contrastive sounds from the mother tongue to the target language based on a specific characteristic present in both languages although in a different context. Therefore, the author investigated the native and nonnative's use of vowel duration in English as a perceptual cue for contrasting final fricative voicing from both English and Dutch listeners.

The research took in consideration that both languages have similar contrasts between /v-f/ and /s-z/, and that vowel duration works as a perceptual cue for the contrasts, except for the voicing contrast in word-final position, which happens in English but not in Dutch.

The study was carried out in two parts (experiments): the first to collect the listeners' goodness ratings of the stimuli, and the second to assess the phonetic categorization of such stimuli. Each experiment was administered to 16 Dutch and 16 English listeners, being the Dutch listeners all proficient in English as a L2, and the English listeners without any knowledge of the Dutch language. However, the material used was the same for both experiments. It consisted of nonwords in English ending in the final fricatives /v/, /f/, /s/, /z/, in which two different continua holding 11 steps from the natural voiced end-point to the natural voiceless end-point were created.

The results yielded that both listeners used vowel duration to distinguish between final fricative voicing, although the English listeners used it more than the Dutch ones, which was expected considering the

native language experience on the perceptual cue. Interestingly, "the effect of vowel duration was smaller for the /s-z/ contrast than for the /v-f/ contrast in both experiments" (Broersma, 2010, pg. 1642). Moreover, the author concluded, "experience with a perceptual cue for a contrast in the L1 may not suffice for the efficient use of this cue for a different contrast in the L2, or even for a similar contrast in a different phonetic position in the L2". (Broersma, 2010, pg. 1643).

Johnson and Babel (2007) also studied the perception of fricatives by Dutch and English listeners. Their investigation focused on the voiceless fricatives /f/, /θ/, /s/, /ʃ/, /x/, and /h/. The research was carried out with two experiments as well, in which the authors analyzed the similarities and differences between how the listeners of both languages discriminated the target sounds based on a phonetic similarity theory.

In the first experiment, there were 16 American English speakers and 12 Dutch speakers. The participants were asked to complete a rating perceptual similarity task in which the stimuli were composed of eighteen disyllabic vowel-fricative-vowel tokens. The results portrayed that the Dutch listeners rated certain pairs of fricatives differently than the English listeners, that is, the groups' ratings differed in the similarity level when the pairs contrasted were [s] - [ʃ], [s] - [θ], and [ʃ] - [θ], which was expected given the languages' inventories and the listeners' experience with the sounds. The authors added that, "the results of this similarity rating experiment suggest that phonological alternation has a powerful impact on speech perception". (Johnson & Babel, 2007, p. 311).

The second experiment contained 19 American English speakers and 15 Dutch speakers, being nine of the Dutch participants from the previous experiment. The stimuli used was the same elaborated for the first one, which in turn was used to design a speeded discrimination task with the intention of looking at lower-level auditory processing of the fricatives. Notably, the participants achieved a 95% rate of correctness, and the results demonstrated no significant difference in performance between the listeners, that is, no language effect. Hence, the researchers believed it was due to their emphasis on the speed of responding and that further research is needed in this type of experiment.

Bilbao (2015) investigated the perception of the contrastive English fricatives /s/ and /ʃ/ by native Spanish speakers. The contrast of these phonemes lies on the place of articulation in the vocal tract, and the palate-alveolar fricative is not part of the Spanish phonemic system. Therefore, the study is based on the perceptual difficulty (due to lack of experience) of distinguishing non-native speech contrasts that are not present in the listeners' mother tongue.

The experiment used a synthetic speech version of the minimal pair 'Sue/shoe' to control the acoustic signal and manipulate the acoustic cues. Hence, the test material was elaborated with the variation in the frication and F2 (second formants) transitions, since the focus of the research was on the perception of the fricatives based on the place of articulation. The task was a forced identification test for analyzing the Spanish listeners' categorization ability.

There were 26 Spanish listeners (Spain) and 20 native speakers of British English acting as a control group for the study. The results showed that when both acoustic cues (frication and F2 transitions) were presented, the Spanish listeners had a "progressive" identification to which the contrast gradually moved from /s/ to /ʃ/, and the same happened when only the frication cues were presented in the stimuli. Diversely, when only the F2 transitions acoustic cues were presented, the identification was random.

Thus, the data depicted that the Spanish participants "were almost entirely reliant on the frequency and amplitude of the frication noise for establishing the place of articulation contrast" (Bilbao, 2015, pg. 49), which also depicted their ability to process the non-native contrast. Interestingly, the control group had very similar results (slightly better), portraying that F2 transitions are not enough for listeners to perceive the distinction in the acoustic signal.

Turning once more to the production of fricatives, Song, Demuth, Evans, and Shattuck-Hufnagel (2013) studied the developmental realization of fricatives in coda position by English-speaking children (monolingual). The study was based on the fact that the fricatives are usually reported to be late acquired sounds in the production of children compared to other sounds, and that most of the existing research focused on word-initial rather than on codas, in addition to the contrastive importance that fricatives possess in word final position in the English language.

The authors examined acoustically the alveolar fricatives /s/ and /z/ of three 2-year-olds and six mothers speaking spontaneous American English. Importantly, the data were collected longitudinally (2 years). The research was divided into two parallel experiments, in which the first focused on the voicing effects of duration in the contrast of the fricatives in monomorphemic words, that is, words like 'cheese' and 'peace'. The second experiment focused on analyzing the morphemic effects on the duration of the alveolar /z/, which was based on words inflected with the –s morpheme in the plural or the singular third person. Therefore, it was

expected different results between contexts of analysis and between the children and the adults.

The target words for the first experiment were chosen based on the frequency in the children's speech and it consisted of three CVC (consonant-vowel-consonant) words ending in /z/, and five CVC words ending in /s/, being all of them monomorphemic verbs or nouns. Furthermore, the target words were analyzed in five different contexts (utterance-final position; utterance-medial before stressed vowels/unstressed vowels/glide-initial words/non-glide consonant-initial words) at three different times. Firstly, the results depicted that there were no significant changes in the duration of the frication in the children's speech across times. However, the authors found that the frication duration was longer for /s/ than /z/ for both groups (children and mothers), although children portrayed longer durations in both contexts (final/medial position) than the adults did, as predicted by the researchers.

The data for the second experiment followed the same reasoning of the first one and consisted of six morphemic and three non-morphemic codas (/z/) that were analyzed. Equal to the results of the first experiment, there were no significant changes in the frication duration in the children's sample throughout the time in which the data were collected. Moreover, the children showed longer frication duration in the second experiment as well. As expected, the duration was also longer for utterance-final than utterance-medial position. Lastly, there was a significant difference between the morphemic /z/ and the non-morphemic /z/, being the former longer than the latter, in which the researchers suggest that "children as young as two years old are distinguishing between morphological and non-morphological coda fricatives in their speech processing, as suggested by some aspects of the adult data as well". (Song et al. 2013, p. 2943).

Nittrouer (2002) carried out another study conducted on the perception of fricative sounds in American English native speakers with both children and adults. In this analytical research, the author tested the predictions of the *developmental weighting shift*, which hypothesizes that along with experience in the L1 the amount of attention given to specific information about the speech signal changes, namely, the formant transitions and the noise spectra.

She elaborated two experiments in which the first examined the perception of the /f/ and /θ/ contrast, and the second for the /s/ and /ʃ/ sounds. In the first experiment, there were 36 children split into three different age groups (4, 6, and 8), and 13 adults with the mean age of 30. In the second experiment, there were 39 children divided into the same

age groups and 12 adults with the mean age of 31. In both experiments a labelling task was administered, using stimuli that was a hybrid of natural and synthetic speech, in which the fricative sounds were natural ones combined with synthetic vocalic portions forming a continuum.

The results from both experiments met the predictions stated by the literature proposed. In other words, there were no significant differences among groups as expected in the first experiment; meanwhile there was a clear shift in perceptual attention from formant transitions to noise spectra in the second one. Although this study does not concern the perception of English as an L2, it does portray that the perceptual mechanism adapts, or evolves, as experience with the language is acquired.

Kabak and Maniwa (2007) investigated the perception of English fricatives by standard German and Swabian German speakers taking into consideration phonemic and phonetic factors, besides analyzing whether clear speech enhances intelligibility. Meanwhile in standard German there is a restricted contrast for voicing in fricative sounds, in Swabian German it is not found at all, "so the voicing distinction is completely absent for sibilants" (Kabak & Maniwa, 2007, p. 781) in the dialect.

The experiment was carried out with 14 Standard-German listeners, 14 Swabian-dialect listeners, and 14 American English native speakers. The stimuli consisted of VCV (vowel-consonant-vowel) tokens containing the eight English fricatives divided into minimal pairs, which were tested through a perception identification test.

In general, the results portrayed that the native group performed better than the others, and that the standard German listeners did better than the Swabian informants. There were significant results contrasting clear and conversational speech, also showing improvement in intelligibility for all groups. In conclusion, the authors imply, regarding the aspects studied, that "it is interactions between these factors (and probably others), and not any one factor acting alone that determines how listeners perceive non-native contrasts" (Kabak & Maniwa, 2007, p. 784). In other words, it is not only the phonemic, or phonetic factor that underlies perception, but rather a mixture of them and possibly others elements that are present in speech.

2.7.1 Reaction time and speech perception

This last study review concerns reaction time and its relation to speech perception. It is relevant for the present investigation considering that time on task is an aspect analyzed in the study. Markedly, the present

study investigates time on task rather than reaction time, considering that the test procedures were not propitious for the reaction time measurement itself. Nonetheless, it is presumed that time on task is related to reaction time.

Hence, in a different standpoint, Pisoni and Tash (2012) approach speech perception from a psycholinguistic standpoint, investigating how reaction time can help to demonstrate a relationship between auditory and phonetic information in speech perception. The authors make use of Posner's reaction time matching paradigm, which "provides an opportunity to examine the level of analysis at which comparisons are made by measuring the processing time required for different types of comparisons" (p. 02).

Therefore, the methodology used in their investigation concerns the listeners' discrimination ability, in which it was measured the reaction time of the informants of their "same or different" responses across the designed synthetic stimuli (bilabial stop consonant vowel). Notwithstanding, identification tests were also administered because their outcome might influence the analysis of the following matching tests.

In general, their results on the identification test portray that reaction time increases as the level of consistency at the phonetic boundary decreases, and the opposite occurs. In the discrimination tasks, the results portray that listeners are faster for acoustically identical stimuli, rather than acoustically different ones. Furthermore, the authors discuss that the "Reaction Time task reveals another level of analysis" (p. 07), which might assist better understanding of speech perception in general.

Thus, taking into consideration the brief review of the study presented above, the current investigation considers the authors' findings on reaction time to elaborate a research question (RQ3) and a respective hypothesis (H3) on the time on task that is employed within the identification test administered in this piece of research.

Having reviewed a considerable amount of research on the production and perception of the English fricatives, including studies on both native and non-native listeners of the TL, besides the study on reaction time, the following chapter presents the method adopted by the researcher in order to carry out the present investigation on the perception of the –s morpheme by Brazilian EFL learners.

CHAPTER III

3 METHOD

This study adopts a quantitative approach with the intention of generating data for the research field. In order to carry out the research, the participation of an English native speaker to provide tokens to design the perception test, and the participation of English native listeners to constitute a control group for the research, as well as the participation of a number of Brazilian learners of English to provide the perception data were necessary. Concerning the objectives of the research, a perception test was elaborated using a computer software designed specifically for this purpose. In addition, a questionnaire to obtain personal and linguistic information from the participants was administered, along with a proficiency test commonly used in the research field, which was completed by the Brazilian participants. Furthermore, all the participants, including the talker, respecting the guidelines of the ethics research board, signed a term of consent.

Reviewing the purposes of the investigation, the research questions inquire about the ability of Brazilian learners of EFL to identify the different realizations of the –s morpheme in the target language. The influence of the phonological context in the perception of the allomorphs, the roles of the confidence level and time on task, and proficiency level are some of the variables that possibly intervene with the overall results, as established in the hypotheses.

3.1 PARTICIPANTS

The research required the participation of English native speakers, being one the talker who recorded the study material, and the others acted as listeners to form the control group. In addition, a number of Brazilian learners of EFL was essential in order to collect relevant data for the study. One of the purposes of the native speakers lies in the capability of providing speech samples of the English language, which in turn, is essential to elaborate the perception test proposed by the present study. The additional purpose is to form a control group with the purpose of validating the perception test elaborated for the study. Consequently, the participation of the Brazilian learners was necessary to perform the mentioned test and investigate their perception of the English –s morpheme.

For a small-scale pilot study, the researcher gathered material from a native participant, allowing the elaboration of a first version of the perception identification test, which in turn became the perception test used in this research after further adaptions, which are demonstrated in the pilot section (3.4).

Concerning the selection of the participants, the English native speakers were contacted through indications from the researcher's university colleagues, mainly taking into consideration the feasibility of finding English native speakers in the city willing to collaborate with the research. In regards to the Brazilian participants, they were all students from the same university of the researcher (UFSC), and enrolled in different levels of the English *Extracurricular* course.

All the participants had to read, agree, and sign a term of consent allowing the researcher to use the data provided by them. They also had to complete a questionnaire regarding their personal and linguistic profile. The native talker participant, specifically, recorded the material for the test described in section 3.2.2, and the Brazilian participants, as well as the English native listeners, took the perception test. Moreover, the EFL learners also had to fill out a brief feedback form concerning the test and to take a proficiency test, since the proficiency level is an important factor in the research. Further information on the participants is portrayed in more detail in the following sections, as well as the procedures adopted.

3.1.1 English native participants

3.1.1.1 English native talker

An English male native speaker who was eighteen years old provided the speaking data in a recording session. As the talker explained in the profile questionnaire (Appendix A), he was born in Hawaii, on the island of Oahu, and has lived most of his life in the suburbs of Cleveland, USA. At the time of the data collection, he declared to be living in Florianopolis, Santa Catarina, Brazil, for little less than four months. Regarding the use of English, he replied: "At this time I scarcely use English to communicate with Brazilians except for when I do not know the word or conjugation that I am trying to communicate."

Concerning knowledge of other languages, he stated to speak German and Portuguese as foreign languages frequently. Then, in a scale from 'not at all' to 'very well' for how well is the understanding and speaking of those languages, the answer was 'very well' for both of them. As for the time of study of those languages, for German he said to have

spent one year in an exchange program in Germany followed by one year in high school, and that for Portuguese the time was “the amount of time I have lived here without any classes.” Lastly, the participant declared not to have any speech impairment.

Thus, it is possible to point out that the English native speaker was a young person with considerable travelling, and consequently L2 experience. However, it seems relevant to highlight that the time he had spent in Brazil was fairly short. In other words, he was not an established person in the country who had been speaking BP for a long period. Similarly, he stated not having any formal classes in BP.

3.1.1.2 English native listeners

The same questionnaire (Appendix A) was employed to obtain information about the English native listeners that constituted the control group for the present study, being three males and four females. The mean age of the group was of 26.42 years old. They were all living in the city of Florianópolis at the time of their participation, and they were all from the United States of America, although from different states, such as California, Alabama, Nevada, and New York. Besides Brazil, most of the participants stated to have travelled (days/weeks), or even lived (months/years), in other different places around the globe, like Argentina, Colombia, Spain, France, Africa, and Australia. As regards the time spent in Brazil, the participants varied from four weeks to four years in the country, being the majority (57.14%) around 1 one year at the time of the data collection. Their occupations were also diversified, including students, teachers, and a data scientist.

Considering the participants’ linguistic profile, specifically their use of English, they all declared to communicate using the language on a daily basis, being occasionally mixed with Portuguese, which five informants (71.42%) reported to speak frequently, and very/fairly well. From the remaining two, both reported no considerable knowledge of Portuguese. Other languages that have been declared to take part in the participants’ linguistic profile include Spanish, French, and Amharic, which is somehow connected to their travelling records. Lastly, none reported to have any speech impairments.

3.1.2 Brazilian participants

The participants were selected from the pool of students from three different levels of the *Inglês Extracurricular* program from UFSC. They were students of levels 5, 6, and 7 of the English course (considered as intermediate) at the time of the data collection. Students from lower levels were not invited to participate because the researcher intended to work with learners that would be capable of answering the questionnaire and comprehending the tutorial utilized for demonstrating how the perception test works without accessing their mother tongue. Thus, the choice intended to narrow the participants' level to lower intermediate and above, however, the proficiency test depicted beginners as well (higher course levels were not made available for data collection).

The reason for selecting participants from different course levels is that it is assumed that there is varied proficiency levels among them, seeing that proficiency is a key variable that is analyzed in this research. Moreover, the proficiency test (section 3.2.1) was administered in order to identify the participants' level with the purpose of verifying if different levels achieved contrasting results in the perception test.

The researcher worked with 33 BP participants, chosen randomly within the course levels, considering that for Applied Linguistics, Dornyei (2007) states that this number (30) seems to be an appropriate one for quantitative studies. Additionally, the author articulates that it is important to work with a safety margin considering that certain participants might abandon the research, or that data from specific participants may not be appropriate for analysis.

A different questionnaire was elaborated in order to gather information about the Brazilian EFL learners (Appendix B). From the 33 participants, 10 were male and 23 female. The mean age of the group was 28.15 years old. They were all living in the city of Florianópolis at the time of their participation, and the majority (72.7%) was born in the same state of Santa Catarina. Other states include Rio Grande do Sul, Paraná, São Paulo, and Ceará. Regarding any experience in another country in which English was an official language, seven participants declared to have spent from weeks to more than a year overseas (Appendix C). There were also participants who had stated they traveled to other places, such as Denmark and Germany, which may be connected to the variety in other languages' knowledge reported by them: Danish, Italian, French, German, and Spanish, for instance.

The participants were also asked to inform the time they had been studying English, however, this piece of information was removed from

the study considering that it was a complex question in order to obtain accurate responses. Perhaps, the fact that the English has constantly been part of their course of study (ELF/EFL) is one of the reasons why this matter is truly complicated to be measured in such context.

3.2 INSTRUMENTS

Four main instruments were designed to carry out the research. Firstly, the term of consent designed based on the ethics committee orientations from the CEPSH-UFSC (*Comitê de Ética com Pesquisa em Seres Humanos*). It is important to depict that due to the three different types of participants, the English native speaker, the English native listeners, and the Brazilian listeners, three different terms were written, with slight modifications, which basically refers to the activities that the participants are requested to do compared to each other, as can be seen in appendices D, E and F.

Secondly, questionnaires were elaborated by the researcher to gather the personal and linguistic profile of all the participants involved. Once more, there were two different questionnaires with modest changes between them to fit the participants' characteristics (Appendices A and B). The questionnaires consisted of personal questions such as the current place of living, and language knowledge questions such as the amount of time they spent using the English language.

The third instrument is the perception test elaborated with a computer software called TP Worken (Kluge; Rauber; Rato; and Santos, 2013), a specific operating system for designing this type of test. Its details shall be depicted along with the specificities of the test itself in subsection 3.2.2, including the familiarization session (presentation and mock test) and the test feedback, which are all parts of the same instrument. Finally, an English proficiency test administered to the Brazilian participants was chosen as the tool to evaluate the listeners' English level as it is outlined in the next subsection.

3.2.1 Proficiency test (QPT)

Considering the purposes of the study, the proficiency level of the participants is important to be described. In order to accomplish this, a placement test was administered along with the data collection procedures. The selected test is called Quick Placement Test (QPT), in the paper and pen test version from Oxford University Press, which was designed for "learners from secondary age and above at any level" (Allan,

2004). There are two versions of the test with a different sequence of the questions for the sake of avoiding cheating if more than one test is administered at the same time.

The QPT assesses reading, vocabulary and grammar with an average of 30 minutes to be completed. All the questions are multiple-choice and the answers should be written on the answer sheet. The test is composed of two parts, being Part 1 directed to all students taking the test, consisting of 40 questions, and Part 2 for higher ability students only, with 20 more questions. Taking into consideration that all the participants that were asked to take part in the present research were expected to be in the intermediate level and above, Part 2 was required for all of them, as it helps to discriminate between intermediate and advanced proficiency levels.

With regard to the interpretation of the results, the scores of the paper and pen version scales up to 60 points, which is the total amount of questions from Part 1 and Part 2. The marks are then interpreted according to Association of Language Testers in Europe table, and further compared to the correspondent level of the Common European Framework of Reference (CEFR), as well as the Cambridge ESOL Examinations (Council of Europe, 2001). Thus, the test is a simple and objective way of allocating the participants according to their proficiency level. Furthermore, it allowed the researcher to compare the listeners' proficiency level according to the QPT and their proficiency level according to their own self-rating statements in the questionnaires.

3.2.2 Perception test

Two different types of perception tests were intended to be administered. One identification test, and one discrimination test. The goal was to have two tests with diverse features (identification/discrimination), and to be able to gather diverse data for analysis. Notwithstanding, only the identification test was designed. The discrimination test was not accomplished due to its nature and its incompatibility with the tokens used in this piece of research.

The problematic lies exactly on the language feature that is the scope of the study. Normally, auditory discrimination tests (usually with an ABX format) make use of minimal pairs to elaborate its trials. In this manner, there is only one sound (the target) that differs among the words used as tokens. Thus, the listener may be asked to discriminate if the sounds are the same or different. Therefore, considering that the focus

here is the different realizations of the –s morpheme, that is, the sound [s] and its allomorphs in coda position, and that they occur based on the regressive assimilation inflection rule, it becomes impractical the design of a discrimination test with such feature, since the words are very dissimilar from each other (Table 1, section 3.2.2.1).

Having said that, the following subsections describe in detail the identification test design and its purpose, including the selection of words made by the researcher that were used as tokens for the test, as well as the procedures of how they were recorded, besides the TP software and the sound equipment.

3.2.2.1 Identification test design

The Identification test consists of listening to a target stimulus (a short plural noun, which could also be considered as a third person present verb) and selecting the option that better represents the last sound of the word spoken, that is, to identify [s], [z], or [ɪz] in coda position. The analysis is based on the number of correct answers obtained through the tests. For instance, if the target stimulus is the word "kicks", the proper answer according to the literature is [s]. Hence, the identification test allows the researcher to verify if listeners are able to identify the different English –s morpheme realizations.

Regarding the selection of tokens for the test, the researcher selected 30 monosyllabic words to be tested considering their singular form, a number that resonates with Dornyei's (2007) statement depicted previously within applied linguistics. Monosyllabic words are easier to control for the phonological context and stress, which could be confounding variables in perception tests.

The choice of words as tokens for the data collection was based on a frequency list provided at www.newgeneralservicelist.org. The list called *A New General Service List (1.01)* (NGSL) describes itself as containing "the most important words for second language learners of English", and it "provides over 90% coverage for most general English texts". It was elaborated based on the two billion word Cambridge English Corpus by Browne, Culligan, and Phillips, J. (2013), and it consists of 2801 words.

NGSL 1.01 counts frequency for word derivations. That is, the word, or *lemma*, '*be*' occupies the second position considering its variants '*am*', '*is*', '*are*', '*been*', '*was*', '*were*', '*being*', etc. However, it does not combine word frequency regardless of part of speech, which happens in

its predecessor General Service List. Besides, numbers, days of the week and months of the year are excluded from the list, although they are encompassed as an appendix.

The following criteria guided the selection of words from the NGSL 1.01 corpus: (a) 30 words were chosen, and they were divided into three groups of ten. Each group comprises ten words ending with one of the different plural form inflection realizations. That is, one group holds ten words that end in [s] as in 'maps' [mæps]. Another group holds ten words in which the last sound of its plural form is [z], as in 'eyes' [aɪz], and finally, the last group holds ten words ending in [ɪz], as is 'mazes' [meɪzɪz].

Moreover, (b) only monosyllabic words were chosen regarding the purpose of the study, besides the fact that, according to the literature, an extra syllable should be placed for words ending with a fricative sound before the addition of another fricative sound for the plural marker. Therefore, the last group of words, while in plural form, are not monosyllabic (e.g., 'pages' /peɪdʒ.ɪz/). The last criterion was that (c) the target word should appear in high frequency rank in the NGSL corpus.

As can be seen in Table 1, the first word with the /-s/ ending sound is '*like*', as in 'likes' /laɪks/ (e.g., more than one million facebook likes), occupying the 45th rank of the NGSL list. The first token for the /-z/ ending sound is '*time*', as in 'times' /taɪmz/ (e.g., I have counted three times), occupying the 49th rank. Finally, the last word included in the test is '*base*' (e.g., Army bases), which occupies the 327th position in the rank from the 2801 words provided by NGSL 1.01 (see complete tables in Appendix G).

Another relevant piece of information regarding the selection of tokens from the NGSL 1.01 is that most words belong to more than one word class. That is, the word "time" can be an adjective, a verb, and a noun. Words that (also) belong to the pronoun word class were not considered (e.g., *one*, or *lot*). Words like "up" and "down" were not considered either, since the researcher believes that their plural forms are not as common as their singular forms (e.g., *we all have ups and downs*). Moreover, words with irregular plural forms were also discarded (e.g. *life - lives*).

Table 1
Selection of tokens for the identification test

/-s/	SFI[a] rank	/-z/	SFI rank	/-ɪz/	SFI rank
like	45	time	49	place	114
work	67	year	58	change	113
look	75	way	80	pause	649
talk	137	thing	87	course	164
part	130	need	90	case	168
point	131	mean	95	face	249
week	157	show	110	age	282
group	167	try	125	price	296
book	171	school	146	watch	326
set	185	end	152	base	327

[a] *Frequency rank according to NGSL 1.01*

In order to record the American talker, a PowerPoint presentation was elaborated with the target words from the study. Those words were placed in carrier sentences throughout the slides. There were a total of four carrier sentences, and they are: a) I say ___, b) I say ___ twice, c) I say ___ definitely, and d) I say ___ again. In this way, the native participant had to produce the same word in four different contexts, considering that the focus is on the coda position of the words. Thus, in the first carrier sentence there is no following context (silence), in the second one there is a voiceless plosive consonant (/t/), in the third example there is a voiced plosive consonant (/d/), and for the last, there is an unstressed vowel (/ə/) as the following context. Each slide contained the four carrier sentences and the same target word in the gaps. There were a total of 34 slides, being 30 words chosen as the total amount of tokens, and that the first two slides, as well as the last two slides were not target words, with the intention of reducing distracting/tiredness issues from the talker's data

By designing the production procedure in this manner, the English native speaker produced the same target word four times. It allowed the researcher to evaluate if the listeners perceived the difference among the tokens of the same word distributed in different phonological contexts, if there was any.

3.2.2.2 The TP software

The perception test was elaborated with the TP (Teste/Treinamento de Percepção) Worken software, 3.1 version[10]. This free software allows the creation and application of perception tests/tasks using audio and audiovisual stimuli. Rauber, Rato, Kluge, and Santos (2013) created the software and the tutorial that teaches how to operate it, and the program was developed by Marcos Figueiredo.

The TP worken software was set to display all messages and headings in English (the software allows the display of other languages such as Portuguese and Spanish). In this fashion, the researcher minimizes the chances of having the listeners use/access their mother tongue during the process.

All audio files, each of them containing one token, were added into the TP program. The tokens were selected from the native talker's recorded material. Then, one by one, the correct answer according to the researcher analysis was selected for each target word. Only eight tokens (composed by the words 'ups' ([s]), 'downs' [z] and 'mazes'([ɪz])) were included in the familiarization session test, and none of them is a target word from the main identification test, which consists of 120 tokens (30 target words (10 for each –s allomorph) x four carrier sentences). Therefore, the mock test was designed the same way the actual test was.

3.2.3 Sound equipment

The specifications of the sound equipment used for recording the research stimuli are as follows. Regarding the hardware, the computer utilized was an iMac (model iMac9.1), version Mac OS X 10.6.8, Intel Core Duo, 2GHz, 4GB 1067MHz DDR3. The sound card model was MOTU UltraLite-mk3 Hybrid (Hybrid FireWire – USB audio interface with on-board effects and mixing) for Mac OS X systems. The microphone was a SHURE SM48-LC cardioid vocal dynamic (55 - 14,000 Hz frequency), and lastly, the headphone was a Behringer HPX2000. With reference to the software, the following programs were employed: Ocenaudio version 2 rc 1 (build 5141), with the sampling rate set at 44100Hz, mono, 16 bits, besides CueMix version FX 1.6 57985. Moreover, PRAAT version 5.4.17 was employed for data analysis.

[10] Available at www.worken.com.br/tp.

Another set of equipment was used in order to collect the data from the listeners' informants. The computer was a Samsung notebook (model NP270E5G-XD1BR), Windows 10 Pro, Intel Core i5, 2.60GHz, 8GB. The headphone was a Microsoft LifeChat LX-3000 (model 1084). Moreover, an auxiliary Microsoft Wireless Keyboard 3000 v2.0, and a Microsoft Wireless Mouse 5000 were adopted with the intention of improving comfort in the data collection procedures.

3.3 PROCEDURES FOR DATA COLLECTION

Considering the four main instruments designed for the study, there were four main procedures proposed for the data collection. Firstly, the participants (speaker and listeners) read the term of consent thoroughly and any question regarding its content was clarified. Upon agreeing to contribute, the participants and the researcher signed two copies of the term, as it is stated in the document itself, since one copy is meant to be with each of them. Then, the questionnaires were administered, and next in order was the recording for the talker, the perception test for the listeners, and the proficiency test for the Brazilian learners consecutively.

Before administering the identification test, the researcher made use of a PowerPoint presentation (Appendix H), to explain how the test works, and allowed the participants to practice performing the test by completing a mock test (familiarization session). This was followed by the performance of the actual perception test. The familiarization session was fundamental for the participants so that they could learn how to proceed to perform the identification test. The procedures were done either at FONAPLI (*Laboratório de Fonética Aplica*), or at a specific data collection room at the university, where the researcher collected data from each participant individually.

Finally, the proficiency test was administered. The motive behind the order established for the procedures, which leaves it as the last item, regards the fact that the researcher assumes that the participants are more self-motivated to take the proficiency test, rather than the perception test. Thus, it is an attempt to maintain the participants' interest, focus, and motivation throughout the whole process of data collection, which was completed in one single meeting with an average of one and a half hour during the year of 2016.

3.3.1 Test procedures

Before initiating the perception test, the participants went through a familiarization session with the researcher. The session consisted in a presentation depicting how the test works, as well as a familiarization test as a consolidation of the preceding explanation, which were essential steps for a proper performance from the participants.

Thus, the initial step was to open the TP software and click on 'Application'. Then, the listeners had to type their names and last names, and click on 'Start Identification Test' (the images can be seen within the familiarization slides in appendix H). As soon as the participant clicked to start the test, the first word was played and the main screen of the test was displayed (Figure 2).

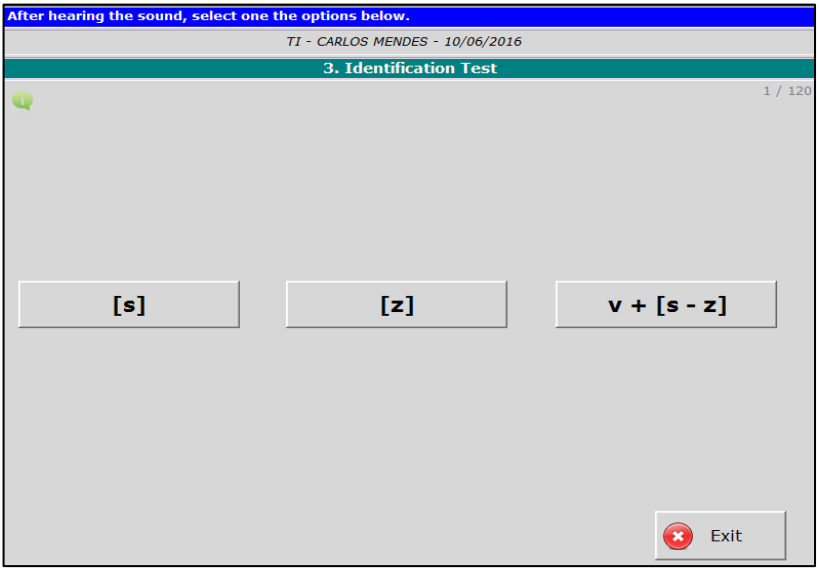


Figure 2. TP screenshot showing the Likert scale at the bottom.

As shown in Figure 2, the test displays three possible answers: 1) [s], 2) [z], 3) v + [s – z]. Hence, according to the literature, the word 'books' should end with [s], and the correct answer should be 1) [s]. Therefore, there were 40 (10 words produced 4 times, each time in a different phonological context) tokens for each target allomorph realization, totalizing 120 tokens in the perception test as previously mentioned.

Upon selecting one of the options, the test displayed a Likert scale (see bottom of Figure 3). The scale goes from 1 to 9, and it is expected to express how certain the participants were about their choice, being 1 ‘not sure’ and 9 ‘absolutely sure’ (this second step was also explained in the familiarization session). This feature allowed the investigator to look closer at difficulties faced by the participants. Then, upon selecting one of the numbers, the scale disappeared and the next word was played, repeating this sequence until the end of the test, except for the pause that was inserted at the middle of the test (trial 60), in which a window popped informing the participants they could stop and rest for some minutes. There was no duration limit imposed for the participants in the pause, neither in the test itself.

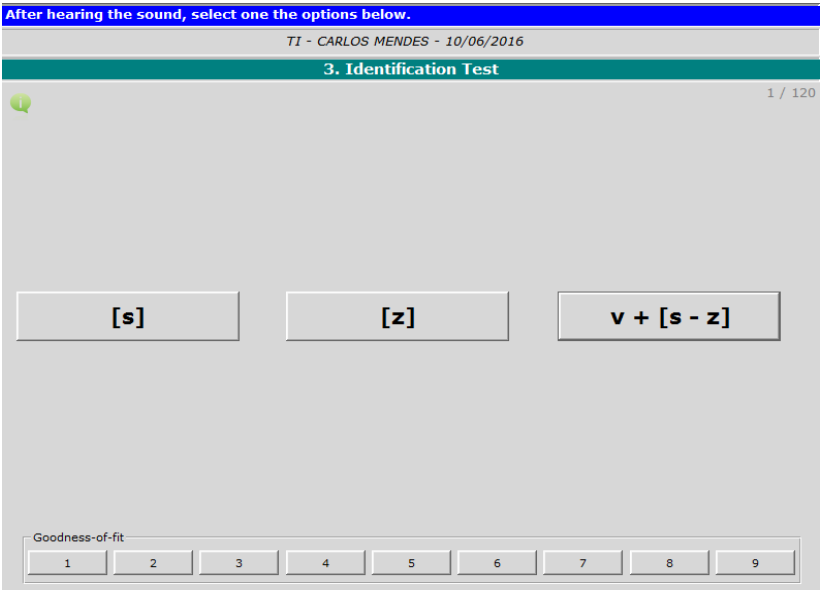


Figure 3. TP screenshot showing the Identification Test response options.

Once the test was completed, a window popped informing the automatic results for the performance of each participant (Figure 4). Thus, the participant had the opportunity to instantly visualize his/her results. Although it does not seem to have a direct importance for the study, it might have influenced the participants’ feedback replies, considering that they were able to see their numbers of correct and incorrect answers.

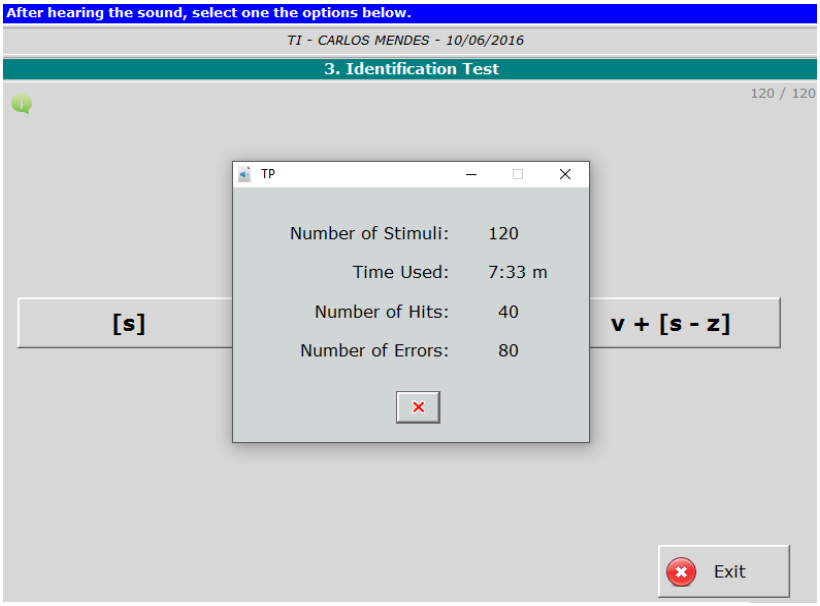


Figure 4. TP screenshot showing the results window.

Once the task was completed, the participants were asked to fill out a brief feedback form about the perception test (Appendix I). It consisted of four questions regarding the difficulty of the test, the duration, the effort, and any previous experience with this sort of activity. Furthermore, the informants also had the opportunity to convey the reason for their responses, as well as any comments or suggestions. This tool provided the researcher with information for a supplementary analysis of the results obtained through the data collection.

The following subsection describes the small-scale pilot study carried out by the researcher before the actual data collection. It served to test all the instruments that were designed to conduct the study, and as a consequence, to make the necessary adaptations to the instruments and data collection procedures.

3.4 PILOT STUDY

The pilot study was conducted with the intention of testing if the instruments designed to collect data for the research were appropriately working and providing the expected material for the data analysis. It was

an important procedure since it showed that some adaptations were necessary, mostly in the perception test – described in detail further – since it was the main tool of the research, and that all the other instruments were working properly.

Firstly, the pilot started with the recording of the English native speaker participant (subsection 3.2.1). The procedure went well and without any complications. That is to say that no other recordings were needed from the speaker to move from the pilot phase to the official study itself. It also implies that both term of consent, and the questionnaire administered to the participant functioned adequately (section 3.3).

The recording provided the researcher with the audio data necessary to elaborate the perception test, which in turn, after moderate modifications became the actual test. The corpus used to record the audio material, including the method chosen to achieve it, and the perception test itself, were portrayed in the *Perception test design* (3.3.2.1) subsection, and the specifications of the sound room and its equipment for the procedure was likewise presented in subsection 3.2.3 (Sound equipment).

Posterior to the participation of the English native speaker, the first version of the perception identification test was designed. Hence, as complementary parts of the test, the first version of the familiarization test (mock test) used as a tool to contextualize the participants, and the initial section done through a power point presentation were elaborated as well, which all suffered modifications.

The four Brazilian listeners for the pilot study were chosen from a class of the undergraduate program of *Letras e Literaturas de Língua Inglesa* from UFSC. There were a total amount of four participants, and they were all from the 3rd semester in the time of their participation. They were all women living in Santa Catarina with the mean age of 20 years old. They declared no for the questionnaire about living or visiting a foreign country, for speaking any other foreign language besides English, and for having any hearing impairment as well.

Essentially, the perception identification test went through two specific adaptations thereafter the pilot study. At first, the test displayed four response options (instead of three) that the listener had to choose from to indicate what sound(s) was spoken for the realization of the –s morpheme. It was noticed from the analysis of the participants' performance in the test that the former third and fourth options (v + [s], and v + [z] respectively) were problematic. In other words, there was a discrepancy between the numbers of hits from the first two options compared to the last ones. The researcher believes it was due to the fact

that much attention was given to whether the sound was [s] or [z], and not to the fact that there was a preceding vowel sound, thus, it became a reasonably hard task to identify the vocalic phoneme. Therefore, it was decided to combine the third and fourth options: v + [s – z] (Figure 2). In this way, the listeners could focus on whether there was a vowel sound before the alveolar fricatives or not. Moreover, the options matched the literature in the sense that it tells there are three possible outcomes for the pronunciation of –s morpheme in the English language, although it does not envisage the [s] sound succeeding the vowel, however, it is a feature of the spoken language present in the tokens of the study, probably due to assimilation of the following phonological context[11].

Another aspect that required changes involved the time space between each token of the perception test. In its first version, it was added a pause of 1.0sec before each token. It means that after selecting one of the numbers from the Likert scale there was a 1.0 sec time before the next token started. In the final version of the perception test, it was added a 2.0sec pause before token, therefore, extending the period of silence before the listener could listen to the next word. This procedure was taken based on the feedback (section 3.3.1) that the participants from the pilot study provided about the task, considering that they all pointed out having problems with the speed in which the words were played. With regards to the other elements of the feedback, such as duration of the test and tiredness from the activity, nothing was changed due to positive replies.

Subsequent to the perception test, a proficiency test (see subsection 3.3.1) was administered as the last task required from the Brazilian participants. The instrument worked properly and no changes were needed. It depicted that three out of the four participants were classified as lower intermediate, and one as upper-intermediate. The results somehow matched their own self-ratings inquired in the questionnaire, since they all evaluated themselves around the intermediate numbers of the scale proposed, in which 1 would be a beginner, and 10 an advanced speaker. Another way of interpreting the scale would be 1-2 = Elementary (A2), 3-4 = Lower Intermediate (B1), 5-6 Upper Intermediate (B2), 7-8 = Lower Advanced (C1), and 9-10 = Upper Advanced (C2).

As abovementioned, the familiarization test and the initial session are considered complementary parts of the perception test. Therefore, the main changes that were implemented to the perception test occurred to

[11] For instance, the –s morpheme of ‘ends’ being produced as [s] instead of [z] due to the following phonological context that presents a voiceless feature, such as in the word ‘twice’.

the mock test and to the session teaching how to complete the test correspondingly (i.e., increasing duration of time before presentation of target words and using three response options).

Finally, changes in the way the data were collected were done for the actual study. For the pilot, the participants were asked to provide data in two different sessions. In this fashion, the first day would comprise the term of consent, the questionnaire, the perception identification test (presentation and mock test included), and the test feedback, leaving the second day for the proficiency test. Such sequencing regarded the fact that the researcher assumed that the participants were more self-motivated to take the proficiency test, rather than the perception test. Thus, it was an attempt to maintain the participants' interest, focus, and motivation throughout the whole process of data collection, and avoid tiredness. Nonetheless, the time and effort spent in participating in two different days were bigger than gathering all the data at once, predominantly because the time estimated to achieve it was longer than the time used, with an overall of one hour and thirty minutes.

Once more, the pilot study exposed the characteristics and procedures that were needed to be modified for a better research. In a nutshell, it served as a preliminary tool of analysis shedding light into the path the research had walked upon. That being said, the next section deals with the acoustic signal of the research stimuli, which has been concisely analyzed with the purpose of better understanding the nature of the material.

3.5 THE ACOUSTIC SIGNAL

A brief analysis of the acoustic signal is hereby presented. The primary objective of this analysis was to find whether it was possible to characterize the target sound (-s morpheme) into the voiceless [s], or its voiced counterpart [z], based on their acoustic elements, besides the aural inspection, in order to avoid a completely subjective categorization. A second objective was to verify whether the sounds produced by the native speaker were in accordance with the literature, that is, if the –s morpheme realizations were produced as described in the literature, hence, it would be possible to compare the listeners' replies and the respective target sound signal.

In order to acoustically analyze the fricative sounds, there is specific information that needs to be identified in the spectrogram. Therefore, the acoustic elements that were gathered from the stimuli are: 1) frequency; 2) duration; 3) intensity; and 4) sonority bar. The

parameters for selecting these, as well as the procedures[12] that were followed to gather such information were acquired from different sources (Jongman et al. 1998; Ladefoged, 2003; Colantoni, 2015), including the ones quoted in section 2.6. The software used to obtain such information was PRAAT 5.4.17.

After an extensive analysis of the research stimuli, in which the four acoustic cues named above were inspected, the researcher came to the conclusion that it was not feasible to accomplish the goals established for this specific investigation within the research. Strictly speaking, it was not possible to clearly separate the [s – z] contrast from the stimuli, and compare it with the listeners' performance consecutively.

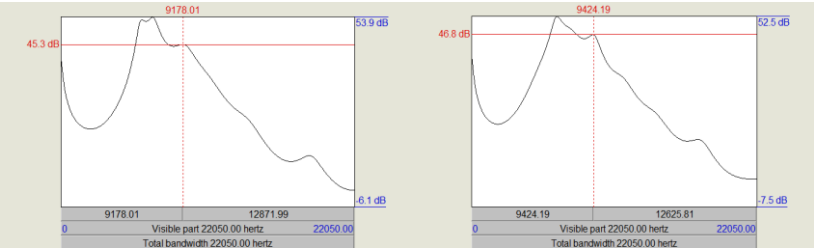


Figure 5. Screenshots of the LPC spectrum from the central portion of the frication noise of 'likes' and 'needs' respectively.

First, the frequency measurement did not yield any significant difference between the ideal [s] from the [z] realization. The voiceless sound was expected to have a higher frequency than the voiced one. However, the frequency range across the tokens, taking into consideration the following contexts in which they were produced, depicted very similar numbers, although a subtle pattern can be found. For instance, the token 'likes' ([s]), followed by silence, displayed a frequency of 6652-9424Hz (peaks gathered from an LPC spectrum), meanwhile the token 'needs' ([z]), followed by the same context, displayed 6926-9178Hz. Figure 5 above depicts the LPC spectrum window obtained through the central portion of the frication noise of the target –s morpheme productions for the words 'likes' (left) and 'needs' (right). The red vertical dotted line portrays the second peak from which the numbers aforementioned were retrieved.

[12] The step by step procedures followed to inspect the target fricative sounds are not detailed within the study regarding the purpose of a brief review over this matter. Such specific information can be found on the quoted literature of the present section, and from section 2.6 (Fricatives in the spectrogram).

Moreover, duration was also a tool that did not provide any substantial difference. Notwithstanding, it can be seen a slight tendency for longer durations in the voiceless tokens than the voiced ones, which is in accordance with the literature. The tokens ‘ends’ ([s]) and ‘books’ ([z]), with the same following context (silence), have 187ms and 145ms correspondingly as can be seen in Figures 6 and 7 below. (boundaries at the zero crossing in the beginning and end of the frication noise).

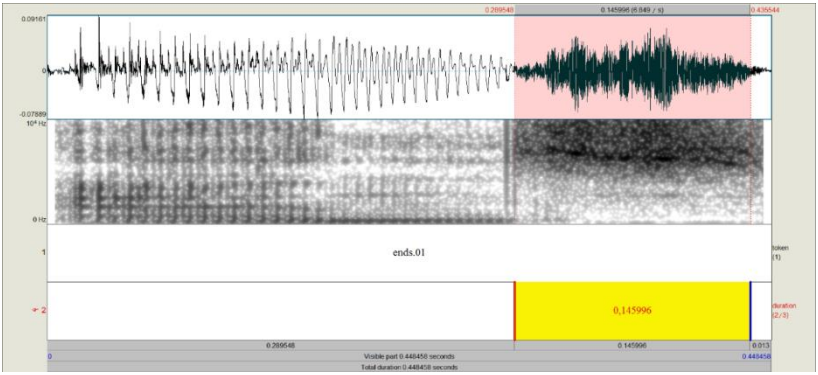


Figure 6. Screenshot of the token ‘ends’ with the duration of the frication selected.

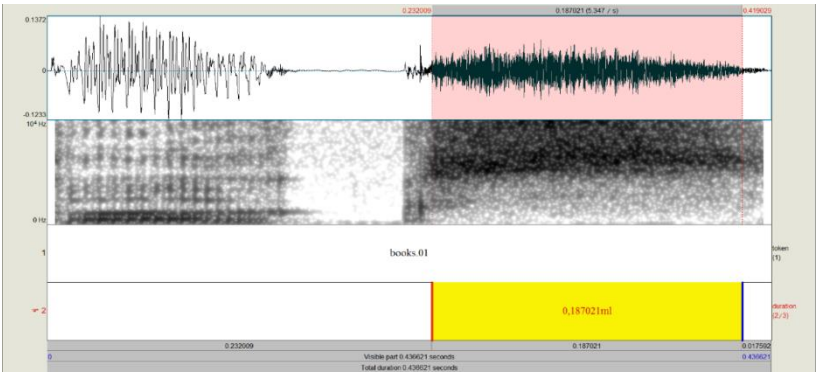


Figure 7. Screenshot of the token ‘books’ with the duration of the frication selected.

The third acoustic cue analyzed was intensity, taken from the central portion of the fricative, which yielded highly similar numbers for both [s] and [z] (e.g. 59 for ‘likes’ ([s]), and 57 for ‘schools’ ([z])), being

the most ineffective measurement to distinguish between voiced and voiceless fricatives.

The last acoustic element inspected was sonority, which was done by inspecting the voicing bar. This item was the most confounding one, mainly considering the subjective analysis of its presence, or absence, in the spectrogram. To the best of my knowledge, there is no command that can be applied within the software to precisely determine such aspect. Therefore, there were cases in which the previous acoustic cues were indicating a voiced sound; nonetheless, the voicing bar was not present, or it could be only considered as partially present. The tokens for the word 'schools' can serve as examples of this circumstance as can be seen in the Figures 8 and 9. Figure 8 depicts the token 'schools' followed by silence, and Figure 9 depicts the token followed by a vowel context. In this case, when followed by silence, the duration is considerably bigger than when followed by a vowel, indicating a possible voiceless –s realization. Nonetheless, the voicing bar, is not clearly present in none of the realizations, although it might be considered a partial presence for the token in which is followed by a vowel (Fig. 9).

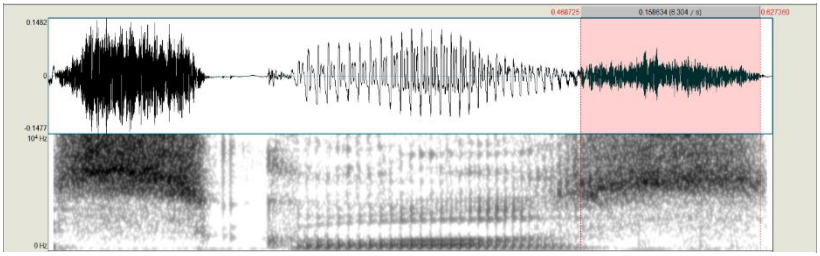


Figure 8. Screenshot of the token 'schools' followed by silence.

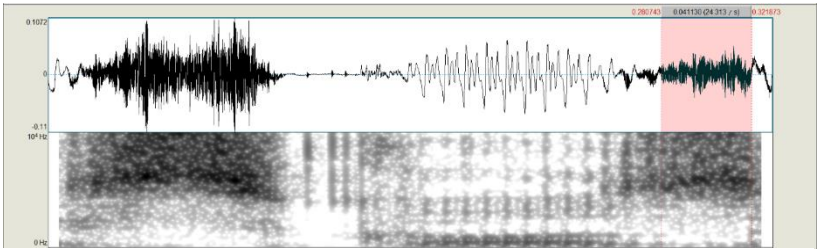


Figure 9. Screenshot of the word 'schools' followed by vowel.

In conclusion, the acoustic cues that were inspected with the intention of accomplishing the clear categorization of the [s – z] contrast of the research stimuli did not assist the categorization. It seems that the elements that were examined are of great aid when the task is to discriminate among fricative sounds, that is, distinguishing /f/ from /v/, or /s/, but not as helpful when the task is to distinguish the same fricative in its voiceless or voiced realization. Another issue faced in this distinction is that the target sounds are in coda position, which complicates acoustic analysis even more.

Jongman (1998) states that "noise duration provides a robust cue to the voicing distinction in syllable-initial position" (p.197). Even if that is the case, Ladefoged (2003) explains that the fricative "properties are not easy to measure precisely" (p. 155), and regarding the spectral properties that "an analysis made at one instant would find energy at different frequencies from an analysis at a later moment" (p.153). Thus, fricatives prove to be complex sounds to be worked with acoustically, and the line that distinguishes them is very delicate, which means that relying on auditory analysis is the best alternative for distinguishing between voiced and voiceless alveolar fricatives.

Having discussed the nature of the acoustic signal of the stimuli used in the present research, which assists the comprehension of the results that are portrayed in the next chapter, the following subsection approach the procedures employed for the data analysis.

3.6 DATA ANALYSIS

With reference to the data analysis, the TP Worken software already provides the researcher with test templates for investigation by delivering automatic spreadsheets comprising the test results. The spreadsheets depict the stimulus heard, the response selected by the participant, the result of the response (correct or incorrect), the time spent on each stimulus, the number selected as the degree of certainty for each stimulus (goodness-of- fit scale), the sequence of the played stimuli, and lastly, a summary comprising the total number of hits and errors, as well as the total amount of time used for each participant to complete the tests. This information was used to run the statistical tests (non-parametric) in order to answer the research questions proposed in the study. Moreover, in detail, there were 3960 responses (33 participants x 120 tokens) for the experimental group and 840 (7 participants x 120 tokens) responses for the control group. There were no missing values in the data.

The proficiency test follows the same quantitative scoring structure as the perception tests, with no discursive questions. By way of explanation, each correct question counted as one point for the total scores, thus, the higher the score, the higher the proficiency (See section 3.2.1). Importantly, although there were different proficiency levels within the experimental group, they were not divided into subgroups for analysis. Furthermore, the questionnaire was analyzed quantitatively and qualitatively, considering the different types of questions proposed. Furthermore, software applications like Excel and SPSS 2.0 were used for statistical procedures and chart elaboration.

The data gathered from the instruments designed for this investigation helped the researcher to answer the research questions established for the study. The perception test provided information on the informants' perception, assisting to verify if the specific sounds analyzed are perceived by this sample. Besides, the other instruments propitiated other essential information for this piece of research. The results and discussion are presented in the following chapter.

CHAPTER IV

4 RESULTS AND DISCUSSION

This section presents the results obtained through the data collection instruments designed for the research, mainly the perception identification test and the respective discussion. The outcomes are presented following the sequence of the research questions elaborated to carry out the study. In this regard, it is portrayed the descriptive statistics results from the informants and the statistical tests that were utilized in order to assist the interpretation of the data.

The results reported are discussed in detail, encircling individual analysis that are portrayed within each research question. Additionally, the information obtained from the control group is also depicted to function as a tool to validate the perception test designed for the investigation. Therefore, the research questions and their respective hypotheses are restated below with the intention of depicting if the assumptions were confirmed or not, along with the possible explanations for the associated outcome.

Lastly, this section also brings extra information such as specific responses from the informants that were obtained in the post-test procedure, which included some questions to elicit the informants' feedback about the Perception Test (section 4.5), as well as the researcher's observations and considerations throughout the entire process. This specific information is left to be analyzed and discussed later since it required a qualitative analysis, besides the fact that it did not directly interfere with the testing of the hypotheses proposed in the research.

4.1 RESEARCH QUESTION 1: RATE OF IDENTIFICATION OF THE –S MORPHEME

RQ1 – Do Brazilian learners identify the different allophonic realizations of the English –s morpheme: [s], [z], and [ɪz]?

H1 – Based on the Speech Learning Model's (Flege, 1995) first hypothesis of the 'position sensitive allophone', Brazilian learners of English are expected to face difficulties in identifying the different realizations of the –s morpheme in the target language. This is due to the fact that in Portuguese, the [s - z] contrast is not phonological in codas as it is in English. Therefore, the contrasting sounds in word-final position

are likely to be overlooked, which is also in accordance with the Perceptual Assimilation Model for Second Language 'attunement' concept (Best & Tyler, 2007).

The first research question proposes a straightforward investigation, which is the inquiry of the Brazilian learners' ability to identify the different allophonic realizations of the English –s morpheme. Even more specifically, the analysis of their perception ability to identify the three forms [s], [z], and [ɪz] in coda position of English words, which is a linguistic feature of the language in the plural inflection rule, as well as the inflection of the present third person singular (Celce-Murcia et al., 2010).

In order to attempt to answer such question, a forced choice perception identification test was designed (See section 3.2.2.1). The test consisted of 120 tokens, in which each allophonic realization held 40 tokens. Therefore, Table 2 depicts the results for each of the tested –s morpheme pronunciations, together with the total of hits from the combined outcome of the test for all the participants.

Table 2
Perception identification test general results – Experimental group correct responses

	N	Min (%)	Max (%)	Mean (%)	Sum	SD[b]
[s]	33	19 (47)	39 (98)	29.79 (74)	983	5.683
[z]	33	3 (08)	23 (58)	15.58 (39)	514	4.867
V + [s – z][a]	33	1 (02)	40 (100)	27.55 (69)	909	11.468
Hits	33	43 (36)	93 (78)	72.91 (60)	2406	13.796

[a] *Third allomorph variation ([ɪz])*

[b] *Standard Deviation*

As can be seen in Table 2, the results are divided into the three allophonic variations [s], [z], and [ɪz], in which [ɪz] is interpreted as V + [s - z] (See pilot study section 3.4). The number 33 represents the totality of the Brazilian learners that took part in the research. Importantly, there are no missing values. Moreover, it is depicted the minimum and maximum of correct responses of all listeners added up, additional to the mean, the sum of accurate replies, standard deviation and the percentages of the results in parenthesis.

The first –s morpheme realization, the coda [s], is the allophonic variation that yielded the highest means of correct responses. It characterizes that this allomorph is the one for which Brazilian EFL

learners obtained the best scores in the perception test, accomplishing a mean of 29.79 hits out of 40 tokens, or 74% of correct responses. Notably, the minimum number for the [s] realization is particularly higher than the others, exposing a discrepancy in the informants' ability to identify the remaining variations. This outcome was somehow predicted according to the literature, which will be further discussed.

Contrary to the [s] results, the second –s morpheme realization, the coda [z], presents the poorest scores among the participants, with the average of only 15.58 hits (39% of correct responses). The sum column confirms the difficulty that the Brazilian learners faced in identifying the [z] (514) sound in coda position compared to the final [s] (983) and V + [s - z] (909) numbers. Once more, this outcome was also expected by the study.

In the last variation, the V + [s - z] ([ɪz]), the most interesting results were found, mainly considering the minimum and maximum column, in which it is portrayed 2% and 100% hits, culminating in the highest standard deviation number. The mean of correct responses was 27.55, which represents 69% of correct responses and indicates that this allomorph reached a medium level of difficulty for the Brazilian listeners. These results are due to the individual differences in performance across the participants, and shall be later considered. As for the last row of the table, the total hits represents the numbers for the aggregate amount of correct responses throughout the participants.

Before recalling the hypothesis and testing it with the help of statistical tests, it seems relevant to portray the individual performances in the interest of better understanding the nature of the results in conjunction with a more assertive confirmation, or refutation, of the hypothesis established for this first research question. Table 3 compresses the individual results from the 33 participants in the perception identification test.

In this manner, it is possible to visualize that the participant (P) with the lowest score obtained 36% of correct responses (P15 in Table 03), meanwhile the one with the highest score obtained 78% (P01 in Table 03). The mean of accuracy in the perception identification test across the population sample was 60% (mean: 72.91 tokens). Hence, it is already possible to infer that the overall results demonstrate the English –s morpheme allophonic variations pose difficulty at the perception identification level for Brazilian EFL learners.

Table 3
Perception identification test individual results for the experimental group in percentages

	[s]	[z]	V + [s – z]	Hits[a]		[s]	[z]	V + [s – z]	Hits
P01	85	48	100	78	P18	90	32	88	70
P02	82	28	95	68	P19	82	22	88	64
P03	47	25	85	52	P20	75	22	98	65
P04	50	50	92	64	P21	75	48	90	71
P05	80	50	50	60	P22	72	48	2	41
P06	92	8	15	38	P23	90	48	38	58
P07	55	48	8	37	P24	98	30	98	75
P08	55	35	62	51	P25	72	38	88	66
P09	50	45	28	41	P26	75	30	80	62
P10	88	48	78	71	P27	68	50	82	67
P11	72	58	65	65	P28	78	42	65	62
P12	58	52	98	69	P29	98	30	72	67
P13	75	58	55	62	P30	68	52	88	69
P14	88	35	98	73	P31	68	40	70	59
P15	62	30	15	36	P32	68	28	80	58
P16	98	48	68	71	P33	80	20	48	49
P17	65	42	90	66					

[a] *Total scores*

Table 3 portrays the individual results from all the 33 Brazilian EFL learners, depicting the amount of accurate responses for each target –s morpheme realization, along with the total hits (percentages). In summary, for the [s] variation, there are 18 participants who scored from 75% to 98%, 14 scored from 50% to 72%, and only one scored less than 50% (P03). For the [z] variation, seven participants scored from 50% to 58%, 22 scored from 25% to 48%, and four scored less than 25% (P6, P19, P20, and P33). In the V + [s - z] realization, 18 participants scored from 78% to 100%, eight scored from 50% to 72%, three scored from 28% to 48%, and four scored less than 25% (P6, P7, P15, and P22). Finally, for the total hits, there are 12 participants who scored from 67% to 78%, 15 scored from 51% to 66%, and six scored less than 50% (P06, P07, P09, P15, P22, and P33).

Looking at the participants who scored the lowest in each of the categories it is possible to visualize their repetition among the groups. For instance, P06 appears with the least scores for [z], V + [s - z], and

consequently the total hits. Interestingly, P03 scored less than 50% in the [s] variation, which was the category with the highest scores as could be seen in Table 2; however, this participant does not appear in any other group with the lowest performances, even though his/her score for the [z] was also low (25%). Furthermore, although P06 has the overall worst performance, his/her score for the [s] variation is high (92%).

The hypothesis for RQ1 assumes that the Brazilian EFL learners will face difficulties in identifying the different allophonic variations of the English –s morpheme. It is a result of the distinct feature of the English language compared to Brazilian Portuguese. Recall of the pronunciation patterns of the BP –s morpheme presented in section 1.2. The hypothesis is supported by the SLM position-sensitive allophone, and also the PAM-L2 attunement concept, which discuss the probability of speakers/learners to block, or bypass, the perception/production of the target sound considering their L1.

In order to conclusively support, or refute, the hypothesis for RQ1, as well as the remaining research questions, statistical tests were run using the SPSS 2.0 software. Hence, the first stage was to verify if the research data is normally distributed or not, so as to determine the following types of statistical tests that needed to be utilized. Therefore, as can be seen in Table 4 below, the data are not normally distributed since the values of significance in the Shapiro-Wilk (a test that is less strict than the Kolmogorov-Smirnov also displayed in Table 4) results demonstrate the variables [s] and [z] with numbers higher than $p<.05$, and the V + [s - z] variable with a number lower than $p<.05$. Consequently, the data lack normal distribution across the variations, and non-parametric statistical tests should be used (Larson-Hall, 2010).

Table 4
Tests of Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
[s]	.081	33	.200	.966	33	.369
[z]	.183	33	.006*	.943	33	.081
V + [s – z]	.166	33	.021*	.864	33	.001*

** Significant results*

Hence, a non-parametric Friedman test was run to compare the results from the three allomorphs of –s morpheme. The outcome of the test portrayed a significant result ($X^2 = 78.697$, $p < .001$), which rejects

the null hypothesis that the distribution of the three variables are equal. Thus, post-hoc tests needed to be run to identify where the difference is.

Three post-hoc tests were run comparing the means from the three-allomorph variables. The first test compared the [s] mean with the [z] mean; the second compared the [s] mean with the V + [s - z] mean; and the third one compared the [z] mean with the V + [s - z] mean. These were conducted running non-parametric two-related samples (Wilcoxon test). The outcome of the three comparisons are depicted in the compressed table below.

Table 5
Compressed Wilcoxon results for the allomorphs distribution comparisons

	[s] - [z]	[s] - V + [s – z]	[z] - V + [s – z]
p.values	.000*	.513	.000*

* *Significant comparisons*

It is noticed from Table 5 that there are two significant differences among the three different allomorphs comparisons. The first is the difference between [s] and [z] ($p < .001$), and the second is the difference between [z] and V + [s - z] ($p < .001$). These results show that [z] is the most difficult allomorph, and that it is much more difficult for Brazilians to perceive the difference between [z] and the other allomorphs.

Thus, according to the results presented above, considering the lowest scores for the [z] variation, and mainly the statistical tests that were run with the data, the hypothesis for RQ1 is confirmed. This is due to the fact that the hypothesis predicted difficulty in identifying the target sounds in general, even though it is clear the difference in their identification performance when [s] and [z], and [z] and V + [s - z] are contrasted, this difference is drastically reduced when the same procedure is done with [s] and V + [s - z] variations.

Therefore, as demonstrated above, the [s] realization did not impose difficulties for the participants as expected considering their L1. The allomorph [z], as stated above, was the most complex for the Brazilian EFL learners, resulting in the worst scores throughout the informants. Finally, in the last realization, the V + [s - z], the participants achieved considerably close results to the [s] performance, even though there is a higher variance in the former allomorph (Table 2). Moreover, the statistical tests did not display a significant difference between [s] and V + [s – z] (Table 5). Consequently, the hypothesis established for this first research question is confirmed, in which the –s morpheme

realizations were problematic, which is in accordance with the SLM position-sensitive-allophone and the PAM-L2 attunement concept.

With the confirmation of the hypothesis stated, auditory perception tests may cause some difficulties to participants, given that they demand a great amount of attention and concentration. For this reason, it is important to validate the perception test used in the present study, to make sure it was suitable for testing the different pronunciations of the –s morpheme. Within this section, it is portrayed the results from the control group formed by seven English native listeners, who took the test and whose performance may help to validate the test and therefore the results obtained for the experimental group. Table 6 below depicts the general results for the control group, showing data from the perception identification test.

Table 6
Perception identification test general results – Control group correct responses

	N	Min (%)	Max (%)	Mean (%)	Sum	SD
[s]	7	36 (90)	40 (100)	38.71 (96)	271	1.604
[z]	7	18 (45)	40 (100)	29.71 (74)	208	9.464
V + [s – z]	7	36 (90)	40 (100)	39.14 (98)	274	1.464
Hits	7	94 (78)	120 (100)	107.57 (89)	753	10.628

Table 6 has the same display of the experimental group general results (Table 2), and missing values did not occur. Hence, it can be clearly observed a ceiling effect achieved by the control group in the perception identification test. Inspecting the table per rows and columns corroborates with such conclusion. For instance, the maximum column depicts 100% accuracy for all of the –s morpheme allophonic variations and the total hits successively. Additionally, the means across the participants also portray high values. Peculiarly, the [z] allomorph is the one with the lowest scores, equivalent to the results obtained from the Brazilian learners; it is also the form with the highest standard deviation, for which a more detailed interpretation can be found in the following paragraphs. Moreover, a table with the individual results from the perception test for the control group can be found at Appendix J.

Thereupon, standing on the ceiling effect obtained for the control group, it is possible to assert that the test designed by the researcher to investigate the perception identification ability of Brazilian EFL learners is a valid tool. It considers that the English native listeners were expected to perform with an average of 85% of correct responses or higher in the overall results, demonstrating that the material elaborated for analysis is a valid measure of the listeners' ability to identify the three pronunciations of the –s morpheme.

Within the results from RQ1, there are still two specific points left to be discussed. First is the numerical difference across the results from the [s] variation in relation to the others. More specifically, the discrepancy among the allomorphs in the minimum of correct responses performed in the identification test (Table 2), which portrays 19 for [s], 3 for [z], and only 1 for V + [s – z]. As previously depicted, this outcome was anticipated according to the hypothesis based on the SLM position-sensitive allophone, and the attunement concept from PAM-L2. Therefore, the informants were expected to bypass the [z] and V + [s – z] variations considering their L1, resulting in the identification of [s] due to their L1, which was the case, since in Brazilian Portuguese, the [s – z] contrast is not phonological in coda position.

Notwithstanding, when the numbers from the maximum column are also analyzed, it can be seen that Table 2 yielded interesting results, portraying 39 for [s], 23 for [z], and, remarkably, 40 (100%) for the V + [s – z] variation. This is the point in which individual analysis seems to be relevant, in which the V + [s – z] variation yielded the lowest rate of correct identification (P22 = 1), the highest rate score (P01 = 40), and yet, result in a similar overall outcome comparing the mean rates of correct identification from V + [s – z] and the [s] variations (74% vs 69%), which might have happened considering the patterns of BP for the –s morpheme.

In Table 3, it can be seen that P01 is the informant with the highest mean within the group for the total scores, with 78% of correct responses, that is, this participant had the best performance, yet, it is peculiar that his/her result for the [s] allomorph is lower than the V + [s – z]. What is more, P01 was not the only one who performed better for V + [s – z] than [s], 16 more participants (51% as total) also followed the same pattern. Note, however, that none of the participants obtained higher scores for [z] than for [s].

This result might implicate that Brazilian EFL learners tend to face more difficulties in identifying the [s – z] difference in coda position, rather than being able to identify the third allomorph variation of the

English –s morpheme, the [ɪz], hereby interpreted as V + [s – z]. It may be due to the vowel itself that facilitates the identification of this allomorph, since it adds an extra syllable to the word, which could be perceived, and therefore identified by the listeners. Further research on the identification of extra syllables might corroborate with this indication.

Still on the individual analysis, P22 who scored the least for the V + [s – z] obtained 41% of correct responses for the test, which is among the lowest scores of the group. However, it is not the one with the poorest performance (P15 = 36%). The performance of both P22, P15, and P07 follows higher rates of correct responses for [s], medium rates for [z] and low rates for V + [s – z], indicating a clear difficulty in identifying the different –s morpheme realizations. Although there are more participants with the same scoring pattern, they do not represent the majority (48%), and among them there are participants with high mean of correct responses, as it is the case of P24, with a 75% accuracy rate.

P03 is the only one that scored less than 50% in the [s] variation, being the lowest score (47%). P06 is the one with the lowest score for [z] (8%). Both informants had an overall poor performance. However, P03 had an 85% rate for V + [s – z], and P06 had 92% for [s]. In order to better understand such outcome, a closer look at the Confidence Rate and Time on Task measures of these participants is necessary to better understand their performance; therefore, this analysis will continue under the discussion of RQ3. Perhaps, one of the reasons why the hypothesis for RQ1 was confirmed is due to the diverse patterns of performance on the identification test.

The second concerns the results obtained from the control group in the identification test. It is because even though the group achieved a ceiling effect, it also depicted a certain variation among the allomorphs, which follows a similar pattern to the results obtained from the experimental group. As can be seen in Table 6, the means for the allomorphs in the control group are 96% for [s], 74% for [z], and 98% for V + [s – z]. Thus, the [z] variation is once more the variation with the lowest percentage of accuracy. The difference between the first and third variations is negligible.

In pursuance of an explanation for the fact that even the control group, which is formed by native speakers, portrayed a relatively low percentage for the [z] allomorph compared to the other two, I seek support in the characteristics of the acoustic signal of the sounds that have been reviewed in section 2.6, as well as in the acoustic analysis of the research stimuli presented in the method chapter.

In those sections, it is described that certain fricatives are hard to be identified, mainly the contrast between a voiceless and a voiced one, which is the case of the [s – z] contrast. In addition, the voiced fricatives are harder for the vocal tract, and this difficulty is enhanced when the target sounds are in coda position (Yavas, 2011). Moreover, the acoustic analysis portrays that the target signal is highly complex, therefore, the difficulty in identifying the [z] allomorph may lay on the characteristics of the sound itself that can be carried over from production to perception, which may legitimize the lower scores from the control group for this specific variation.

Having answered the first research question and confirming its hypothesis, I shall now move to RQ2 that addressed the role played by the acoustic cues of the following phonological context.

4.2 RESEARCH QUESTION 2: THE ROLE OF THE PHONOLOGICAL CONTEXT

RQ2 – Do the acoustic cues from the following phonological context of the English –s morpheme influence its perception?

H2 – Given studies conducted on the production of the English –s morpheme (e.g., Pereira, 1994; Zanfra, 2013) by Brazilian learners, and the different assimilation patterns in Brazilian Portuguese and English (progressive vs. regressive), learners are expected to carry over L1 processes into the L2 production of the –s morpheme. Similar results are expected at the perception level considering the acoustic cues from the following phonological context. Although the present study tests words in isolation, the stimuli were recorded by inserting the carrier words in utterances with different phonological contexts following the –s morpheme. Thus, the acoustic quality of the plural allomorphs might have incorporated acoustic characteristics from these different contexts, which could influence the listeners' performance on the identification test.

The second research question suggests an investigation of an alleged influence of the following context of the English –s morpheme on the perception identification ability of its allophonic variations by Brazilian EFL learners. In other words, the proposal here is that the sound that follows the target realization of the –s morpheme somehow affects the perception of the target sound itself regarding that there will be variance in the acoustic signal. That is, depending on the acoustic characteristics of the following context, the perception of the allophonic variations might be affect by it.

Seeking to answer this question, the words used in the perception identification test were recorded in four different carrier sentences, thus, providing four different following contexts for each word. The first context after the realization of the target –s morpheme is silence (or a pause), the second is a voiceless consonant, the third is a voiced consonant, and the fourth is a vowel (See section 3.2.2.1). Hence, each context brings different acoustic characteristics that proceeds the respective realizations of the –s morpheme. Note that the listeners heard the words in isolation, but it was expected that the acoustic signal for each token to be somehow modified by the following context during the talker's recordings. There are 30 words for each context, computing 120, which is the total amount of tokens in the perception test.

Table 7
Results per following context – Response frequency[a] for allophone

Context		[s]	[z]	V + [s – z]
silence	N	30	30	30
	Mean	16.63	5.37	11.00
	Sum	499	161	330
	SD	9.441	4.774	10.828
voiceless cons	N	30	30	30
	Mean	16.60	6.67	9.73
	Sum	498	200	292
	SD	7.749	4.722	9.812
voiced cons	N	30	30	30
	Mean	14.50	8.90	9.60
	Sum	435	267	288
	SD	8.110	5.548	9.648
vowel	N	30	30	30
	Mean	14.17	9.13	9.70
	Sum	425	274	291
	SD	8.562	7.295	9.735
Total	N	120	120	120
	Mean	15.48	7.52	10.01
	Sum	1857	902	1201
	SD	8.460	5.827	9.907

[a] *Number of selected responses*

Table 7 portrays the results per context. Note, however, that this table depicts the amount of times that each target allophonic realization was chosen as an answer for the tokens in the identification task. Thus,

Table 7 depicts the response tendencies across the participants, and not the numbers of correct responses (Table 8).

The first row of the table depicts the words in which there were no other sound after the realization of the –s morpheme, that is, silence. In BP, this context leads to [s] production . As can be noticed, the numbers portrayed for the [s] form are higher than the others, and that V + [s – z] is higher than the [z]. Once more, likewise to the general results demonstrated in the previous tables, this pattern of responses is repeated across the results: [s] > V + [s – z] > [z].

The next tier (voiceless cons) reproduces the results for the tokens in which the following context was occupied by a voiceless consonant, in this case, the sound /t/. Then, according to the acoustic characteristics of the sound, in which the main meaningful feature for this analysis is the voiceless element, the perception identification ability of the participants could be biased being conditioned by such proceeding element. Similarly, the aforesaid effect would arise in the third and fourth following contexts as well (voiced consonant, and vowel), albeit the main meaningful acoustic feature is now voiced, the consonant /d/, and the vowel /ə/ respectively.

Along these lines, standing on previous production studies (Pereira, 1994; Zanfra, 2013), the hypothesis posits that the different pronunciation assimilation pattern from English that is present in Portuguese, the progressive pattern, is expected to be transferred to the TL in the perception level as well (See section –s morpheme). Hence, the following contexts are expected to interfere. For instance, the voiceless consonant following context would bias the perception of all the target allophonic variations to the correspondent [s] realization, due to the fact that the proceeding acoustic element is voiceless. Equivalently, the voiced consonant and vowel contexts would deflect the three variations into the [z] realization. Furthermore, in BP the silence context would lead to a voiceless production (Zanfra, 2013), hence, similar results are expected for perception. Notwithstanding, only the talker had access to the following context considering the recording procedures. The target words were presented in isolation for the listeners, therefore, it is actually expected that the varying acoustic cues presented in the talker's speech (section 3.5) could influence the perception of the target sounds.

As previously mentioned, the sequence [s] > V + [s – z] > [z] echoes in all the tabulations. Not contrariwise, it also emerges throughout Table 7. In this manner, it delineates that the following contexts did not have any allegedly impact on the perception identification ability of the Brazilian EFL learners, since it would be expected the sequence to be

somehow modified across the circumstances, demonstrating that the following context deviated the perception of the target variation. An example would be if the voiced consonant, or vowel rows, showed the highest numbers for [z], restructuring the sequence to [z] > V + [s – z] > [s] comparatively, which is not case. Notwithstanding, there is a clear tendency for higher means for [z] when it is followed by the voiced consonant and vowel contexts. Further statistical analysis with the percentage of correct responses (Table 8) needed to be conducted in order to substantiate these findings and determine whether the hypothesis holds or not.

A table with the same display from Table 7 depicting the outcome from the control group can be found in Appendix K. Its results are not discussed here since the native listeners accomplished a ceiling effect in the test, therefore, it does not provide the material for analysis of the contexts individually. Interestingly, the sequence [s] > V + [s – z] > [z] is also present, even though the numbers are reasonably close to each other.

Table 8
Percentage of correct responses per following context

Context	Target	N	Mean	Min	Max	SD
silence	[s]	10	79.09	45.45	90.91	15.87
	[z]	10	29.09	9.09	60.61	16.73
	V + [s – z]	10	73.64	63.64	84.85	6.55
	Total	30	60.61	9.09	90.91	26.41
voiceless cons	[s]	10	73.64	48.48	93.94	13.93
	[z]	10	31.82	9.09	51.52	14.93
	V + [s – z]	10	67.28	60.61	72.73	4.91
	Total	30	57.58	9.09	93.94	22.07
voiced cons	[s]	10	72.12	54.55	96.97	12.52
	[z]	10	44.24	18.18	66.67	15.53
	V + [s – z]	10	65.76	48.48	78.79	8.21
	Total	30	60.71	18.18	96.97	17.08
vowel	[s]	10	72.73	45.45	84.85	15.12
	[z]	10	52.43	9.09	72.73	19.70
	V + [s – z]	10	67.88	57.58	72.73	5.19
	Total	30	64.35	9.09	84.85	16.65
Total	[s]	40	74.40	45.45	96.97	14.13
	[z]	40	39.39	9.09	72.73	18.78
	V + [s – z]	40	68.64	48.48	84.85	6.81
	Total	120	60.81	9.09	96.97	20.81

Turning now to the percentage of correct responses according to the following phonological contexts, Table 8 summarizes the results portraying the target allomorphs in each one of the contexts comprising the mean, minimum, maximum, and standard deviation numbers.

Table 8 presents once more the /s/ > V + /s - z/ > /z/ sequence that can be seen in the mean, minimum, and maximum columns of all the four following contexts. Notwithstanding, although there are relatively close numbers across the columns and rows, there is also a variation in the percentage of correct responses when the contexts are compared. In this fashion, statistical tests were run with the intention of verifying if there is any significant difference between the perception of the target allomorphs and their following contexts. Recall from RQ1 that the data is non-normally distributed, culminating in non-parametric tests.

In order to answer the question about the role of context in the identification of the –s morpheme allomorphs, two types of analysis were carried out: 1) an overall comparison of percentage of correct responses for the four phonological contexts, and 2) a comparison of the four contexts for each of the three allomorphs.

For the first step, a Kruskal-Wallis test was run and the results showed no significant difference across the four phonological contexts when the percentages of correct responses for the three allomorphs are combined (X^2 = ,2.01, p = .589). The next step consisted running three Kruskal-Wallis test, each time using the percent of correct responses for one of the allomorphs. The results, displayed in Table 9, show that the phonological context following the allomorphs played a significant role for [z] only.

Table 9
Compressed Kruskal-Wallis results

	[s]	[z]	V + [s – z]
X^2 (p value)	2.24 (.52)	10.71 (.01)*	.72 (.86)

* *Significant p value*

Having found a significant role for the phonological context when the results for the [z] allomorph was considered, it was necessary to run a series of pair-wise comparisons with Mann-Whitney tests. This time it was necessary to apply the Bonferroni correction formula[13] for multiple comparisons, so that a significant p value would be .008 or less. As can

[13] The original alpha value (0.5) was divided by the number of tests (6), as recommended by Larson-Hall (2010).

be seen in Table 10, the only comparisons that came out significant were the silence context versus the voiced consonant context (.003), and silence versus vowel (.01).

Table 10
Kruskal-Wallis results

	Silence/ Voiceless	Silence/ Voiced	Silence/ Vowel	Voiceless/ Voiced	Voiceless/Vowel	Voiced/ Vowel
Z (p value)	-1.47 (.13)	-2.99 (.003)*	-2.44 (.01)*	-1.69 (.09)	-.87 (.38)	-.76 (.44)

** Significant correlations*

Hence, according to the results from Table 9, which depicts that the following contexts played a role for the [z] allomorph, it offers support to the hypothesis stated for RQ2. It was expected that the following context would influence on the perception of the target –s morpheme realizations.

Furthermore, the results from Table 8, which used the percentage of correct responses to run the comparisons, confirm the aforementioned tendency of an increase of the [z] mean following the voiced consonant and vowel contexts. This specific result is in total accordance with the hypothesis proposed for this second research question. It can be stated that the progressive assimilation pattern from the participants' L1 was partly carried over into the perception of the English –s morpheme. The main acoustic element of the two following contexts in which significant results were found, that is, the voiced element, influenced the perception of the preceding target sound as a voiced one as well, in this case, into the [z] realization. Therefore, the hypothesis from RQ2 is confirmed.

Alike RQ1, the second research hypothesis was confirmed, positing that the voiced consonant, and vowel following contexts influenced the perception of the [z] allomorph, thus suggesting that the Brazilian listeners were influenced by the acoustic cues present in the acoustic signal.

The basis for this argumentation comes from the acoustic signal analysis of the research stimuli previously described in the method section (See section 3.5). In this case, the duration of the fricatives is the acoustic cue that allows such deliberation, even though the other elements did not yield a solid distinguishability for the voiced/voiceless contrast. For instance, the production of the word 'shows' ([z]), as well as others (e.g. 'ends', 'means', 'needs'), presents a decreasing period of frication

throughout the four following contexts: for the silence context = 0,162255ms duration; for the voiceless consonant = 0,074489ms; for the voiced consonant = 0,043105; and for the vowel = 0,037426ms. Hence, in the two last following contexts that present the voiced element, the frication period is clearly shorter than in the two first, mainly comparing the voiced consonants and vowel with the silence context. Recall that this comparison was found significant in the listeners' performance (Table 10).

Thus, according to the literature, the numbers aforementioned corroborate with the designation that voiced fricatives are shorter than their voiceless counterparts (Yavas, 2011; Barbosa and Madureira, 2015). Therefore, the following contexts might have influenced the production of the English –s morpheme realizations, and that this difference found in the production level might have aided the perception of the [z] allomorph by the Brazilian EFL learners.

Peculiarly, contrariwise to such allegation are the results from the control group that achieved a ceiling effect in the test, and so an analysis of comparisons across following contexts are impracticable. Perhaps, what may support the conjecture that the specified acoustic signal characteristics aforesaid influenced the perception of the experimental group, and yet this influence did not occur in the control group is the fact that English native speakers are already perceptually attuned (Best, 1995) to their language specificities, and that slight differences might be considered acceptable deviations, and that for the non-native speakers such differences might have played a more important role. Notwithstanding, further research needs to be carried out in order to proceed with the presumptions. Next, I present the results from the third research question.

4.3 RESEARCH QUESTION 3: CONFIDENCE RATES AND TIME ON TASK

RQ3 – Is there a correlation between the participants' accuracy in the perception test, their time on task, and their level of confidence in their responses?

H3 – Following Pisoni and Tash (2012) patterns on reaction time measurements in speech perception, a positive correlation between the informants' correct responses and their time on task, as well as their level of confidence in the identification test is expected. It seems that learners with more difficulty to identify the –s morpheme realizations will take longer to reply and will be unsure about their responses.

The proposal for the third research question is to possibly identify a correlation among the participants' performance in the perception test and the time they took to select a response, and how confident they felt about their responses. Recall that besides the main identification task, the informants were also asked to express their level of confidence about each of their responses through a Likert scale ranging from 1 to 9, in which 1 represented 'not sure', and 9 'absolutely sure' (section 3.3.1). Moreover, their time on task was also being calculated, that is, how long it took for each participant to select an answer (one of the three –s allomorphs). Importantly, no time limit was imposed for the participants, thus, they could take as long as they needed, although they could not listen to the same token more than once (no repetition allowed). That is one of the reasons why time on task is considered rather than reaction time, since reaction time would require the participants to be as fast and accurate as possible. Table 11 summarizes the participants' level of confidence throughout the test.

Table 11
Confidence level responses - Experimental group

	Min	Max	Mean	SD		Min	Max	Mean	SD
P01	1	9	7.30	1.663	P18	1	9	6.92	1.575
P02	3	9	6.90	1.642	P19	1	9	7.07	3.439
P03	4	9	7.08	1.164	P20	5	9	8.69	.797
P04	1	9	7.06	2.001	P21	2	9	7.41	1.756
P05	1	9	6.03	2.816	P22	4	7	5.26	.884
P06	5	8	6.96	.627	P23	1	9	7.56	2.020
P07	5	5	5.00	.000	P24	6	9	8.45	.787
P08	1	6	4.58	1.010	P25	1	9	6.82	1.598
P09	1	9	5.86	1.716	P26	2	9	5.85	1.515
P10	1	9	6.04	1.789	P27	2	9	6.87	2.021
P11	1	8	6.73	1.838	P28	1	9	6.84	1.879
P12	1	9	5.01	2.317	P29	3	9	6.16	1.223
P13	1	9	7.67	1.722	P30	2	9	7.89	1.431
P14	1	9	7.27	1.887	P31	1	8	4.93	1.769
P15	4	7	6.53	.673	P32	4	9	6.80	1.127
P16	5	9	8.11	1.035	P33	1	9	5.03	1.715
P17	3	9	6.13	1.703					

Table 11 presents the minimum, maximum, mean, and standard deviation values for each participant. Strictly speaking, the variety of responses that the informants selected to express their level of confidence. In this way, the higher the mean is, the more confident they were about their responses.

Concisely, there are three participants whose mean is 8, which means that they all presented high confidence levels about most of their responses. There are nine participants with the average of 7, and 13 (the

majority) with the mean of 6 (medium confidence level), the remaining eight participants' mean was of 5-4, which were the ones with the lowest confidence level. Note that there are many participants whose confidence level varied from 1 to 9 (42%), Markedly, there is one participant (P07) who did not vary at all in his/her level of confidence. Further analysis about individual performance is discussed. Next is the time on task measurement.

Table 12 depicts the time on task of the Brazilian EFL learners. It displays the minimum and maximum amount of time each participant used, as well as the sum (total time used to complete the test), the mean, and the standard deviation. The minimum, maximum, mean, and standard deviation columns are depicted in seconds, meanwhile the sum column is depicted is minutes.

Table 12
Time on task - Experimental group

	Min	Max	Sum[a]	Mean	SD		Min	Max	Sum[a]	Mean	SD
P01	2.69	64.39	20.6	10.30	15.46	P18	2.58	63.83	17.3	8.63	15.68
P02	3.02	64.98	12.5	6.24	10.51	P19	3.21	68.96	25.6	12.79	17.75
P03	3.06	63.76	22.8	11.40	17.10	P20	3.12	68.17	22.1	11.03	15.69
P04	3.09	64.29	25.7	12.83	16.45	P21	2.31	62.63	15.0	7.51	13.09
P05	3.09	64.29	25.7	12.83	16.45	P22	2.44	62.98	15.1	7.55	13.16
P06	2.27	63.82	14.5	7.24	13.34	P23	2.92	66.72	21.5	10.73	16.53
P07	2.39	59.83	14.4	7.19	12.78	P24	2.55	63.10	15.3	7.65	14.22
P08	3.02	69.28	21.9	10.93	15.80	P25	2.91	62.96	16.0	7.97	13.73
P09	3.14	71.60	29.7	14.82	18.37	P26	3.43	66.69	27.3	13.67	17.86
P10	2.50	60.07	13.9	6.95	11.73	P27	2.67	62.79	19.1	9.53	15.17
P11	2.91	62.07	16.5	8.24	12.80	P28	3.07	65.65	19.2	9.61	15.38
P12	2.58	64.94	19.0	9.49	15.69	P29	3.06	66.33	22.0	10.99	16.43
P13	2.68	65.47	18.5	9.24	14.41	P30	2.74	66.15	20.3	10.17	15.43
P14	2.72	61.88	15.3	7.64	13.57	P31	3.43	65.03	25.7	12.82	16.40
P15	2.29	64.70	15.4	7.69	13.91	P32	4.02	69.25	26.5	13.26	17.74
P16	2.55	61.86	15.0	7.49	13.69	P33	2.82	79.89	26.7	13.33	18.38
P17	2.88	61.79	17.7	8.83	15.10						

[a] *Values in minutes*

The sum time on task column shows that there are 14 participants that took an average of 12.5min to 17.5min to complete the test, 11 participants took from 19min to 22.5min, and eight participants took from 24min to 27.5min. Additionally, as can be seen in the mean column, the same 14 participants had an average time on task of 7 seconds per word, the same 11 ones had an average of 10 seconds per word, and the remaining eight participants displayed an average time on task of 13 seconds per word. Thus, these results indicate that there might be a correlation between time on task and overall performance that needs to be analyzed.

Having presented the outcome of the level of confidence and the time on task obtained in the data collection, the subsequent paragraph

deals with the statistical tests that were used with the intention of finding a potential correlation among the aforementioned data and the accuracy of the Brazilian EFL learners in identifying the allophonic realizations of the English –s morpheme. The hypothesis is established on the patterns of reaction time found by Pisoni and Tash (2012), which indicates that the faster the participants are, the higher was the confidence level, and as a consequence, the participant is likely to have a better performance in the overall results of the perception test.

In order to examine possible correlations among the data presented above, Spearman correlations were run employing the percentage of correct responses in the perception test for each –s morpheme pronunciation and the total percentage of correct responses (hits) from Table 2, with the confidence rate (CR) outcome from Table 11, and the time on task data from Table 12. In this way, four tests were run, the first comparing the results from the [s] allomorph, the second with [z], the third with V + [s – z], and the last with the total scores from the perception test with the time on task and confidence rates. The results are portrayed in Table 13.

As can be seen in Table 13, there are three different significant correlations that were found when the number of correct responses from the target –s allomorphs, along with the total amount of correctness from the test, were compared with the means from the time on task and confidence level of the informants. Interestingly, all of the three significant correlations that were found regard the confidence rate, and none was found for time on task. However, notably, all the correlations comparing the time on task and the test results are negative correlations. This indicates that while a variable increases, the other decreases, thus, in such case, as the time on task increases, the number of correct responses decreases, following the researcher's prediction in the hypothesis, although none was found as a significant correlation.

Regarding the confidence rate, the three correlations that were found as statistically significant are moderate positive correlations. Hence, while one variable increases, the other increases likewise. Therefore, as the confidence level of the participants was higher, the higher was their scores in the test, which is, once more, in accordance with the researcher's prediction in the hypothesis, which in turn is supported by the statistical analysis this time.

Table 13
Time on task and confidence rate correlations

			Time on Task	CR
Spearman's rho	[s]	Correlation Coefficient	-.306	.420
		Sig. (2-tailed)	.084	**.015***
		N	33	33
	[z]	Correlation Coefficient	-.145	-.012
		Sig. (2-tailed)	.419	.946
		N	33	33
	V + [s – z]	Correlation Coefficient	-.018	.448
		Sig. (2-tailed)	.923	**.009***
		N	33	33
	Hits	Correlation Coefficient	-.317	.491
		Sig. (2-tailed)	.072	**.004***
		N	33	33
	Time on Task	Correlation Coefficient		-.188
		Sig. (2-tailed)		.295
		N		33

* *Significant correlations*

Namely, the positive correlations were found between the confidence level and the [s] allomorph, the V + [s – z], and the total hits. Particularly, the only negative, and non-significant correlation found with the confidence rate was with the [z] variation. Such result implies one more time that the [z] allomorph consisted in the most difficult –s morpheme realization for the Brazilian EFL learners, depicting that even though they were expressing a higher level of confidence in their responses, they did not accurately perceive the sound, and vice-versa.

Hence, with the results here portrayed for the third research question, it can be stated that its respective hypothesis was partially confirmed, since the statistics only revealed significant numbers for the confidence rate variable, and none for the time on task variable, even though it can be clearly seen the tendency for better results with a shorter time on task.

Still on the discussion of RQ3 concerning the listeners' confidence level and time on task, these variables will be discussed considering specific informants who obtained the lowest and highest rates for these measures.

First, in the CR rates, P16, P20, and P24 were the most confident informants with the mean of 8, presenting a high confidence level (Table 11) as previously described. The least confident were P08 and P31 with the mean of 4. Moreover, P07 did not vary at all in his/her confidence, depicting the constant rate of 5. As the statistics portrayed, the correlation between CR and accuracy is positive and significant, which reflects the performance of the participants in discussion here. The most confident ones performed better than the least confident.

CR is an interesting aspect to analyze, as it demonstrates how informants feel about their performance. Thus, it could be said that the informants with a higher CR are the ones that are somehow more perceptually attuned (PAM-L2) than the ones with lower confidence levels. Possibly, the most confident participants might already have studied, or even learned by some means to a certain extent, the linguistic feature hereby investigated, which may likewise be connected to the proficiency level.

P07 is another example of the significant correlation, since his/her CR mean is considerably low, as it is his/her performance in the perception test (37%). It is interesting that his/her confidence rate kept invariable (5). Hence, along the lines abovementioned, it may seem that this specific participant had little knowledge about the linguistic feature that was being tested, portraying the same low CR through the entire test.

Moving to time on task, the participant with the highest mean is P09 (Table 12), with 14,82sec. The ones with the lowest means are P02 and P10 with 6,24sec and 6,95sec respectively. Although no significant correlations were found between time on task and accuracy, it has already been stated that the results indicate a tendency for better performance as time on task decreases. Once more, these participants reflect the tendency that a higher time on task indicates a poorer performance, since P09 overall accuracy was 41%, and P02 and P10 performed 68% and 71% accordingly (Table 3).

As Pisoni and Tash (2012) interpret, RT might help to better understand speech perception, which is relatable to time on task. This may be due to the appearance that RT is also a reflection of knowledge, equally to the interpretation of the CR. Therefore, the faster the listener is to identify the target allomorph, the more familiar it is with this language feature.

Nonetheless, it cannot be ignored the fact that the opposite might also be true. That is, if there is no knowledge about the components of the task, the listener might as well be fast to select any alternative without caring for accuracy. That is one of the reasons why the CR is a desirable tool, and P07 is once more an example of such circumstance. His/her time on task mean is 7,19sec, which is one of the lowest, however, his/her accuracy is also low, and his/her CR (mean: 5) confirms the lack of experience in the identification of the –s morpheme.

Before proceeding to RQ4, there is one aspect from the discussion of RQ1 that was left to be complemented under RQ3: the performance of P03 and P06. The former scored the least for [s], and the latter the least for the [z] allomorph. Hence, studying their CR and time on task might reveal an explanation for such outcome. Both participants depicted a reasonably high CR, being the means 7,08 and 6,96 respectively. However, their time on task differ from 11,40sec to 7,24sec accordingly. Therefore, P03 who had the poorest performance for the [s] allomorph, also had a high confidence level throughout the test that does not help to understand the low scores, and the same happens for P06. Nonetheless, P03 time on task is considerably high, which is in accordance with the aforesaid assumption that longer durations signal a poorer accuracy, being able to account for it. On the other hand, P06 has a low time on task, which would be considered a predictor of high accuracy. In this fashion, it has to be taken into consideration that the opposite holds true, as discussed above.

Therefore, time on task needs to be contemplated in both ways, since it may assist the individual results comprehension in different manners, as it might signal both good and poor performance on perceptions tests. In other words, a listener may respond faster because the contrast is easily perceived or because it is difficult and the listener is just trying to guess an answer to move along with the test. These ambiguous results may help to understand why the correlations between time on task and accuracy failed to reach significance. The following subsection features the last research question proposed in this study about the proficiency level of the Brazilian EFL learners.

4.4 RESEARCH QUESTION 4: L2 PROFICIENCY AND PERCEPTION

RQ4 – How is the target language proficiency of the participants related to their perception ability of the allophonic variations of the English –s morpheme?

H4 – Both Speech Learning Model and Perceptual Assimilation Model for Second Language posit that experience greatly influences the perception of non-native speech. Thus, it is expected that the higher the proficiency level of a learner, the higher is the ability to identify the realizations of the target sounds.

The last research question designed for this piece of research considers a commonly studied factor in the L2 research field, proficiency level. Innumerous studies have already analyzed how experience with the TL, measured with proficiency tests or questionnaire items[14], influences its production and perception. The present investigation administered a proficiency test (QPT) in order to incorporate the learners' proficiency level in the analysis (See section QPT). Supplementary to the test, the participants were also asked to rank their proficiency level in the questionnaire (See procedures section). Therefore, Table 14 portrays the EFL learners' proficiency level according to their results in the QPT and their self-ratings, which will further be compared.

Table 14
Proficiency level according to the QPT and self-rating

	QPT[a]	Self.rates		QPT[a]	Self.rates
P01	Lower Inter	Lower Adv	P18	Lower Adv	Lower Adv
P02	Lower Inter	Lower Inter	P19	Elementary	Lower Adv
P03	Lower Inter	Lower Adv	P20	Lower Inter	Lower Adv
P04	Lower Inter	Lower Adv	P21	Lower Inter	Lower Adv
P05	Elementary	Upper Inter	P22	Elementary	Upper Inter
P06	Elementary	Lower Inter	P23	Lower Inter	Upper Inter
P07	Elementary	Lower Inter	P24	Upper Inter	Upper Inter
P08	Lower Inter	Lower Adv	P25	Upper Inter	Lower Adv
P09	Upper Inter	Lower Adv	P26	Elementary	Upper Inter
P10	Elementary	Upper Inter	P27	Lower Inter	Lower Adv
P11	Lower Inter	Upper Inter	P28	Elementary	Upper Inter
P12	Lower Inter	Upper Inter	P29	Lower Inter	Lower Adv
P13	Lower Inter	Upper Inter	P30	Lower Inter	Upper Inter
P14	Lower Inter	Upper Inter	P31	Elementary	Upper Inter
P15	Lower Inter	Upper Inter	P32	Elementary	Upper Inter
P16	Lower Inter	Lower Adv	P33	Lower Inter	Lower Inter
P17	Lower Inter	Upper Inter	Total	33	33

[a] *Quick Placement Test*

[14] For example, self-rated proficiency, and likert-scales examining the amount of exposure to the L2.

In Table 14, the first column depicts the results obtained through the QPT, and the second one depicts the listeners' proficiency self-ratings. The results can also be interpreted according to the CEFR, in which Elementary is A2, Lower Intermediate is B1, Upper Intermediate is B2, and Lower Advanced is C1. Shortly, according to the QPT scores, there are 10 (30.3%) Elementary listeners, 19 (57.5%) Lower Intermediate, 3 (9%) Upper Intermediate and only one (3%) Lower Advanced listener. Comparing the QPT results with the listeners' self-assessment, there are only four participants (P02, P18, P24, P33) that have equivalent ratings. In addition, none of the learners rated themselves as possessing an elementary level; notwithstanding, the proficiency test indicated 10 listeners with this proficiency level. What is more, besides the equivalent ratings from the previously mentioned four participants, all the participants rated themselves with a higher proficiency level than their results in the QPT suggested. Perhaps, it might have been a result from the level correspondence in their English courses.

A Spearman correlation was run for the two proficiency variables and, despite the evident discrepancy between the participants' proficiency test results and their self-ratings, the results showed a moderate, positive, significant correlation (rho=.511, p =.002). For this reason, and because the QPT has a wide range of scores, in the correlational analysis that follows, only the QPT results were correlated with the correct responses for each allomorph and the total of correct responses. Complete tables displaying the exact QPT scores and self-ratings for each listener are available in Appendix L. Table 15 follows the same format used for Table 13, but instead of using the Time on Task and the Confidence Rate variables, Table 15 displays the results of the correlational analysis for the Proficiency Test.

Table 15 presents the correlations between each of the target –s morpheme realizations, as well as the total hits from the test, with the results from the proficiency test (QPT). In this table, there are two significant correlations. The first one is attributed to the moderate correlation between the proficiency variable and the V + [s – z] allomorph, and the second one is a weak correlation that involves the total percentage of correct responses in the perception test (Hits) and the proficiency variable. All of the significant correlations are positive ones, meaning that as the proficiency level increased, the number of correct responses increased as well.

Table 15
Proficiency correlations

			Hits	QPT
Spearman's rho	[s]	Correlation Coefficient	.460	-.145
		Sig. (2-tailed)	.007	.420
		N	33	33
	[z]	Correlation Coefficient	.241	.086
		Sig. (2-tailed)	.177	.632
		N	33	33
	V + [s – z]	Correlation Coefficient	.786	.407
		Sig. (2-tailed)	.000	**.019***
		N	33	33
	Hits	Correlation Coefficient		.380
		Sig. (2-tailed)		**.029***
		N		33

** Significant correlations*

Conclusively, it can be said that the statistical tests only depicted a significant correlation between the proficiency level and the V + [s – z] allomorph and the total percent of correct responses in the perception test. Moreover, it portrays that the proficiency level of the participants only played a substantial role in the identification of a specific allomorph, and the overall performance in the identification test. Thus, the hypothesis proposed for this last research question, which was based on the SLM and PAM-L2 models stating the influence of the target language experience on its perception can be considered partially confirmed, since only one of the target –s morpheme realizations yielded a significant correlation.

The proficiency level is probably the most complicated aspect to be discussed in this piece of research, given the complexity of measuring the proficiency level itself. It is necessary to account for the fact that proficiency tests may not reflect exactly the learners' competence, and this may be due to various circumstances that can be internal or external. In other words, it can be the tool itself that is used for measuring proficiency, or it can be the learner's motivation in the specific day of test taking, for instance. In the case of this investigation, the instrument (QPT) administered did not test listening, even though the focus of the study is perception, which may be considered an internal issue.

Furthermore, even though the participants were selected from the same English course program (See section 3.1.2), and that within the program specific levels were chosen, the informants demonstrated different proficiency levels in the QPT. This means that besides the different individual experiences that each learner possesses, they also bring different group experiences. Moreover, their proficiency level indicated by the QPT split the group in an unbalanced pattern as can be seen in Table 14.

Lastly, the ELF phenomenon, and the consequent foreign language classroom environment complicates it even more. If it is taken into consideration that the English language surrounds us in our daily lives, a certain degree of experience is being acquired regularly, and this is only one of the reasons why measuring the proficiency level of EFL learners is remarkably delicate. In addition, the learners' previous involvement with the foreign language classroom has usually been fragmented, that is, it has started, stopped, and restarted in a later moment, making the time dedicated to study the language dispersed (which is why this information has been omitted from the description of the Brazilian participants). Having said that, I shall concisely discuss about a few overall individual results in the test and their respective proficiency level according to the QPT.

As Table 14 depicts, there is only one participant (P18) that achieved a Lower Advanced, or C1, proficient level. Therefore, it seems relevant to verify if this specific informant outperformed the others. Similarly, to compare if the least proficient participants were the ones with the lowest scores in the perception test.

P18 accomplished a 70% accuracy rate in the test (Table 3). Below P18 in the proficiency scale are P09, P24, and P25 (Upper Intermediate/B2), with the respective 41%, 75%, and 66% accuracy rate. From here, it is already possible to visualize that a higher proficiency level does not always lead to a better performance in this research sample. Actually, P24 (75%) performed the test with a higher accuracy rate than P18. In this way, P18 and P24 are among the informants with the best performance in the perception test. On the other hand, P09, which is among the most proficient, is also among the ones with the poorest performance (41%) in the perception test, once again inducing that proficiency level does not lead to high accuracy rates in the perception test.

Finally, there are ten participants considered as Elementary learners, or A2 (P05, P06, P07, P10, P19, P22, P26, P28, P31, and P32). Even within this lowest proficient group, there is one participant (P10)

that performed slightly better than P18, with a 71% accuracy rate. It is also a fact that this group presents informants with the poorest scores, as P06 and P07 with 38% and 37%. Therefore, this uneven relation between the proficiency level and general performance, although a pattern can be identified as RQ4 demonstrated, may be the reason why the hypothesis for such research question was only partially confirmed.

Having accomplished the presentation and discussion of the results for all of the four research questions proposed in the study, both statistically and interpretatively, I shall now make the last considerations regarding the data gathered in the study, as well as the complimentary observations from the researcher throughout the entire process.

4.5 COMPLIMENTARY ANALYSIS

As it was portrayed in the method section, the Brazilian participants were asked to give specific feedback on the perception test within the data collection (Appendix I). Therefore, from their evaluation about the test, the following information can be retrieved: firstly, only 2 (6.06%) participants had already taken a similar test before, leaving the remaining 31 (93.93%) participants with no previous experience in this type of cognitive task. The lack of acquaintance with the kind of task is one of the reasons why the familiarization session (section 3.3) is of absolute value, since inexperience might influence the informant's performance.

In regards to the level of difficulty that the informants reported for the identification task, 15.15% considered it as "Easy", 42.42% considered it "OK", 33.33% "Difficult", and 9.09% "Very difficult". Hence, the majority of the participants considered the identification of the English –s morpheme an "OK" task. If we take into consideration that the mean accuracy across the informants was of 60% (Table 2), the "OK" judgement seems very reasonable regarding the point that the easier, or harder, one believes a task to be, the more, or less accurate s/he will be. Moreover, another great part of the group (33%) considered the identification task as "Difficult", which may reveal why the overall performance of the group cannot be considered as great, mainly taking into consideration the results from the [z] allomorph that has already been discussed.

Considering the duration of the perception test, 28 (84.84%) participants estimated it as "OK", while the remaining 5 (15.15%) as "Short". Recall that the informants took from 12.5min to 27.5min (Table 12) to complete the test. This seems to be a good feedback for the task,

considering that lengthened activities might be exhausting for the informants, and that it might also influence their performance. Thus, the length/duration of the identification test proposed in the present study can be considered as plausible. Moreover, in addition to the duration of the test, 30 (90.90%) participants considered it as "Not tiresome", 2 (6.06%) as "Tiresome", and only 1 (3.03%) as "Very tiresome".

Lastly, the participants could also inform the reason of their opinions about the level of difficulty of the test, as well as suggest, or comment on anything regarding the data collection procedures. From this stance, I have selected some of their answers[15] to be depicted and discussed below. In general, most participants declared that the [s – z] contrast was problematic, which occasionally was linked to the speed of which the words were played. Recall that because the target words were produced in different carrier sentences, they possessed different lengths/speed (section 3.2.2.1).

P17 declared, "It's really difficult to distinguish between /s/ and /z/". Other participants shared the same thought, such as P10 in "I had problems to realize what was /z/ and /s/", P12 "Because sometimes the sound of /s/ was very similar with /z/", or P33 that said, "The sound of 's' and 'z' are very similar to me". Thus, as can be seen in the words of the informants, it is clear that the Brazilian EFL learners face difficulties in identifying the different –s morpheme realizations, which has been exposed in this investigation. Therefore, it seems relevant to call attention to the language classroom, and foster the learners' awareness of subtle linguistics differences such as the [s – z] contrast in coda position.

Furthermore, some participants stated that the speed of the words influenced their performance. For instance, P03 answered, "The faster words were more difficult to understand the sound". P23 said, "Sometimes the same word it seems to have different pronunciation, when the word was pronunciated slow and fast, the pronunciation could be's' or 'z'. P24 complemented **"**It was hard to tell the difference between the same word, it was said faster and then slower, some words seemed to have a 'z' sound when faster, and then a 's' sound when said slower".

The above statements about the length of the target sounds are remarkably appealing. It has to do with the acoustic characteristics of the [s – z] contrast that has been discussed in this research. It somehow reflects the inference presented under RQ2 that the non-native listeners made use of the duration cue to distinguish between the sounds,

[15] The participants replies were not edited, therefore, they may present language errors.

meanwhile the native listeners considered the slight differences of duration as acceptable variations due to their language attunement. Therefore, the informants' allegations that the "slower" sounds were more perceptually identified as [s], and "faster" sounds as the sound [z], are in accordance with the description of these fricatives. Further research needs to be carried out on the use of the duration cue as a distinguishing factor in the English alveolar fricatives by Brazilian EFL learners, and Broersma (2010) that has been reviewed in section 2.7 could be used as a parameter.

Still on the informants' replies, perhaps, one of the most interesting answers was from P09 that stated "It's hard for me relate the letter "S" with the /z/ sound. I never had stopped to pay attention how similar and different they are". The same participant added, "Maybe if we could see the words, it was easier to think and relate the sounds (phonetic)". First, P09 admits the difficulty in relating the written form with their different sound correspondences, which regards the morphophonology factor. Second, it also admits no previous awareness about the [s – z] contrast. Finally, the informant suggests that the test should display the written form of the target words in the attempt of better relating the sounds, however, it contradicts the first revelation, since the spelling of the words would always be with the final –s. Perchance, the informant tried to convey that being able to read the word could help based on the previous –s morpheme sound. Nonetheless, it would require a great familiarity with the linguistic feature itself, as well as the knowledge of the acoustic characteristics of the previous sounds, which is not likely to be true for Brazilian EFL learners.

Within this standpoint, it needs to be acknowledged that while being tested the informants might have thought of the written form of the words with the same intent of P09, as P29 demonstrated: "Because I tried to think in how the word is written, but it was bad sometimes". Thus, once more, there is evidence of the morphophonological aspect of the language playing an important role on the identification of the –s morpheme for the TL learners. Therefore, it can be concluded that not only the learners L1 sound system is interfering with their perception, but the written system as well.

Lastly, in order to conclude with the chapter, I would like to link the abovementioned aspect of spelling and discuss two specific words that were used as tokens in the present study, which are "way" and "try". These two words take part in the [z] allomorph group, since they end with a voiced sound. Notwithstanding, they are different from the others in the sense that they end with the letter 'Y', and that their previous –s morpheme sounds are actually vowels (diphthongs). This might have

constituted an issue in the perception test regarding the fact that the third variation was displayed as V + [s – z], hence, the informants could be biased to select it, which cannot be considered wrong, unless 'Y' is considered the previous –s morpheme sound as a semi-consonant for "ways", yet, with "tries" it would still be not possible.

Thus, I hereby present the informants' responses for the tokens of both words (Table 16). For "ways", it seems that the aforesaid possible issue did not impact on the listeners' performance, since the majority accurately identified the token as [z], as can be seen in the table below. However, for "tries" it seems that the informants were biased considering that the majority selected V + [s – z].

Having demonstrated this specific research limitation, the researcher believes that the single tokens for the word "tries" could not interfere with the overall results of the study. Moreover, further research on the influence of the visual (written) stimuli on the perception of the English –s morpheme do not seem to assist the better understanding of this linguistic feature perception according to the arguments abovementioned.

Table 16
Responses for 'ways' and 'tries'

	Context[a]	[s]	[z]	V + [s – z]
ways	1	11	16	6
	2	12	15	6
	3	7	22	4
	4	7	23	3
tries	1	7	4	22
	2	12	6	15
	3	5	10	18
	4	8	12	13

[a] *The four different following contexts*

In conclusion, this chapter presented and discussed the results for the four research questions proposed in the investigation, conjointly with further argumentations on the material gathered throughout the research data collection procedures. The following, and final chapter, presents the conclusion derived from this study, and its possible pedagogical implications.

CHAPTER V

5 CONCLUSION

This last chapter presents the final considerations regarding the entire research. It portrays the summary of the results achieved through the instruments designed for the study, mainly the outcome of the research questions and hypotheses proposed. It also depicts the study limitations and possible niches for further research. Finally, it attempts to demonstrate how the knowledge acquired through this piece of research could be utilized for pedagogical purposes.

5.1 SUMMARY OF THE RESULTS

This study investigated the perception of the English –s morpheme by Brazilian EFL learners, that is, the perception of non-native speech. Therefore, the research was based on well-known linguistic models of speech perception, mainly the SLM and PAM-L2. In English, the –s morpheme pronunciation rules are different from BP, even though they are commonly used for marking plurality in both languages. Hence, from these different patterns, namely, the progressive and regressive, four research questions and their respective hypotheses were proposed to guide the investigation, besides the specific literature that composes the study.

The first research question inquired about the ability of the Brazilian EFL learners to identify the different –s morpheme realizations: [s], [z], and [ɪz]. Thus, according to the perception models aforementioned, the learners were expected to face difficulties based on the languages' different assimilation patterns. Seeking to answer such question, a forced-choice identification perception test was elaborated with the participation of an English native speaker who provided the audio stimuli. The results from the 33 participants that were tested demonstrated that Brazilian EFL learners faced difficulties in identifying the [z] allomorph. Therefore, the hypothesis for the RQ1 was confirmed, considering that one realization imposed difficulty for the informants.

The second research question inquired about an alleged influence of the –s morpheme following context on the perception of the Brazilian EFL learners. In other words, if the sound succeeding the target –s realization would cause any impact on the perception of the target sound itself considering its acoustic characteristics. More specifically, if the

varying acoustic cues from the target sounds due the following phonological context impacted on the speech perception. Thus, based on previous studies on the production of Brazilian EFL learners, the hypothesis proposed that similar results would be found on the perception of the learners in light of the different pronunciation assimilation patterns. In order to answer the question, the words used as tokens in the test were produced in four different following contexts, being silence, voiceless consonant, voiced consonant, and vowel respectively. An analysis on the results per context exposed that the following context played a role in the identification of the [z] allomorph, more specifically, the voiced consonant and vowel contexts. Hence, once more, the hypothesis was confirmed, since the acoustic cues from the following contexts affected the perception of one allomorph.

Moving to the third research question, it investigated if there was any correlation between the participants' overall performance with their confidence rate and time on task measurements. The hypothesis for this question was based both on a previous study on reaction time, as well as the researcher's intuition, suggesting that the faster the informants are to identify the target sounds, and the more confident they are about their choices, the better their performance in the test would be. In pursuance of a possible confirmation or refutation of the hypothesis, the perception identification test measured the time on task of the informants, and it also displayed a Likert scale that they had to use to inform their level of confidence in all of their responses. Posterior statistical correlation tests were run and they depicted a significant positive correlation between the overall performance and the confidence rate of the participants; no significant correlations were found for the time on task. Therefore, the hypothesis for the third research question was partially confirmed, meeting the predictions for the confidence rate, but not for the time on task.

Lastly, the fourth research question dealt with the proficiency level factor. Following the predictions about language experience that are presented in the SLM and PAM-L2, the hypothesis stablished was that the more proficient a learner was, the more accurate it would have been in the identification of the –s morpheme realizations, considering experience as a propulsive element. Hence, an English proficiency test was administered to the Brazilian EFL learners subsequent to the perception test for the sake of verifying if the predictions for the last research question would be met. The results portrayed that the proficiency level of the informants played a significant role in the identification of the

[ɪz] allomorph, and for the overall performance in the test. As a result, the hypothesis was partially confirmed, in consideration of the fact that no significant correlations were found for the [s] and [z] allomorphs.

The present study also had a control group formed by seven English native speakers. This group went through the same procedures as the experimental group, that is, the Brazilian EFL learners, except for the proficiency test. Thus, the results from the control group worked out as a validation tool for the perception identification test designed for the research, seeing that their performance achieved a ceiling effect.

Furthermore, along with the presentment of the results from the investigation, a thorough discussion of the outcome for each research question has been offered, encompassing specific individual analysis that were of value for the research. More than that, the study also provided a brief analysis on the acoustic signal of the research stimuli with the intention of better understanding the source of the perception to which the informants have been introduced.

5.2 STUDY LIMITATIONS AND FURTHER RESEARCH

From the hypotheses proposed in this investigation, two were confirmed (RQ1 and RQ2) and two were partially confirmed (RQ3 and RQ4). This indicates that the literature that has been structuring this class of research is on the right path, notwithstanding, it does not provide a complete understanding of the language phenomena studied yet. Therefore, further research needs to be carried out in order to find out where the predictions are failing to materialize. For instance, a deeper investigation into the relation of the acoustic signal (possibly analyzing F0 and glottal pulses) and the perception of the English –s morpheme variations is required, as well as more refined instruments and procedures to investigate the roles of variables such as reaction time and L2 proficiency.

It also needs to be acknowledged that the present study has its own limitations. Firstly, testing the role of the phonological context was complex since the words were actually presented in isolation, therefore, a new study presenting the stimuli in context and without context would be able to better analyze such variable. From this standpoint, it is not unexpected that the Brazilian learners had the best performance for the [s] variation regarding the fact that for the participants the words were always followed by silence, and that [s] is the expected sound in such context.

Another point is that using the acoustic analysis to examine the tokens also proved to be a difficult task, hence, a new study controlling/manipulating the acoustic signal seems a finer alternative. Furthermore, the proficiency measure should tackle L2 listening, and perhaps pronunciation skills. Lastly, a relationship between perception and production could also provide a better understanding of the target language characteristics used by the Brazilian EFL learners.

5.3 PEDAGOGICAL IMPLICATIONS

In conclusion, the objectives of the research were achieved taking into consideration that the main scope was to verify if the Brazilian EFL learners were able to perceptually identify the three different English –s morpheme variations, in which the research has demonstrated that the [z] allomorph constitutes as an issue. Therefore, the results can serve as a base to improve the language teaching and learning, or even foster further research on the matter in the interest of analyzing how such linguistic feature is used (production/perception) in a more pragmatic level, which could be done employing an intelligibility perspective.

These results can lead to some considerations about the language classroom and the teaching and learning of pronunciation. What are the teachers/learners' objectives regarding pronunciation? Is the foreign language classroom concerned with subtle phonological details such as the –s morpheme realizations? Does such phonological details influence intelligibility concerning ELF? Such questions disclose an enormous amount of room for debate. Nonetheless, the intent here is not to answer the questions, therefore covering such aspects of the language classroom, but rather to foster further research, as well as retaining the primary objectives of this research concerning speech perception.

Moreover, the study also provides a better understanding on how non-native speech is perceived by Brazilian EFL learners, considering that the research questions and their respective hypotheses encircled different aspects that were correlated with the perception itself. Therefore, the present investigation contributes with the research field filling a niche that was once exposed, although it requires more scientific knowledge that can be acquired by further work.

The English –s morpheme pronunciation patterns seem to be relatively unknown by non-native speakers, as can be seen by this study results, as well as in the statements of the informants that were hereby exposed. Interestingly, even for the native speakers, it seems that when the [s – z] contrast is found in coda position, it becomes a complex task

to accurately identify the sounds. Once more, it appears to be relevant to analyze if the production of the English –morpheme is corresponding to its rules in the literature. The point here is that language is always evolving, therefore, linguistics features are constantly being shaped, created, or even forgotten. Perhaps, the English –s morpheme variations are more gradient than they are described in the literature; and the following phonological context seems to shape the acoustic signal to a certain extent in English L1 as well. Perhaps, these variations could be used for the benefit of English learners who have difficulty with the voiced/voiceless contrast in coda position. Having said that, the knowledge presented in this study can be used to trigger new ones, besides its use for possible pedagogical implications as aforementioned.

REFERENCES

Abello-Contesse, C. (2008) *Age and the critical period hypothesis*. ELT Journal. 63 (2): 170-172.doi: 10.1093/elt/ccn072.

Allan, D. (2004) *Oxford Placement Test 1*. Oxford University Press.

Archila-Suerte, P. Zevin, J. Bunta, F. & Hernandez, A. E. (2012). *Age of acquisition and proficiency in a second language independently influence the perception of non-native speech*. Bilingualism: Language and Cognition, 15, pp. 190-201 doi: 10.1017/S1366728911000125.

Barbosa, P. A. & Madureira, S. (2015) *Manual de Fonética Acústica Experimental*. Cortez Editora.

Becker, M. R., & Kluge, D. C. (2014). Intelligibility of English as a Lingua Franca (ELF): Perception by Speakers of Brazilian Portuguese. *COPAL, 5*, 50-57.

Best, C.T. (1995). A direct realistic view of cross-language speech perception. In W. Strange (Ed.), *Speech perception and linguistic experience: Issues in crosslanguage research* (pp. 171-206). Timonium, MD: York Press.

Best, C.T., & Tyler, M.D. (2007). Nonnative and second-language speech perception: Commonalities and complementarities. In M. J. Munro & O.-S. Bohn (Eds.), *Second language speech learning: The role of language experience in speech perception and production* (pp. 13-34). Amsterdam: John Benjamins.

Bilbao, S. C. (2015). Perception of place of articulation in English fricatives by Spanish listeners. *Vigo International Journal of Applied Linguistics, 12*, 37-62.

Broersma, M. (2010). Perception of final fricative voicing: Native and nonantive listeners' use of vowel duration. *Acoustic Society of America, 127*(3), 1636-1644. doi:10.1121/1.3292996.

Browne, C., Culligan, B. & Phillips, J. (2013). *The New General Service List*. Retrieved from http://www.newgeneralservicelist.org.

Celce-Murcia, M., & Brinton, D. (2010). *Teaching pronunciation: A course book and reference guide* (2nd ed.). New York: Cambridge University Press.

Colantoni, L., Steele, J., & Escudero, P. (2015). *Second Language Speech: Theory and Practice*. Cambridge: Cambridge University Press.

Council of Europe. (2001) *Common European framework of reference for languages: Learning, teaching assessment*. Cambridge, U.K: Press Syndicate of the University of Cambridge.

Cutler, A. (2015). Representation of second language phonology. *Applied Psycholinguistics, 36*(01), 115-128. doi:10.1017/s0142716414000459.

Delatorre, F. (2006) *Brazilian Efl Learners' Production of Vowel Epenthesis in Words Ending In –ed*. Unpublished master thesis. Florianópolis: Universidade Federal de Santa Catarina.

Dörnyei, Z. (2007) *Research Methods in Applied Linguistics: Quantitative, Qualitative and Mixed Methodologies*. Oxford: Oxford University Press.

Flege, J. E. (1995) Second Language Speech Learning Theory, Findings, and Problems. In W. Strange (Ed.), *Speech Perception and Linguistic Experience: Issues in Cross-Language Research* (pp. 233-277). Timonium, MD: York Press.

Gomes, M. L. (2009) *A produção das palavras do inglês com o morfema ed por falantes brasileiros: uma visão dinâmica*. Unpublished doctoral dissertation. Curitiba: Universidade Federal do Paraná.

Jenkins, J. (2005) *Implementing an International Approach to English Pronunciation: The Role of Teacher Attitudes and Identity*. TESOL *Quartely*, 39(3), 535-543.

Johnson, K. & Babel, M. (2007). "Perception of fricatives by Dutch and English speakers". *UC Berkeley Phonology Lab Annual Report 2007*, p. 302- 325.

Jongman, A., Wayland, R., & Wong, S. (1998). Acoustic characteristics of English fricatives: I. Static Cues. *Working Papers of the Cornell Phonetics Laboratory, 12*, 195-205.

Kabak, B. & Maniwa, K. (2007). *L2 perception of English fricatives in clear and conversational speech: The role of phonemic, phonetic, and acoustic factors*. Proceedings of the 16 the International Congress of Phonetic Sciences. Saarbrücken, Germany. (pp. 781-784).

Kluender, K., & Kiefte, M. (2006). Speech Perception within a Biologically Realistic Information-Theoretic Framework. In *Handbook of psycholinguistics* (2nd ed.) (pp. 153-199). Boston: Elsevier.

Kluge. D. C. (2009) *Brazilian EFL learners' identification of word final /m-n/: native/non-native realizations and effect of visual cues.* Unpublished master thesis. Florianópolis: Universidade Federal de Santa Catarina.

Kluge, D. C., Rauber, A. S., Rato, A., & Santos, G. R. dos. (2013). *Percepção de sons de língua estrangeira: questões metodológicas e o uso dos aplicativos Praat e TP*. Revista Letras, 88. 171-188.

Koerich, R.D. (2002). Perception and Production of Vowel Epenthesis in Word Final Single Consonant Codas. Unpublished doctoral dissertation. Florianópolis: UFSC

Kuhl, P. K. (1991). Human adults and human infants show a "perceptual magnet effect" for the prototypes of speech categories, monkeys do not. *Perception & Psychophysics, 50*(2), 93-107. doi:10.3758/bf03212211.

Kuhl, P. K. (1993). *Early linguistic experience and phonetic perception: Implications* for theories of developmental speech perception. *Journal of Phonetics, 21,* 125-139.

Kuhl, P.K., Iverson, P. (1995). Linguistic experience and the "perceptual magnet effect". In W. Strange (Ed.), *Speech perception and linguistic experience*: *Issues in cross-language research* (pp.121-154). Timonium, MD: York Press.

Kuiper, K., & Allan, W. (2010). *An Introduction to English Language: Word, Sound and Sentence* (3rd ed.). Basingstoke: Palgrave Macmillan.

Ladefoged, P. (2003). *Phonetic data analysis: an introduction to fieldwork and instrumental techniques*. Malden, MA: Blackwell Pub.

Ladefoged, P., & Maddieson, I. (1996). *The sounds of the world's languages*. Oxford, OX, UK: Blackwell.

Ladefoged, P., & Johnson, K. (2011). *A course in phonetics* (6th ed.). Boston, MA: Wadsworth/Cengage Learning.

Larson-Hall, J. (2010). *A guide to doing statistics in second language research using SPSS*. New York: Routledge.

Nittrouer, S. (2002). Learning to perceive speech: How fricative perception changes, and how it stays the same. *The Journal of the Acoustical Society of America, 112*(2), 711-719. doi:10.1121/1.1496082.

Pereira, C. (1994) *Acquisition of Morphological Rules by EFL Brazilian Students.* Unpublished master thesis. Florianópolis: Universidade Federal de Santa Catarina.

Pisoni DB, Tash J. (2012) *Reaction times to comparisons within and across phonetic categories*. Perception & Psychophysics. 1974;15(2):285–290.

Perozzo, R. V. (2013) *Percepção de Oclusivas Não Vozeadas Sem Soltura Audível em Codas Finais do Inglês (L2) por Brasileiros: o Papel do Contexto Fonético-Fonológico, da Instrução Explícita e do Nível de Proficiência.* Unpublished master thesis. Porto Alegre: Universidade Federal do Rio Grande do Sul.

Perozzo, R. V., & Alves, U. K. (2016). Uma discussão acerca da aplicação do Perceptual Assimilation Model-L2 à percepção fônica de língua estrangeira: questões de pesquisa e desafios teóricos. *Domínios de Lingu@gem, 10*(2), 733-764. doi:10.14393/DL22-v10n2a2016-13.

Poeppel, D., & Monahan, P. (2008). Speech Perception: Cognitive Foundations and Cortical Implementation. *Current Directions in Psychological Science, 17*(2), 80-85. *research* (pp. 233-272). Timonium, MD: York Press. Pulvermüller, F. Semantic embodiment, disembodiment or misembodiment? In search of meaning in modules and neuron circuits. Brain and Language, 127, 86-103, 2013.

Reis, M. S. (2006). *The Perception and Production of English Interdental Fricatives by Brazilian Efl Learners.* Unpublished master thesis. Florianópolis: Universidade Federal de Santa Catarina.

Seidlhofer, B. (2005) *English as lingua franca*. ELT Journal, 59(4), 339-341.

Silva, T. (2007). *Fonética e fonologia do português roteiro de estudos e guia de exercícios* (9.th ed.). São Paulo: Ed. Contexto.

Silveira, R. (2004) *The Influence of Pronunciation Instruction on the perception and production of English Word-Final consonants*. Unpublished doctoral dissertation. Florianópolis: Universidade Federal de Santa Catarina.

Song, J. Y., Demuth, K., Evans, K., & Shattuck-Hufnagel, S. (2013). Durational cues to fricative codas in 2-year-olds' American English: Voicing and morphemic factors. *The Journal of the Acoustical Society of America, 133*(5), 2931-2946. doi:10.1121/1.4795772.

Walker. R. (2010) *Teaching the pronunciation of English as a Lingua Franca.* Oxford. Oxford University Press.

Yavas, M (2011) *Applied English Phonology* (2nd ed.). Oxford: Wiley-Blackwell.

Zanfra, M. (2013) *Phonological Context as a Trigger of Voicing Change: A Study on The Production of English /s/ and /z/ in Word-Final Position by Brazilians.* Unpublished master thesis. Florianópolis: Universidade Federal de Santa Catarina.

Zimmer, M. C. Alves, U. K. Silveira, R. (2006) *A aprendizagem da L2 como processo cognitivo: a interação entre conhecimento explícito e implícito*. Nonada, n. 9, p. 89-102.

APPENDICES

Appendix A

QUESTIONNAIRE *for English Native Speakers*

Full name: _____
E-mail address: _____
Date: ____/____/2016

Dear participant,
The present questionnaire seeks to obtain information to be used in the data analysis of this study. Neither your identity nor any piece of information, which may reveal your identity, are to be published.

Personal and Linguistic Profile

1. What is your age? _____
2. Where are you from (city/state)? _____
3. Where do you currently live? For how long?
_____
4. Where did you spend most of your life?
_____
5. Have you ever been/lived abroad apart from Brazil? Where? For how long?
_____
6. What is your occupation?
_____
7. How often do you use English to communicate, and in what contexts?
_____
_____

8. Do you speak any foreign language(s)?

Yes ❑ No ❑

- If your answer is "**no**", please, go to question number **9**.

a. Which one(s)?

_____

b. How often?

Frequently ❑ Generally ❑ Occasionally ❑ Hardly ever ❑

c. How well?

Very well ❑ Fairly well ❑ Not well ❑ Not at all ❑

d. How often do/did you study:

	Frequently	Generally	Rarely	Hardly ever
Listening	❑	❑	❑	❑
Speaking	❑	❑	❑	❑
Reading	❑	❑	❑	❑
Writing	❑	❑	❑	❑

9. Do you have any speech/hearing impairments?

Yes ❑ No ❑

Which one(s)? _____

If there is any other relevant information you may find fitting for this research, please, comment below.

_____

_____

_____

Thanks for participating!

Appendix B

QUESTIONNAIRE *for Brazilian participants*

Full name: _____
E-mail address: _____
Date: ____/____/2016

Dear participant,
The present questionnaire seeks to obtain information to be used in the data analysis of this study. Neither your identity nor any piece of information, which may reveal your identity, are to be published.

Personal and Linguistic Profile

1. What is your age? _____
2. Where are you from (city/state)? _____
3. Where do you currently live? For how long?
_____
4. Have you ever been/lived abroad? Where? For how long?
_____
5. How long have you been studying English?
_____
6. How often do you study English?

Frequently ❑ Generally ❑ Occasionally ❑ Hardly ever ❑

7. How often do you study:

	Frequently	Generally	Rarely	Hardly ever
Listening	❑	❑	❑	❑
Speaking	❑	❑	❑	❑
Reading	❑	❑	❑	❑
Writing	❑	❑	❑	❑

8. How often do you use English outside the classroom?

Frequently ❑ Generally ❑ Occasionally ❑ Hardly ever ❑

What for?_____

9. From beginner (nº01) to advanced (nº10), which level do you consider yourself to be in English?

Beginner Advanced

1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10

10. Have you ever done any proficiency test? (e.g. FCE, TOEFL, TOIC)

Yes ❑ No ❑

Which one(s)? _____

Test scores: _____

11. Do you speak any other foreign language(s)?

Yes ❑ No ❑

Which one(s)? _____

12. Do you have any speech/hearing impairments?

Yes ❑ No ❑

Which one(s)? _____

If there is any other relevant information you may find fitting for this research, please, comment below.

_____

_____

_____

Thanks for participating!

Appendix C

Table 17
Brazilian participants with overseas experience – English language

Participant	Place	Time
P05	United Kingdom	3 months
P07	United States of America	3 weeks
P08	United Kingdom	1 month
P09	Ireland	14 months
P16	United Kingdom	2 weeks
P17	Canada	3 months
P22	United States of America	1 year

Appendix D

Universidade Federal de Santa Catarina - UFSC
Centro de Comunicação e Expressão - CCE
Programa de Pós-Graduação em Inglês: Estudos Linguísticos e Literários - PPGI

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Você está convidado a participar do projeto de pesquisa *The Perception of English words by Brazilian Speakers*. Esta pesquisa está associada ao projeto de mestrado de Carlos Felipe Mendes, orientado por Rosane Silveira, do programa de Pós-Graduação em Inglês da Universidade Federal de Santa Catarina, que busca estudar as características da fala da língua inglesa, assim como a sua compreensão por falantes brasileiros. Este estudo procura melhor compreender como a linguagem é assimilada, objetivando benefícios tais como, contribuir sobretudo com o conhecimento linguístico em geral, como também com o seu ensino e aprendizagem, especificadamente para falantes brasileiros de inglês como segunda língua.

Caso você aceite participar da pesquisa, você irá (I) ler e assinar este termo de consentimento, (II) responder um questionário contendendo informações sobre o seu perfil pessoal e linguístico, e (III) ler, em voz alta, um conjunto de sentenças, e/ou palavras, elaboradas pelo pesquisador, que serão gravadas em áudio em uma cabine acústica. Durante os procedimentos de coleta de dados, você estará sempre acompanhado por um dos pesquisadores, que lhe prestará toda a assistência necessária ou acionará pessoal competente para isso.

Os riscos ou desconfortos associados à sua participação na pesquisa são mínimos, limitando-se a possível cansaço mental, nervosismo e/ou ansiedade ao efetuar as gravações e responder ao questionário. Para que isto possa ser evitado, você poderá optar por fazer pequenas pausas durante os procedimentos de coleta. As informações fornecidas e o material coletado serão absolutamente confidenciais e não haverá identificação nominal, nem divulgação de quaisquer informações que podem revelar sua identidade. No entanto, sempre existe a remota possibilidade da quebra do sigilo, mesmo que involuntário e não intencional, cujas consequências serão tratadas nos termos da lei. Esta pesquisa será concluída no início de 2017, tornando-se pública. Ela poderá ser apresentada em possíveis meios de publicação como relatórios, artigos, apresentações em eventos e/ou divulgação de outra natureza, sendo garantidos o sigilo e a confidencialidade dos dados referentes à identificação dos participantes da pesquisa.

Você poderá, a qualquer momento, deixar de participar da pesquisa, informando o pesquisador de sua decisão, a fim de que ele não utilize mais os seus dados. Isto não acarretará em nenhum prejuízo para o participante. Além disso, esta pesquisa está submetida aos critérios da Resolução CNS 466/12 e suas complementares.

Duas vias deste documento estão sendo rubricadas e assinadas por você e pelo pesquisador responsável. É de suma importância que você guarde cuidadosamente a sua via, pois é um documento que traz importantes informações de contato e garante os seus direitos como participante da pesquisa. Caso você tenha algum prejuízo material ou imaterial em decorrência da pesquisa poderá solicitar indenização, de acordo com a legislação vigente e amplamente consubstanciada

A participação nesta pesquisa não acarreta, de forma alguma, em prejuízos ou em privilégios. No entanto, sua participação contribuirá para futuros desenvolvimentos na área de pesquisa através deste estudo, assim como no ensino e aprendizagem da língua inglesa de modo geral. Caso tenha alguma dúvida sobre os procedimentos ou sobre o projeto você poderá entrar em contato com o pesquisador a qualquer momento pelo telefone ou e-mail abaixo fornecido.

Se porventura existirem, por mínimas que sejam, qualquer tipo de despesas tidas pelos participantes da pesquisa e dela decorrentes, conforme item IV 3 (g) da Resolução 466/2012 haverá garantia de ressarcimento dos gastos pelo pesquisador responsável, bem como indenização diante de eventuais danos oriundos também da pesquisa.

Caso suas dúvidas não sejam resolvidas pelos pesquisadores ou seus direitos sejam negados, favor recorrer ao Comitê de Ética em Pesquisa com Seres Humanos (CEPSH) da Universidade Federal de Santa Catarina pelo telefone (48) 3721-6094 ou nas instalações localizadas no Prédio Reitoria II, 4º andar, sala 401, localizado na Rua Desembargador Vitor Lima, nº 222, Trindade, Florianópolis.

Eu, _____,
RG (ou passaporte) número _____,
li este documento e obtive dos pesquisadores todas as informações que julguei necessárias para me sentir esclarecido e optar por livre e espontânea vontade participar da pesquisa, e autorizo o pesquisador a utilizar os dados por mim fornecidos.

_____
Assinatura do Participante

_____
Assinatura do Pesquisador Principal, Carlos Felipe Mendes

_____
Assinatura do Pesquisador Responsável, Rosane Silveira

Florianópolis, ____ / ____/ _____.

Contatos:

UFSC: Rosane Silveira, rosanesilveira@hotmail.com, (48) 9615-9978, Campus Trindade, Florianópolis, CCE-Prédio B, sala 108.

UFSC: Carlos Felipe Mendes, carloslipem@hotmail.com, (48) 9854-5064.

Appendix E

Universidade Federal de Santa Catarina - UFSC
Centro de Comunicação e Expressão - CCE
Programa de Pós-Graduação em Inglês: Estudos Linguísticos e Literários - PPGI

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Você está convidado a participar do projeto de pesquisa *The Perception of English words by Brazilian Speakers*. Esta pesquisa está associada ao projeto de mestrado de Carlos Felipe Mendes, orientado por Rosane Silveira, do programa de Pós-Graduação em Inglês da Universidade Federal de Santa Catarina, que busca estudar as características da fala da língua inglesa, assim como a sua compreensão por falantes brasileiros. Este estudo procura melhor compreender como a linguagem é assimilada, objetivando benefícios tais como, sobretudo com o conhecimento linguístico em geral, como também com o seu ensino e aprendizagem, especificadamente para falantes brasileiros de inglês como segunda língua.

Caso você aceite participar da pesquisa, você irá (I) ler e assinar este termo de consentimento, (II) responder um questionário contendendo informações sobre o seu perfil pessoal e linguístico, (III) fazer um teste de percepção através de um computador, onde terá que responder sobre estímulos auditivos. Durante os procedimentos de coleta de dados, você estará sempre acompanhado por um dos pesquisadores, que lhe prestará toda a assistência necessária ou acionará pessoal competente para isso.

Os riscos ou desconfortos associados à sua participação na pesquisa são mínimos, limitando-se a possível cansaço mental, nervosismo e/ou ansiedade ao realizar os testes e responder ao questionário. Para que isto possa ser evitado, você poderá optar por fazer pequenas pausas durante os procedimentos de coleta. As informações fornecidas e o material coletado serão absolutamente confidenciais e não haverá identificação nominal, nem divulgação de quaisquer informações que podem revelar sua identidade. No entanto, sempre existe a remota possibilidade da quebra do sigilo, mesmo que involuntário e não intencional, cujas consequências serão tratadas nos termos da lei. Esta pesquisa será concluída no início de 2017, tornando-se pública. Ela poderá ser apresentada em possíveis meios de publicação como relatórios, artigos, apresentações em eventos e/ou divulgação de outra natureza, sendo garantidos o sigilo e a confidencialidade dos dados referentes à identificação dos participantes da pesquisa.

Você poderá, a qualquer momento, deixar de participar da pesquisa, informando o pesquisador de sua decisão, a fim de que ele não utilize mais os seus dados. Isto não acarretará em nenhum prejuízo para o participante. Além disso, esta pesquisa está submetida aos critérios da Resolução CNS 466/12 e suas complementares.

Duas vias deste documento estão sendo rubricadas e assinadas por você e pelo pesquisador responsável. É de suma importância que você guarde cuidadosamente a sua via, pois é um documento que traz importantes informações de contato e garante os seus direitos como participante da pesquisa. Caso você tenha algum prejuízo material ou imaterial em decorrência da pesquisa poderá solicitar indenização, de acordo com a legislação vigente e amplamente consubstanciada

A participação nesta pesquisa não acarreta, de forma alguma, em prejuízos ou em privilégios. No entanto, sua participação contribuirá para futuros desenvolvimentos na área de pesquisa através deste estudo, assim como no ensino e aprendizagem da língua inglesa. Além disto, os participantes receberão, via e-mail, sua pontuação no teste de proficiência e informações sobre seu nível de proficiência de acordo com o Quadro Europeu Comum de Referência para Línguas. Caso tenha alguma dúvida sobre os procedimentos ou sobre o projeto você poderá entrar em contato com o pesquisador a qualquer momento pelo telefone ou e-mail abaixo fornecido.

Se porventura existirem, por mínimas que sejam, qualquer tipo de despesas tidas pelos participantes da pesquisa e dela decorrentes, conforme item IV 3 (g) da Resolução 466/2012 haverá garantia de ressarcimento dos gastos pelo pesquisador responsável, bem como indenização diante de eventuais danos oriundos também da pesquisa.

Caso suas dúvidas não sejam resolvidas pelas pesquisadoras ou seus direitos sejam negados, favor recorrer ao Comitê de Ética em Pesquisa com Seres Humanos (CEPSH) da Universidade Federal de Santa Catarina pelo telefone (48) 3721-6094 ou nas instalações localizadas no Prédio Reitoria II, 4º andar, sala 401, localizado na Rua Desembargador Vitor Lima, nº 222, Trindade, Florianópolis.

Eu, _____, RG (ou passaporte) número _____, li este documento e obtive dos pesquisadores todas as informações que julguei necessárias para me sentir esclarecido e optar por livre e espontânea vontade participar da pesquisa, e autorizo o pesquisador a utilizar os dados por mim fornecidos.

_____
Assinatura do Participante

_____
Assinatura do Pesquisador Principal, Carlos Felipe Mendes

_____
Assinatura do Pesquisador Responsável, Rosane Silveira

Florianópolis, ____ / ____/ _____.

Contatos:

UFSC: Rosane Silveira, rosanesilveira@hotmail.com, (48) 9615-9978, Campus Trindade, Florianópolis, CCE-Prédio B, sala 108.

UFSC: Carlos Felipe Mendes, carloslipem@hotmail.com, (48) 9854-5064.

Appendix F

Universidade Federal de Santa Catarina - UFSC
Centro de Comunicação e Expressão - CCE
Programa de Pós-Graduação em Inglês: Estudos Linguísticos e Literários - PPGI

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Você está convidado a participar do projeto de pesquisa *The Perception of English words by Brazilian Speakers*. Esta pesquisa está associada ao projeto de mestrado de Carlos Felipe Mendes, orientado por Rosane Silveira, do programa de Pós-Graduação em Inglês da Universidade Federal de Santa Catarina, que busca estudar as características da fala da língua inglesa, assim como a sua compreensão por falantes brasileiros. Este estudo procura melhor compreender como a linguagem é assimilada, objetivando benefícios tais como, sobretudo com o conhecimento linguístico em geral, como também com o seu ensino e aprendizagem, especificadamente para falantes brasileiros de inglês como segunda língua.

Caso você aceite participar da pesquisa, você irá (I) ler e assinar este termo de consentimento, (II) responder um questionário contendendo informações sobre o seu perfil pessoal e linguístico, e (III) fazer um teste de percepção através de um computador, onde terá que responder sobre estímulos auditivos, e (IV) fazer um teste de proficiência em língua inglesa. Durante os procedimentos de coleta de dados, você estará sempre acompanhado por um dos pesquisadores, que lhe prestará toda a assistência necessária ou acionará pessoal competente para isso.

Os riscos ou desconfortos associados à sua participação na pesquisa são mínimos, limitando-se a possível cansaço mental, nervosismo e/ou ansiedade ao realizar os testes e responder ao questionário. Para que isto possa ser evitado, você poderá optar por fazer pequenas pausas durante os procedimentos de coleta. As informações fornecidas e o material coletado serão absolutamente confidenciais e não haverá identificação nominal, nem divulgação de quaisquer informações que podem revelar sua identidade. No entanto, sempre existe a remota possibilidade da quebra do sigilo, mesmo que involuntário e não intencional, cujas consequências serão tratadas nos termos da lei. Esta pesquisa será concluída no início de 2017, tornando-se pública. Ela poderá ser apresentada em possíveis meios de publicação como relatórios, artigos, apresentações em eventos e/ou divulgação de outra natureza, sendo garantidos o sigilo e a confidencialidade dos dados referentes à identificação dos participantes da pesquisa.

Você poderá, a qualquer momento, deixar de participar da pesquisa, informando o pesquisador de sua decisão, a fim de que ele não utilize mais os seus dados. Isto não acarretará em nenhum prejuízo para o participante. Além disso, esta pesquisa está submetida aos critérios da Resolução CNS 466/12 e suas complementares.

Duas vias deste documento estão sendo rubricadas e assinadas por você e pelo pesquisador responsável. É de suma importância que você guarde cuidadosamente a sua via, pois é um documento que traz importantes informações de contato e garante os seus direitos como participante da pesquisa. Caso você tenha algum prejuízo material ou imaterial em decorrência da pesquisa poderá solicitar indenização, de acordo com a legislação vigente e amplamente consubstanciada

A participação nesta pesquisa não acarreta, de forma alguma, em prejuízos ou em privilégios. No entanto, sua participação contribuirá para futuros desenvolvimentos na área de pesquisa através deste estudo, assim como no ensino e aprendizagem da língua inglesa. Além disto, os participantes receberão, via e-mail, sua pontuação no teste de proficiência e informações sobre seu nível de proficiência de acordo com o Quadro Europeu Comum de Referência para Línguas. Caso tenha alguma dúvida sobre os procedimentos ou sobre o projeto você poderá entrar em contato com o pesquisador a qualquer momento pelo telefone ou e-mail abaixo fornecido.

Se porventura existirem, por mínimas que sejam, qualquer tipo de despesas tidas pelos participantes da pesquisa e dela decorrentes, conforme item IV 3 (g) da Resolução 466/2012 haverá garantia de ressarcimento dos gastos pelo pesquisador responsável, bem como indenização diante de eventuais danos oriundos também da pesquisa.

Caso suas dúvidas não sejam resolvidas pelas pesquisadoras ou seus direitos sejam negados, favor recorrer ao Comitê de Ética em Pesquisa com Seres Humanos (CEPSH) da Universidade Federal de Santa Catarina pelo telefone (48) 3721-6094 ou nas instalações localizadas no Prédio Reitoria II, 4º andar, sala 401, localizado na Rua Desembargador Vitor Lima, nº 222, Trindade, Florianópolis.

Eu, _____, RG (ou passaporte) número _____, li este documento e obtive dos pesquisadores todas as informações que julguei necessárias para me sentir esclarecido e optar por livre e espontânea vontade participar da pesquisa, e autorizo o pesquisador a utilizar os dados por mim fornecidos.

_____

Assinatura do Participante

_____

Assinatura do Pesquisador Principal, Carlos Felipe Mendes

_____

Assinatura do Pesquisador Responsável, Rosane Silveira

Florianópolis, ____ / ____/ _____.

Contatos:

UFSC: Rosane Silveira, rosanesilveira@hotmail.com, (48) 9615-9978, Campus Trindade, Florianópolis, CCE-Prédio B, sala 108.

UFSC: Carlos Felipe Mendes, carloslipem@hotmail.com, (48) 9854-5064.

Appendix G

Table 18
Tokens selection /-s/

/-s/ exemplars	Std. Frequency Index	Frequency per Million	SFI rank
like	73,92	2465	45
work	72,24	1674	67
look	71,37	1370	75
talk	68,23	665	137
part	68,40	692	130
point	68,35	684	131
week	67,75	596	157
group	67,55	569	167
book	67,53	566	171
set	67,21	526	185

Table 19
Tokens selection /-z/

/-z/ exemplars	Std. Frequency Index	Frequency per Million	SFI rank
time	73,62	2302	49
year	72,90	1949	58
way	71,07	1279	80
thing	70,65	1161	87
need	70,53	1129	90
mean	70,09	1021	95
show	69,18	827	110
try	68,45	699	125
school	68,05	638	146
end	67,92	619	152

Table 20
Tokens selection /-iz/

/-iz/ exemplars	Std.Frequency Index	Frequency per Million	SFI rank
place	69,00	795	114
change	69,02	799	113
pause	61,70	148	649
course	67,60	575	164
case	67,55	569	168
face	65,91	390	249
age	65,43	349	282
price	65,14	327	296
watch	64,80	302	326
base	64,78	300	327

Appendix H

WELCOME

THANKS FOR PARTICIPATING

Slide 01

Perception Tests Procedures

There are two perception tests:

- 1. the short familizarization test.
- 2. the actual perception test.

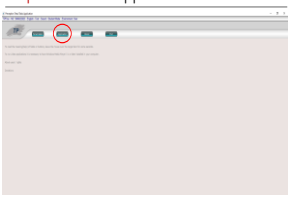
Slide 02

Perception Tests

- The tests are done in a computer software.
- You will learn how the tests work step by step with images.
- There are red circles and instructions to guide you.
- You can ask any question regarding the tests during this presentation.

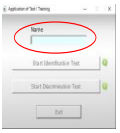
Slide 03

Step 1: Click on 'Application'



Slide 04

Step 2: Write your name and last name



Slide 05

Step 3: Click on 'Start Identification Test'

Attention! As soon as you click on the button the test starts!

Slide 06

Instructions

When you start the test you will hear words in their plural forms, similar to the words below:

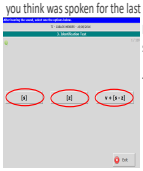
- cats /s/
- dots /s/
- cags /z/
- dogs /z/
- pages extra vowel + /s/ or /z/
- mages extra vowel + /s/ or /z/

Attention! Note that the phonetic transcription regards only the plural marker.

Slide 07

Instructions

Your task is to select the option on the screen to indicate what sound you think was spoken for the last letter -S.



Pay close attention to the last sound(s) of the word.

There are three options to choose.

Slide 08

Examples

If you think the last sound spoken is the sound of the letter 'S', you should choose the option: [s]

cats /s/

For example: In the word 'cats' above, the letter 'S' may be pronounced with the sound of the letter 'S'. The correct option is: [s]

Slide 09

Examples

If you think the last sound spoken is the sound of the letter 'Z', you should choose the option: [z]

dogs /z/

For example: In the word 'dogs' above, the letter 'S' may be pronounced with the sound of the letter 'Z'. The correct option is: [z]

Slide 10

Examples

If you think the last sound spoken is the sound of a vowel + the sound of the letter 'S', you should choose the option: v + [s - z]

pages extra vowel + /s/

For example: in the word 'pages' above, the letter 'S' may be pronounced with the sound of a vowel + the sound of the letter 'S'. The correct option is: v + [s - z]

Slide 11

Examples

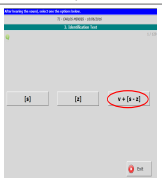
If you think the last sound spoken is the sound of a vowel + the sound of the letter 'Z', you should choose the option: v + [s - z]

pages extra vowel + /z/

For example: in the word 'pages' above, the letter 'S' may be pronounced with the sound of a vowel + the sound of the letter 'Z'. The corret option is: v + [s - z]

Slide 12

Step 4: Choose an option



Slide 13

Instructions

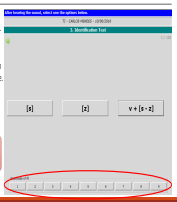
Once you choose an option, there will be a scale at the bottom of the screen.

The scale is from 1 to 9.

You should choose a number based on how certain you are about your choice.

- 1 = not sure
- 9 = absolutely sure.

Attention! As soon as you click on the scale, the next word will start!



Slide 14

Step 5: Choose a number

Slide 15

Instructions

After choosing a number the scale will disappear.

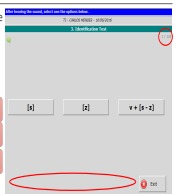
The second word will start.

- Example: 2/120

Repeat steps 4 and 5!

4: Choose an option

5: Choose a number



Slide 16

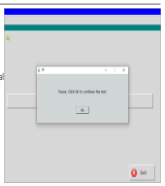
Instructions

There are 08 trials in the familiarization test.

There are 120 trials in the actual perception test.

There is a pause in the middle of the actual test.

Attention! You might hear a word more than once!



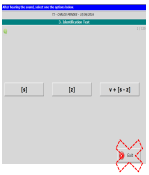
Slide 17

Step 6: Click on 'Ok'

Attention! As soon as you click on 'Ok', the perception test will restart!

Slide 18

Instructions



Attention! Do not exit the test!

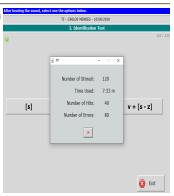
If you click on 'Exit', you will need to restart the test from the beggining.

Slide 19

Instructions

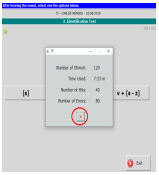
When you complete the test, window with the results will appear.

When you click on 'X', the test is over.



Slide 20

Step 7: Click on 'X'



Slide 21

Appendix I

PERCEPTION TEST FEEDBACK

Participant: _____

1. Identifying the last sound of the words was:

Very easy ❑ Easy ❑ OK ❑ Difficult ❑ Very difficult ❑

Why?

_____

_____

_____

2. Concerning the duration of the test, you consider it was:

Short ❑ OK ❑ Long ❑ Very long ❑

3. Concerning the effort, you consider it was:

Not tiresome ❑ Tiresome ❑ Very tiresome ❑

4. Have you taken a similar test before?

Yes ❑ No ❑

Suggestions/Comments:

_____

_____

_____

Thanks for participating!

Appendix J

Table 21
Perception identification test individual results – Control group

	[s]	[z]	V + [s – z]	Hits*
P1	98.0	45.0	98.0	80.0
P2	100.0	60.0	98.0	85.0
P3	90.0	78.0	100.0	89.0
P4	100.0	100.0	100.0	100.0
P5	98.0	48.0	90.0	78.0
P6	92.0	90.0	100.0	94.0
P7	100.0	100.0	100.0	100.0

** Total scores*

Appendix K

Table 22
Results per following context (Control group)– Response frequency[a] for allophone

Context		[s]	[z]	V + [s – z]
silence	N	30	30	30
	Mean	3.00	1.53	2.47
	Sum	90	46	74
	SD	2.913	2.270	3.235
voiceless cons	N	30	30	30
	Mean	2.83	1.83	2.33
	Sum	85	55	70
	SD	2.995	2.451	3.231
voiced cons	N	30	30	30
	Mean	2.67	1.97	2.37
	Sum	80	59	71
	SD	3.044	2.822	3.211
vowel	N	30	30	30
	Mean	2.70	1.83	2.47
	Sum	81	55	74
	SD	3.030	2.614	3.224
Total	N	120	120	120
	Mean	2.80	1.79	2.41
	Sum	336	215	289
	SD	2.961	2.520	3.185

[a] *Number of selected responses*

Appendix L

Table 23
QPT scores and self-ratings

	QPT scores	Self-ratings
P01	31	8
P02	33	4
P03	39	7
P04	38	7
P05	26	5
P06	27	4
P07	26	3
P08	38	8
P09	41	8
P10	29	5
P11	38	5
P12	35	6
P13	33	5
P14	34	6
P15	31	5
P16	38	7
P17	39	6
P18	50	7
P19	27	7
P20	38	7
P21	38	7
P22	29	5
P23	31	5
P24	43	5
P25	41	7
P26	29	5
P27	38	7
P28	28	5
P29	30	7
P30	36	5
P31	24	6
P32	19	5
P33	33	4