UNIVERSIDADE FEDERAL DE SANTA CATARINA

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THE RELATIONSHIP BETWEEN PERCEPTION AND PRODUCTION OF

WORDS ENDING IN –*ed* BY BRAZILIAN EFL LEARNERS

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**To
Cleusa and Arthur,
with love and gratitude.**

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ABSTRACT

THE RELATIONSHIP BETWEEN PERCEPTION AND PRODUCTION OF WORDS

ENDING IN –*ed* BY BRAZILIAN EFL LEARNERS

RUDINEI ALDINI FRESE

UNIVERSIDADE FEDERAL DE SANTA CATARINA

2006

Supervisor: Dra. Rosana Denise Koerich

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This research focuses on the relationship between perception and production of words ending in -*ed* by Brazilian learners of English as a foreign language. The relationship between perception and production was investigated in terms of the participants' ability to perceive and produce the target sound with the oral stops /p,t,k,b,d,g/ as the preceding and the semi-vowel /^{j}/ as the following phonological environment. Thirty-two learners attending advanced English classes in the extracurricular course at Universidade Federal de Santa Catarina were tested. The hypotheses were investigated in terms of correlation and mean comparisons for /t/, /d/ and /ɪd/. Production data was obtained by the creation of sentences elicited through carrier phrases provided in writing. Perception data was obtained through an oddity discrimination test (Flege, Mackay & Meador, 1999). The results showed that a) there

was a statistically significant and positive correlation between the perception and production of the -e*d* ending; b) the mean for the perception of /ɪd/ was significantly higher than those for /t/ and /d/; c) the mean for the perception of /t/ was significantly higher than the mean for /d/; d) the mean for the production of /ɪd/ was significantly higher than those for /t/ and /d/; and e) the mean for the production of /t/ was significantly higher than that for /d/. Results of the present study provide interesting data to be related in theoretical terms to Flege's (1995) Speech Learning Model, Best's (1995) Perceptual Assimilation Model, Hooper's (1976) Hierarchy of Strength, Selkirk's (1984) Sonority Sequencing Generalization, and Eckman's (1977, 1987) Markedness Differential Hypothesis, and corroborate the findings reported in previous studies (Koerich, 2002; Silveira, 2004) regarding voicing and the relationship between perception and production.

63 pages (excluding appendices)
16.352 words (excluding appendices)

RESUMO

A RELAÇÃO ENTRE PERCEPÇÃO E PRODUÇÃO DE PALAVRAS

TERMINADAS EM –ed POR ESTUDANTES BRASILEIROS DE INGLÊS

RUDINEI ALDINI FRESE

UNIVERSIDADE FEDERAL DE SANTA CATARINA

2006

Orientadora: Dra. Rosana Denise Koerich

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Esta pesquisa focaliza a relação entre percepção e produção de palavras terminadas em -ed por estudantes brasileiros de inglês. A relação entre percepção e produção foi investigada em termos da habilidade dos participantes em perceber e produzir o som alvo com as plosivas orais /p, t, k, b, d, g/ como ambiente fonológico precedente e a semi-vogal /ʲ/ como ambiente fonológico seguinte. Trinta e dois estudantes freqüentando aulas de inglês avançado no curso extracurricular da Universidade Federal de Santa Catarina foram testados. As hipóteses foram investigadas em termos de correlação e comparação de médias para /t/, /d/ e /ɪd/. Os dados de produção foram obtidos pela criação de sentenças a partir de 'frases guias' fornecidas por escrito. Os dados de percepção foram obtidos através de um teste de identificação do item estranho (Flege, Mackay & Meador, 1999). Os resultados mostraram que a)

existe uma relação estatisticamente significativa e positiva entre a percepção e produção do -*ed*; b) a média na percepção do -*ed* pronunciado /ɪd/ foi significativamente maior do que as de /t/ e /d/; c) a média na percepção de /t/ foi estatisticamente significativa e maior que a de /d/; d) a média na produção de /ɪd/ foi significativamente maior do que as de /t/ e /d/; e e) a média na produção de /t/ foi significativamente maior do que a de /d/. Os resultados do presente estudo fornecem dados interessantes a serem relacionados

em termos teóricos ao Modelo de Aprendizagem da Fala (Flege, 1995), ao Modelo de Assimilação da Percepção (Best, 1995), a Hierarquia de Sonoridade (Hooper, 1976), a Generalização da Seqüência Sonora (Selkirk, 1984), e a Hipótese da Relação da Marcação (Eckman, 1977, 1987), e ainda, corroboram os resultados de estudos prévios (Koerich, 2002; Silveira, 2004) em termos de efeito do vozeamento e da relação entre percepção e produção.

Nº de páginas: 63
Nº de palavras: 16.352

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CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Speech perception and production and their complex interrelation has posited an essential question in the Second Language Acquisition (SLA) field: Does perception precede production or production precede perception in the process of L2 speech acquisition (Newman, 1998)? In other words, are L2 learners able to perceive sounds that they cannot produce or produce sounds they are not able to perceive?

As observed by Koerich (2002), the link between speech perception and speech production has provided empirical evidence pointing to three different directions: a) perception precedes production (Flege, Bohn & Jang, 1997); b) production precedes perception (Sheldon & Strange, 1982); and c) there is correlation between perception and production (Bohn & Flege, 1989; Flege, 1993, 1999; Newman, 1998; Flege, Mackay & Meador, 1999; Bradlow, Akahame-Yamada, Pisoni, & Tohkura, 1999).

The pertinent literature is rich in evidence for pronunciation errors EFL learners present in producing the language. For instance, Brazilians have difficulties with single final consonants and consonant clusters, since the only final consonants that occur in final position in Brazilian Portuguese are those represented by the letters *r* and *s* (Baptista, 2001; Koerich, 2002). Baptista also mentions the difficulty Brazilians have with verbs in the simple past tense, which are pronounced as /ɪd/ or /əd/ after /t/

and /d/, as /d/ after vowels and voiced consonants, and as /t/ after voiceless consonants. Once these single final consonants and final consonant clusters do not happen in Brazilian Portuguese, the difficulty is frequently solved by the insertion of vowels, producing /helpɪdɪ/ and /klinɪdɪ/ for 'helped' and cleaned', respectively, breaking the cluster and turning the consonant coda into the onset of a new syllable. A few studies in the area of phonetics and phonology involving Brazilian Portuguese speakers learning English have investigated the relationship between perception and production of vowels and single consonants (e.g., Rochet, 1995; Koerich, 2002; Silveira, 2004), whereas there are no studies focusing specifically on the *-ed* inflectional endings. There are only five studies related to the topic: Delatorre (2004, 2005, 2006) and Pereira (1994) which investigated epenthesis production on *-ed* endings, and Alves (2004), which investigated the role of explicit instruction in its production.

According to Llisterri (1995), time and degree of exposure to the target language, social pressure of the speakers around, the environment in which the L2 is being learned, contextual dependency, age at the time learning is taking place and the phonetic categories involved in an experiment might influence the results concerning the relationship between perception and production.

Baker and Trofimovich (2001) say that perception and production are interdependent skills which may be controlled by different mechanisms. The authors stated that the link between the two skills, which may change over time, is less evident with adults, whose learning is influenced by factors such as language experience and age at the time of learning. However, the Speech Learning Model (SLM) predicts that

the ability to establish new L2 phonetic categories is not lost with age, but L2 production tends to decrease in accuracy as time of learning increases (Flege, 1995). Based on these assumptions, the present study tries to control for variables such as age at onset of L2 learning, age at the time of data collection and phonological environment in order to get consistent results.

1.2 Statement of the Purpose

The present study seeks to offer data to contribute with the clarification of the questions concerning the relationship between speech perception and production of consonants, investigating Brazilian advanced EFL learners in terms of their ability to perceive and produce the three types of *-ed* endings.

In this sense, the data of the present investigation is analyzed quantitatively in terms of participants' scores in the perception and production tests, which aim at investigating whether the results show a significant correlation between the participants' overall performance in perceiving and producing the *-ed* inflectional ending; and whether there are significant differences in the perception and production of each of the *-ed* ending types /t/, /d/ and /ɪd/.

1.3 Significance of the Study

The present study, besides contributing to research in the area of L2 pronunciation acquisition, is expected to provide significant theoretical and pedagogical implications. Firstly, studies investigating the relationship between perception and

production of L2 sounds have provided evidence for a close link between the two skills in experiments with vowels, whereas experiments with consonants have offered inconclusive results (Llisterri, 1995). Secondly, research on the relationship between perception and production has given evidence pointing to three different directions – perception influencing production, production influencing perception, or both developing in parallel (Koerich, 2002). Studies such as the present one will surely add experimental results to the field.

Pedagogically speaking, the present study is expected to contribute with findings about the perception and production of the –ed ending that will help taking decisions for the selection and designing of instructional materials.

1.4 Organization of the Thesis

This thesis consists of 5 chapters. Chapter 1 consists of this introduction, Chapter 2 presents the review of the literature which set the field for the present study, Chapter 3 presents the method adopted in conducting the study, Chapter 4 presents the results and discussion of the findings, and finally, Chapter 5 presents the conclusions of the study.

CHAPTER 2

REVIEW OF THE LITERATURE
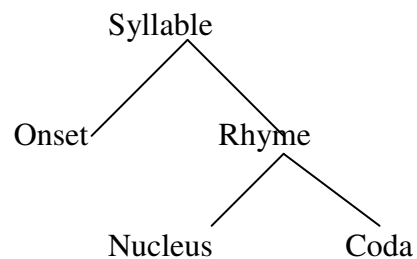
2.1 Introduction

This chapter aims at presenting a brief definition and description of the universal syllable, the English and the Brazilian Portuguese syllables (for an extensive description and definition of these, see Koerich, 2002, Bettoni-Techio, 2005, and Delatorre, 2006). The chapter also reviews markedness and sonority relations related to the present study, along with the phonological environment in which the target sound was tested, and finally, it shows evidence for the relationship between perception and production in terms of theory and empirical studies.

2.2 The Syllable

This section presents a general definition and description of the syllable, besides presenting the most common syllable structures in languages of the world.

In terms of definition, the literature has shown lack of consensus in a syllable concept which defines it both phonetically and phonologically. Regarding phonetics, it is defined as 'a peak in the flow rate of pulmonic air' (Giegerich, 1992, p. 132), and phonologically, it is defined as "a complex unit made up of nuclear and marginal elements" in which nuclear elements are vowels or syllabic segments, and marginal elements are consonants or non-syllabic segments (Laver, 1994, p. 114).

In terms of description, Giegerich (1992) claims that the syllable is constituted by 1) an onset, which is the consonant or sequence of consonants the precedes the nuclear element, and 2) a rhyme, which is further divided into two smaller parts; a) the peak, which represents the most sonorant and indispensable element in the syllable, and b) the coda, which includes any consonant or sequence of consonants following the peak. According to the Metrical Theory (Giegerich, 1992), the syllable structure described above can be represented as in the following:

```
                    Syllable
                   /        \
            Onset              Rhyme
                              /     \
                        Nucleus      Coda
```

Concerning the realization of consonants and vowels in onset, nucleus and coda position, Hooper (1976) represents the structure of the syllable in the following way:

MARGIN	NUCLEUS	MARGIN
obstruents, nasals liquids	glides vowels glides	liquids nasals obstruents
Least vowel-like	Most vowel-like	Least vowel-like
STRONG	WEAK	WEAK

(Hooper, 1976, p. 199)

Regarding the preference for a universal syllable, Laver (1994) states that there is a universal preference for the (CV) syllable structure, thus being known as the universal syllable structure, since, according to the author, there is no language which does not allow its realization. Besides, the author also advocates that the (V), (CV),

(VC) and (CVC) are the four most common types of syllable structures in languages around the world. The author also claims that there are two types of syllables: closed syllables and open syllables. The former is represented by the (VC) structure, and the latter by the (CV) structure, which is referred in the literature as the universal syllable, as described above.

In conclusion, even though the literature provides evidence for a lack of agreement for the concept of the syllable which defines it phonetically and phonologically, the syllable structure presented by Giegerich (1992) and Hooper (1976), and the universal preference for the (CV) syllable structure or open syllable presented by Laver (1994) are relevant to the present study.

2.3 The English Syllable

This section describes the English syllable structure, focusing on the possible combinations for the realization of two member consonant clusters in coda position.

According to Prator and Robinett (1985) and Giegerich (1992), the syllabic system of English can be represented by the (C)(C)(C)V(C)(C)(C)(C) structure, in which the onset can vary from zero to three consonants, as in the words *it* /ɪt/ and *strike* /straɪk/, and the coda from zero to four consonants, as in the words *he* /hɪ/ and *strengths* /strɛŋkθs/. The author also states that the possible combinations of different elements for both onset and coda position follow phonotactic rules, which define the permissible syllable structures, consonant clusters, and vowel sequences in a language.

Giegerich (1992) states that English presents open and closed syllables, that is, the only obligatory element in the syllable is the peak or nucleus, and that its structure not only allows for many different consonants in final position, but also for final consonant clusters. In other words, AE permits almost all consonants to occur in final position except for /h, j, w/, which occur only in syllable initial position. The consonant /ʒ/ appears in the middle of words and in syllable initial or final position of borrowed words, such as in *pleasure, genre* and *garage*[1](Delatorre, 2006).

Jensen (1993), besides presenting the possible combinations for three and four consonant clusters in syllable final position and advocating that simpler combinations are preferred over more complex combinations, states that according to the phonotactics of English, the possible combinations for consonant clusters are the following: a) stop + stop, as in *helped*, *worked, robbed, hugged*; b) fricative + stop, as in *washed*, *laughed, kissed*; c) affricate + stop, as in *watched, judged;* d) nasal + stop, as in *cleaned, screamed*; and e) liquid + stop, as in *called, remembered.*

As stated previously, the present study deals only with stops as the preceding phonological context, thus producing the following combinations: a) stop + /t/, as in *stopped*; b) stop + /d/, as in *cleaned*; and c) stop + /ɪd/, as in needed.

In summary, AE a) allows for the formation of complex onsets and codas; b) permits the realization of open and closed syllables; and c) the realization of /ɪd/ is more frequent than /t/ and /d/.

2.4 The Brazilian Portuguese Syllable

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[1]   Examples from Delatorre (2006).

This section aims at describing the Brazilian Portuguese syllable structure, focusing on the coda.

According to Cristófaro Silva (1999), the syllabic system of Brazilian Portuguese (BP) can be represented by the (C)(C)V(V')(C)(C) structure, in which both the onset, the nucleus and the coda can vary from zero to two consonants, as in the words *ar* /ar/ – air – *prato* /'pra.to/– plate – *caixa* /'kai.ʃa/ – box – and *lá* /la/ – there – *trens* /treins/ – train, respectively.

According to Cristófaro Silva (1999), the number of combinations from zero to two consonants in coda position are very restricted, since BP gives preference to open syllables, as in lá /la/ – there. Therefore, single consonants in final position are phonologically restricted to /l/, /r/, /m/, /n/, /s/ and /z/ (Koerich, 2002), but they are restricted to the archiphonemes /R/ and /S/, because /l/ is usually realized as [u], /m/ and /n/ are nasalized and not themselves pronounced, and /z/ is usually realized as /S/ (Baptista , 2001).

To conclude, BP does not allow for the formation of complex codas, only permitting the realization of the consonants /R/ and /S/ in syllable final position.

2.5 Markedness Relations

This section presents the concept of markedness, reviews the main hypotheses stated in its concept along with some empirical studies testing its principles, which are important to the present study.

The term markedness theory, introduced by European linguists in the 1930s, assumes that all languages in the world present some basic, natural and frequent structures, which are unmarked, and some more complex, unnatural and less frequent structures, which are marked (Eckman, 1977). Based on this principle, the effects of markedness between the languages in contact have been presented in terms of different hypotheses.

Concerning relative difficulties, Lado (1957) proposed the Contrastive Analysis Hypothesis (CAH), which has a strong and a weak version. The strong version states that L2 learners' errors can be predicted by the contrast of the native and the target language in question, thus learning should be focused on these differences. The weak version assumes that the contrast of the L1 and the L2 can help to explain learners' errors. According to the CAH, L2 structures which are similar to L1 structures would be easy to learn, whereas L2 structures which are different from the L2 would be more difficult. This hypothesis involves the concept of transfer. According to Selinker (1992) transfer is the process of applying L1 structure while acquiring the L2, which can be positive when the structure being learned is similar to the L1, and negative, when the structure is different, that is, in the former the process of learning is easier and in the latter the process is more difficult.

Regarding some criticism against the CAH, based on the fact that it could not predict neither explain all L2 learners' errors, Eckman (1977, 1987) proposed the Markedness Differential Hypothesis (MDH), which carried the CAH a step further. The MDH claims that difficulties can be predicted by the comparison between L1 and L2, and markedness relations. The MDH predicts that a) L2 structures which are different from those of the L1 and more marked will be difficult; b) the degree of difficulty

between L1 and L2 depends on the degree of markedness; and c) L2 structures which are different from the L1 but less marked will not be difficult (Eckman, 1977, 1987).

Finally, Eckman (1991) proposed the Structural Conformity Hypothesis (SCH), claiming that L1 and L2 differences are not sufficient to explain acquisition/learning difficulties. Thus the hypothesis makes predictions based on universals, that is, it considers that interlanguages have a tendency to follow the same principles as the native languages do.

Studies in the area of phonetics and phonology have been concerned with the role of markedness relations in explaining difficulties L2 learners face when acquiring/learning the target language (Baptista & Silva Filho, 1997; Carlisle, 1988, 1992, 1994, 1997, 2001; Eckman, 1987; Koerich, 2002).

Baptista & Silva Filho (1997), in investigating the influence of voicing markedness and of universals of cross-syllable with adults, found that voiced consonants induced more epenthesis production than voiceless consonants, 18.8% and 11.6% of the times, respectively, thus confirming the hypothesis that more marked structures, in this case voiced consonants, are more difficult to be produced than less marked structures, in this case voiceless consonants.

Similarly, Koerich (2002), when replicating Baptista & Silva Filho's (1997) study, investigated the production of epenthesis after voiced and voiceless contexts. Findings showed that even though there seems to be a tendency for participants to produce more epenthesis after voiced contexts than after voiceless contexts, confirming markedness predictions, the overall percentages were almost the same, 44.77% and 44.44%, respectively.

To conclude, based on the markedness relations reviewed above, and on the

empirical studies concerning voiced and voiceless consonants, it is possible to predict that participants might have more difficulties in perceiving and producing the / d/ –ed ending, which is more marked, than the / t / –ed ending, which is less marked.

2.6 Sonority Relations

This section aims at presenting the sonority indexes proposed by Selkirk (1984) in her Sonority Sequencing Generalization, and the consonantal values assigned by Hooper (1976) in her the Hierarchy of Strength, along with the predictions these models can make about the present study.

Universal markedness relations are also studied in terms of sonority relations. Based on the Sonority Sequencing Generalization (Selkirk, 1984) and on the Hierarchy of Strength (Hooper, 1976), it is possible to state that the less sonorant a sound is, the more marked it will be, whereas the more sonorant, the less marked (Greenberg, 1960). The former states that sonority rises through the onset, reaches a peak at the syllable nucleus, and falls through the coda, whereas the latter makes claims in terms of sonority, assigning values to consonantal sounds, as shown bellow:

glides	liquids	nasals	voiced continuants	voiceless continuants voiced stops	voiceless stops
1	2	3	4	5	6
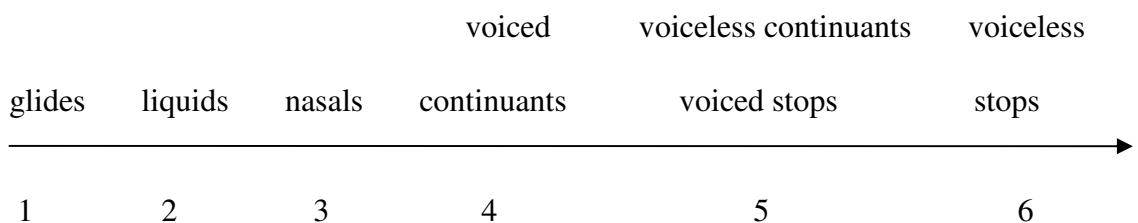
(Hooper, 1976, p. 206)

Selkirk (1984) presents hierarchical sonority indexes for vowels and consonants

as follows:

Correspondence between sound and sonority index

Sound	Sonority index
a	10
e, o	9
i, u	8
r	7
l	6
m, n	5
s	4
v, z, ð	3
f, θ	2
b, d, g	1
p, t, k	0.5

(Selkirk, 1984, p. 112)

According to the phonotatics of the English syllable presented above, elements in both onset and coda position follow a sonority order, predicting that more sonorous sounds are more difficult to be perceived than less sonorant sounds.

Regarding the consonantal values assigned to /t/ and /d/ in Hooper (1976), and the sonority indexes attributed by Selkirk (1984), it is possible to argue that /d/ might be perceived with more difficulties than /t/.

2.7 Phonological Environment Relations

According to Wolfram and Johnson (1992) and many other authors, sound units tend to be influenced by their environments. Several studies investigating phonological environment as a variable have given empirical evidence for its influence on the

production of sounds, for instance, the studies by Carlisle (1991a, 1991b, 1992, 1994, 1997, 2001), who investigated the production of the clusters /sC,st,sp,sk,sl,sN/, the study by Rebello (1997), who investigated the /sC,sCC/ clusters, the study by Baptista and Silva Filho (1997), who examined the /sC,sCC/, the study by Koerich (2002), who investigated the relationship between perception and production in terms of epenthesis, the study by Kluge (2004), who investigated the production of syllable-final nasals   /m,n/ in coda position, and the studies by Delatorre (2004, 2005, 2006), in which the production of epenthesis after different vowels and consonants was examined;

Based on the fact that the studies above found that environment does play a role in the production of the following sound, the present study aims at controlling for this variable in the sense that the target sound – the *-ed* ending – is investigated in both the perception and production tests in the following environments: a)   vowel + voiceless bilabial stop + voiceless alveolar stop + semivowel – /p + t + ʲ/; b) vowel + voiceless alveolar stop + vowel + voiced alveolar stop + semivowel – /t + ɪd + ʲ/;

c) vowel + voiceless velar stop + voiceless alveolar stop + semivowel – /k + t + ʲ/;

d) vowel + voiced bilabial stop + voiced alveolar stop + semivowel – /b + d + ʲ/;

e) vowel + voiced alveolar stop + vowel + voiced alveolar stop + semivowel – /d + ɪd + ʲ/; and f) vowel + voiced velar stop + voiced alveolar stop + semivowel – /g + d + ʲ/.

In conclusion, once theory and empirical studies have given evidence for the

influence of the preceding context, the present study tries to control for this variable in terms of dealing only with stops as the preceding environment, and the semi-vowel / ^{j} / as the following environment.

2.8 The Speech Learning Model (SLM) and the Perceptual Assimilation Model (PAM)

The purpose of this section is to review the Speech Learning Model (Flege, 1995) and the Perceptual Assimilation Model (Best, 1995) in order to set the ground for hypotheses 1, 2, and 3.

The Speech Learning Model (Flege, 1995) and the Perceptual Assimilation Model (Best, 1995) are two of the most influential approaches to how learners perceive L2 sounds. Both models are theoretically related to the present study and are thus reviewed in the following paragraphs.

Flege's (1995) Speech Learning Model (SLM) claims that L1 and L2 sounds are stored in long-term memory in the same phonological space by phonological categories and that the establishment of L2 new categories are limited by how developed the L1 system is. The author describes how L2 learners perceive non-native sounds in the following way: 1) identical, when L2 and L1 sounds share the same acoustic features; 2) similar, when L2 and L1 sounds share some acoustic features; and 3) different, when L2 and L1 sound present different acoustic features. According to Wode (1995), identical L2 sounds are placed in existing phonetic categories of the L1, L2 similar sounds are adjusted in L1 existing phonetic categories, new phonetic categories are created for new L2 sounds. Flege (1987) says that similar sounds are easier to be acquired than new

sounds, but new sounds are produced more accurately than similar sounds after they are acquired (Flege, 1991).

The SLM also predicts that phonetic categories can be established at any time in life once the learner perceives the sub-phonemic features of the L2 sound, but this establishment depends that sounds pass through the filter of equivalence classification, which occurs when an L2 sound is classified as an L1 sound because of its similarity, that is, both the L2 and L1 sounds are perceptually processed by the same phonetic category. Flege (1996) defines equivalence classification as a cognitive mechanism thought to shape L2 speech learning.

Among the postulates and hypotheses stated by Flege (1995), the link between perception and production is of crucial importance in this study. The model predicts that the degree of accuracy in the perception of phonetic differences between the languages in contact is essential for accurate production. The model also predicts that the production of a sound eventually corresponds to the properties represented in its phonetic category representation.

The Perceptual Assimilation Model (PAM), developed by Best (1995), claims that L2 sounds are somehow assimilated to L1 existing phonetic categories and that this process of assimilation known as perceptual similarity is the process in which learners perceive L2 sounds as being similar to L1 existing sounds in terms of their articulatory features.

According to the model, discrimination of non-native sounds depends on their assimilation to sounds in the native phonological system, which can occur in different ways and different degrees, for instance, sounds may be assimilated to a single L1 category, resulting in poor discrimination, or two L1 categories, providing successful

discrimination. Therefore, the model predicts the possible different ways L2 sounds can be assimilated and how they are discriminated in each of the combinations. Best (1995, p. 195), in presenting the different assimilation possibilities and the degree of discrimination in each assimilation, states that in Two-Category Assimilation (TC Type), each non-native segment is assimilated to a different native category, and discrimination is expected to be excellent.

In summary, even though there are differences between Flege's (1995) Speech Learning Model and Best's (1995) Perceptual Assimilation Model such as on how L2 sounds are assimilated to L1 phonetic categories, both the SLM and the PAM hypothesize that non-native perception is determined by the relation of L2 with L1 phonetic categories, and that L2 production errors have a perceptual origin, that is, the latter precedes the former.

2.9 Perception and Production

The purpose of this section is to review the studies which are closely related to the present study in terms of the perception and production relationship, final consonant clusters and -*ed* endings.

The relationship between perception and production is a question which has been investigated for decades and is still far from clear (Rochet, 1995), since the literature shows empirical evidence pointing to different directions for the link between perception and production; a) perception precedes production; b) production precedes perception; and c) there is a relationship between perception and production (see Koerich, 2002).

Considering that there are a few studies investigating the link between

perception and production of consonants, and that there are no studies investigating this link in terms of -ed ending with Brazilians, this section reviews studies, which are related to the present research, investigating: a) perception and production of vowels; b) perception and production of consonants; c) perception and production involving English and Portuguese; and d) studies investigating the *-ed* inflectional ending.

Regarding the perception and production of vowels, it is worth reviewing the study by Bohn and Flege (1989), who investigated the formation of the English vowel /æ/ in relation to the German vowels /e/-/a/-/ɛ/ and the possible relation of perception and production of it, and found a modest relationship between perception and production. Another example is the study by Flege (1993), who examined the production and perception of vowel duration cues to the word-final English /t/-/d/ distinction with 30 late Chinese/English bilinguals and 9 early Chinese/English bilinguals, and found a correlation between the two skills. On the same hand, the study by Flege, Mackay and Meador (1999), who examined the production and perception of English vowels by highly experienced native Italian speakers of English, found a significant correlation between the measures of L2 vowel production and perception. Furthermore, the study by Baker & Trofimovich (2001), who investigated the perception and production of English vowels, namely /ɪ/ - /i/ - /u/ - /ʊ/ - /æ/ - /ɛ/, by 30 Korean-English bilinguals to determine the development of the two skills and to explore other factors that may influence or explain the link between perception and production, and found that both perception and production are related.

Finally, the study by Flege, Bohn & Jang (1997), who investigated the English vowels /i/ - /ɪ/ - /ɛ/ - /æ/ by speakers of German, Spanish, Mandarin, and

Korean in terms of effects of experience in perception and production, found that degrees of accuracy in producing and perceiving the vowels were related and that perception seems to precede production.

Furthermore, the studies by Flege and Schmidt (1995) and Schmidt and Flege (1995), both cited in Flege (1999), investigated the perception and production of voice onset time (VOT) of word-initial English stops by 40 native speakers of Spanish, and Flege, Bohn and Jang (1997), cited in Flege (1999), examined the perception and production of /i/-/ɪ/-/æ/-/ɛ/ by 20 native speakers of German, Spanish, Korean, and Mandarin who were adults at the time of arrival and that had lived in the USA for an average of 4 years. Results showed correlation of perception and production.

Concerning the perception and production of consonants, the study by Bradlow, Akahame-Yamada, Pisoni, & Tohkura (1999), who investigated the English liquids /r/ and /l/ by 23 native speakers of Japanese, aged 19 to 22, who had studied English since junior high school from the age of 12 with the aim to see whether training on perception leads to improvement on production, showed a close link between the skills. On the other hand, studies involving Japanese and Korean learners of English as an L2, provide evidence that production precedes perception. For instance, the study by Sheldon & Strange (1982), cited in Flege (1999), who investigated advanced Japanese speakers of English living in the USA in terms of perception and production of the English consonants /r/-/l/ in minimal pairs. Other findings providing evidence that production outperforms perception were reported by Gass (1984), cited in Leather and James (1991), in which participants from different backgrounds following English classes in the United States were tested in terms of VOT three times at monthly

intervals.

Finally, Newman (1998), who examined the English stops /p/-/t/-/k/- /b/ -/d/-/g/ and the English vowels /i/ - /e/ - /æ/ - /u/- /o/- /ɑ/- /ʌ/ in terms of correlations between speech perception and speech production, found that there was a significant relationship between the participants' production and their perception prototypes.

Regarding studies investigating English and Portuguese in terms of perception and production, the study by Rochet (1995), who investigated the role of perception in the phenomenon of foreign accent and the suitability of auditory training for the teaching of L2 pronunciation in terms of perception and production of the English vowels /i/-/ɪ/-/u/ by 10 native speakers of French, 10 Canadian speakers of English and 10 Brazilian speakers of Portuguese, found that there was a good correlation between perception and production, the first taking precedence over the second.

As regards production, the study by Baptista and Silva Filho (1997) investigated the production of English word-final consonants by 06 Brazilian EFL learners, 03 males and 03 females, in terms of the influence of voicing markedness and of universals of cross-syllable. Participants, aged 19 to 29, native speakers of Portuguese who were attending classes at the undergraduate program of English at Universidade Federal de Santa Catarina (UFSC) at the time of testing, performed a reading test of 432 sentences containing monosyllabic words ending in a single consonant. Results showed that a) participants produced more epenthesis after voiced consonants than after voiceless consonants, and b) degree of sonority and environment influenced production, leading

to the conclusion that frequency of epenthesis in different contexts depends on markedness and phonotatic universals.

On the same hand, the study by Koerich (2002), who investigated the occurrence of vowel epenthesis in word-final consonant codas by 71 Brazilian learners of English, aged 17 to 46 years old, and perception and production, which were assessed in terms of 1) voicing of the target consonant; 2) sonority relations across syllables; and 3) in general terms to establish the degree of association between the abilities, found more epenthesis after voiced contexts than voiceless ones, along with statistically significant results for the link between the two abilities.

Similarly, Silveira (2004), who investigated perception and production of word final consonants in terms of influence of production instruction with 22 beginner Brazilian English speakers - 10 for the control group and 12 for the experimental group, provided evidences which are relevant to the present study. The hypotheses were investigated, among other variables, in terms of different preceding contexts such as voiced and voiceless. The author found that a) the experimental group produced more epenthesis after voiced contexts than after voiceless contexts; and b) there was significant correlation between the perception and production post tests

Finally, Rauber, Escudero, Bion and Baptista (2005), who ivestigated the contrast between the English vowels pairs /i/ - /ɪ/, /ɪ/ - /eɪ/, /ɛ/ - /æ/, /u/ - /ʊ/, /ɔ/ - /ɑ/, /ʊ/ - /ʌ/, /ʊ/ - /oʊ/, and /ʌ/ - /ɑ/, by highly proficient Braziliann EFL speakers, found that lack of accurate production is related to lack of accurate perception, giving evidence for a relationship between perception and production, and the study by Bion, Escudero, Rauber, and Baptista (2006), who

examined the perception and production of English vowels by 17 proficient Brazilian speakers of English as an L2, 13 women and 4 men, aged 18 to 32, and 6 native speakers of English, and found that a strong relationship between perception and production, the first preceding the second.

Concerning research investigating English and Portuguese in terms of the -ed inflectional ending, some studies are reviewed bellow:

Pereira (1994) investigated the *-ed* ending of regular verbs in the past tense and of *-s* with present tense verbs in the third person singular and plural nouns by 40 Brazilian Portuguese learners of English as a second language - 20 beginners and 20 advanced learners - in terms of epenthesis production. Results demonstrated that the advanced group showed a more accurate production of the *-s* and *-ed* sounds than the beginners. According to her, the strategy that L2 learners used was to split the cluster by inserting an epenthetic vowel /ɪ/ or /ə/, thus producing a new syllable, or by palatalizing the final alveolar stops /t/ and /d/ and inserting a following /i/. The conclusions of the study were that a) L1 interferes in the production of *-s* and *-ed* endings in the L2, b) more proficient learners tend to suffer less influence of the L1 than beginners; c) lack of instruction and/or orthographic input seems to have an effect in the production of the target sound, especially with past tense verbs.

Alves (2004) studied the role of explicit instruction in terms of the production of *-ed ending* regular verbs by 07 beginning Brazilian Portuguese learners of English as a second language attending undergraduate English classes at Universidade Federal de Pelotas by an analysis via Optimality Theory (Prince & Smolensky - 1993). Data gathering material was obtained by a) a free speech task, b) a text reading task, and c) a sentence reading task. Participants were tested three times, once before receiving

instruction and twice after receiving instruction. Results showed that instruction plays a role on the production of the target sound, indicating that instruction allowed the formation of a new underlying representation of the consonant clusters investigated in the study.

Delatorre (2004) investigated initial /s/ clusters, single consonants in final position and final consonant clusters in terms of epenthesis production by 06 Brazilian teachers of English, who were considered as being highly proficient speakers of the target language. Data material for the analysis of the participants' production performance was a free speech test obtained by the recording of their classes and the transcription of the regular verbs by the researcher. Results showed a) a low rate of epenthesis production of *-ed* after single consonants in final position (7.05%), b) greater epenthesis production for final clusters (23.55%), and c) high epenthesis production for initial /s/ clusters (66.00%). According to Delatorre, results for epenthesis production in *-ed* might have been influenced by individual differences, because while one of the participants produced epenthesis in all contexts, another produced epenthesis only with the verb *studied*, suggesting that environment played a role.

Delatorre (2005) explored the production of epenthesis with simple past tense regular verbs in terms of the influence of the preceding context in the production of vowel epenthesis in *-ed*, the influence of orthography and influence of task in the production of epenthesis, by 09 intermediate students of English as a second language, 04 males and 05 females, aged 18 to 31, who were attending classes at the Extracurricular Language Program of Universidade Federal de Santa Catarina (UFSC) and had approximately 225 hours of instruction. Participants performed a reading test in which they had to read 10 paragraphs containing 819 words ending in *-ed* and 53 words

with homophonic endings[2], and a free speaking test in which they had to report on a car accident from a sequence of pictures. Results showed a high rate of epenthesis of the reading test and a lower rate for the free speaking test.

Delatorre (2006) investigated the production of medial vowel epenthesis[3] on English words ending in *-ed* in terms of a) the influence of markedness based on the Markedness Differential Hypothesis (MDH), b) the influence of the preceding phonological environment on the process of vowel insertion, c) the influence of orthography, and d) the influence of formality in terms of reading versus free speech. Participants were 26 Brazilian learners of English as a second language, 11 males and 15 females with ages ranging from 15 to 68 years old, who had received about 270 hours of instruction at the time of testing. The participants performed two tests; a paragraph reading test and a free speech task. In the former, participants read a list of monosyllabic regular verbs in the past, past participle or adjectives, and *contrastive words*, which present the same pronunciation as the words ending in *-ed*, and in the latter, participants were given four pictures in which their task was to create a story based on them. The pictures elicited the target verbs. Results demonstrated that markedness in terms of voicing does not seem to influence the production of epenthesis, rather the influence of sonority, the least sonorous/higher consonantal strength induced more epenthesis production, and that phonological environment and orthography do play a role in the production of words ending in *-ed*, as predicted.

Although the studies by Pereira (1994), Alves (2004), and Delatorre (2004, 2005, 2006) have dealt with the investigation of the *-ed* inflectional ending, none of

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[2] Delatorre (2006) defines *homophonic endings* words in which final clusters or the rhyme have the same pronunciation of words ending in *-ed.*

[3] Delatorre (2006) defines medial vowel epenthesis as the term used for vowels that split the final

them investigated the sound in terms of relationship between speech perception and speech production.

2.10 Conclusion

This chapter aimed at reviewing the theoretical and empirical literature which might be relevant to set the group for the hypotheses formulated in Chapter 3, thus going through universal, AE and BP syllable structures, markedness and sonority relations, environment in which the study was carried out, and finally, perceptual models and empirical evidence which might be related to the study.

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cluster in the pronunciation of *-ed* endings.

CHAPTER 3

METHOD

3.1 Introduction

This chapter aims at presenting the research questions and hypotheses stated for the present study, the participants' profile, the data gathering material used for the experiment, the procedures adopted in the tests, and the statistical choices for the data analysis.

3.2 Research Questions and Hypotheses

According to the objectives of this study, and based on theoretical and empirical research from previous literature in the area of Second Language Acquisition (SLA), along with my experience as an EFL teacher and learner, the research questions and hypotheses were stated as follows:

Research Question 1 – How do the perception and production of the *-ed* ending by Brazilian EFL learners relate?

Hypothesis 1 – There is a positive relationship between the perception and production of the -e*d* ending by Brazilian EFL learners.

Research Question 2 – How does the perception of the three pronunciations of the *–ed* ending by Brazilian EFL learners compare?

Hypothesis 2 – The mean for the correct perception of /ɪd/ is significantly higher than

those for /t/ and /d/.

Hypothesis 3 – The mean for the correct perception of /t/ is significantly higher than that for /d/.

Research Question 3 – How does the production of the three pronunciations of the –*ed* ending by Brazilian EFL learners compare?

Hypothesis 4 – The mean for the correct production of /ɪd/ is significantly higher than those for /t/ and /d/.

Hypothesis 5 – The mean for the correct production of /t/ is significantly higher than that for /d/.

3.3 Participants

Thirty-two Brazilian students were tested: 19 males and 13 females, with ages ranging from 18 to 29 years (M = 21 years). All participants were attending advanced English classes in the extracurricular course[4] at Universidade Federal de Santa Catarina (UFSC). All of them had English classes in elementary and high school, with around 400 hours of classes in which, according to them, listening, speaking, reading and writing skills were developed, with an emphasis on reading and writing. Besides that, they also attended from 100 to 300 hours of classes in private language schools before

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[4] The Extracurricular Course is an extension project of the Departamento de Língua e Literatura Estrangeiras at Universidade Federal de Santa Catarina.

studying in the extracurricular course, giving them a total of around 400 to 500 hours of instruction at the time the data was collected.

Participants started studying English at the age of 8 to 12. Twenty-three of them had never been to an English speaking country and rarely spoke English out of classroom. Twenty-nine of the participants said they almost never watched movies in English without subtitles or listened to music paying attention to the lyrics. Twenty-six participants had never learned other languages besides Portuguese and English. Twenty-six of the participants did not have a family member who could speak English.

To conclude, the investigated participants formed a reasonably homogeneous group in terms of age, hours of instruction, the age they started learning English (AOL, according to Flege, 1995), foreign language contact in the classes, with the family and friends, time spent abroad, and interest in developing their English language skills through music or movies.

3.4 Materials

The data collection instruments designed for the investigation, were a participants' background questionnaire, a production test, a perception test for the training session, and a perception test.

The questionnaire (Appendix F), presented and answered in English, consisted of 35 questions aiming at getting the participants' biographical information which was expected to contribute to the analysis and interpretation of the results. In this questionnaire, it was possible to assess information such as the participants' age, sex, place of origin, hours of instruction in regular schools and in language schools, age of

onset of studying English, experience abroad, contact with L2 out of the classroom with native and nonnative speakers, interest in songs and movies in the L2, and relevant contact in the language with family members and friends.

The production test consisted of forty-eight carrier phrases (Appendix G). Twenty-four phrases included *-ed* ending words, such as *"stopped you"* and *"robbed you"*. Other 24 phrases consisted of distractors, that is, phrases where there were no *-ed* ending words, which were included to deviate attention from the objective of the investigation. Phrases such as *"take you"* and *"knows you"* were distractors. The original idea of the researcher was to have participants produce the target sounds in free speech, since that is the way languages are naturally produced in the world; however, as it is frequently mentioned in the literature, it is very difficult to get participants to produce the target sounds in the phonological environments intended, so experiments have to use structured data collection instruments (Bachman, & Palmer, 1996; Ellis, 1986).

In order to ensure that the participants would produce the target sounds as close to free speech as possible, the instructions were presented on the computer screen as follows: *"Use the information given and create sentences. For example: 1) loves you – possible sentence: I know she loves you a lot*; *2) called you – possible sentence: I called you last night, but you weren't at home"*. It is believed that the sentences produced by the participants can be considered as being close to free speech in that the participants had to elaborate on the input given and create a message organizing the idea in their own words. Evidence for the elaboration was provided by the time span of about 2 to 5 seconds between reading the phrases and the production of sentences.

The phonological environment before and after *-ed* endings was controlled by means of selecting words in which the final consonant was /p, t, k, b, d, g/, followed

by the glide /ʲ/ as in the phrases "*stopped you*", *spotted you*", "*locked you*", "*robbed you*", "*godded you*", and "*hugged you*", respectively (Appendix I).

Although some of the carrier phrases involved words that were not expected to be in the participants lexicon, as for example, *"dobbed you"*, *"mobbed you"*, and *"prodded you"*, the researcher dealt strategically with these cases, explaining the problematic verbs to the participants and giving them the synonyms, so that none of the participants demonstrated difficulty when creating the sentences.

The data obtained from the 24 verbs chosen comprised a) 8 productions of /t/; b) 8 productions of /d/; and c) 8 productions of /ɪd/. per participant, giving a total of 768 productions of *-ed* endings – 256 productions of each of the three *-ed* endings from the 32 participants.

The perception test (Appendix D), with the duration of 15 minutes, plus a one-minute break in the middle, was designed with the objective of getting data about the participants' ability to discriminate the three different pronunciations of *–ed* endings. The test followed the design and procedures of the Categorial Discrimination Test (CDT) elaborated by Flege (1999), which consists of trials of the target sound, being realized by three different speakers in order to get participants to ignore acoustic variations, in which the participants' task is to check the odd item out. Specifically, participants listen to the input trials in order to check whether a) the first realization is different from the other two; b) the second realization is different from the other two; c) the third realization is different from the other two; or d) the three realizations are the same. Trials type a, b, and c are called *different trials*. Trials type d, in which the three realizations are equal, with no odd item, are called *catch trials*. The following are

transcriptions of a *different trial* and a *catch trial*:

a) /aɪ/ /stɑːpt/ /ʲuː/   b) /aɪ/ /stɑːpt/ /ʲuː/   c) /aɪ/ /stɑːpɪd/ /ʲuː/

a) /aɪ/ /stɑːpt/ /ʲuː/   b) /aɪ/ /stɑːpt/ /ʲuː/   c) /aɪ/ /stɑːpt/ /ʲuː/

In applying the original CTD, Koerich (2002) added *distractor trials*, trials in which the contrast is not set in terms of the target, but in a different sound. As mentioned before, distractors are included in order to try to divert participants' attention from the objective of the test.

It was decided not to include distractor trials in the test designed for the present study, since a lengthy test could affect the results in the sense that the participants would become too tired and would eventually lose concentration when performing the task. The lack of distractors did not seem to have allowed the students to realize the purpose of the test, since when asked whether they could identify its purpose, none of the participants answered that the test was measuring the perception of *-ed*.

Therefore, the test used in this research was similar to Flege (1999) and Koerich (2002) in that it followed the bases of those; however, in terms of scoring, it was different, since it was decided not to use the A' scoring procedure, the procedure used in both. Flege (1999) suggests that the A'[5] scoring procedure accounts for controlling the guessing rates and provides a more precise perceptual sensitivity assessment. The decision to apply a measure in the computation of the results in the present study was due to statistical choices. A' scores work with percentages, and the statistics for this study work with comparisons of means for the perception and the production of the three possible realizations of the *-ed* endings, and with the correlation of total

perception and production (see section 3.1), thus it was necessary to have interval or ordinal variables instead of percentages (SPSS for Windows 10.0, help menu).

Only the correct items in the different trials were considered in the computation of the results. The reliability of the scoring procedure chosen was guaranteed by the fact that the participants' individual scores in the catch trials were very close to 100% of correctness. Thus, it was reasoned that since the guessing rate in the catch trials was very low, the same would happen in the different trials. For this reason the scores in the different trials were considered as representing the participants' real sensitivity to discriminate the *-ed* endings.

The phrases below were used in the test. These phrases were selected for the following reasons: a) to control for the phonological environment before the target sound; b) to compare the perception of the different realizations of *-ed* endings following the same environment; c) to control for the environment following the target sound; and d) to compare the perception and production of the target sound before and after the same environment.

Sentences used in the perception test

Sentences	Realization with /t/	Realization with /d/	Realization with /ɪd/
I stopped you	/aɪ ˌstɑːpt ˌjuː/	/aɪ ˌstɑːpd ˌjuː/	/aɪ ˌstɑːpɪd ˌjuː/
I spotted you	/aɪ ˌspɑːtt ˌjuː/	/aɪ ˌspɑːtd ˌjuː/	/aɪ ˌspɑːtɪd ˌjuː/
I rocked you	/aɪ ˌrɑːkt ˌjuː/	/aɪ ˌrɑːkd ˌjuː/	/aɪ ˌrɑːkɪd ˌjuː/
I robbed you	/aɪ ˌrɑːbt ˌjuː/	/aɪ ˌrɑːbd ˌjuː/	/aɪ ˌrɑːbɪd ˌjuː/
I godded you	/aɪ ˌgɑːdt ˌjuː/	/aɪ ˌgɑːdd ˌjuː/	/aɪ ˌgɑːdɪd ˌjuː/
I logged you	/aɪ ˌlɑːgt ˌjuː/	/aɪ ˌlɑːgd ˌjuː/	/aɪ ˌlɑːgɪd ˌjuː/

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[5] For a better description of the CTD and A' scores, see Koerich (2002).

The test assessed the participants' ability to discriminate: a) /t/ from /d/; b) /t/ from /ɪd/; and c) /d/ from /ɪd/, as well as their ability to perceive when the three realizations were equal. There were 24 trials for each of the 6 verbs, which gives a total of 144 trials, from which 108 were different trials and 36 were catch trials. Appendix E shows the possible combinations for one of the verbs, in which 6 of the 24 trials were catch trials and the other 18 were different trials. In the following example, the first three trials are different trials, whereas the fourth is a catch trial. The order of trials was randomized for presentation.

/aɪ.stɑːpt. ʲuː/	/aɪ.stɑːpɪd. ʲuː/	/aɪ.stɑːpɪd. ʲuː/
/aɪ.stɑːpɪd. ʲuː/	/aɪ.stɑːpt. ʲuː/	/aɪ.stɑːpɪd. ʲuː/
/aɪ.stɑːpɪd.ʲuː/	/aɪ.stɑːpɪd. ʲuː/	/aɪ.stɑːpt. ʲuː/
/aɪ.stɑːpɪd.ʲuː/	/aɪ.stɑːpɪd. ʲuː/	/aɪ.stɑːpɪd.ʲuː/

The realizations of –ed in some trials, as for instance, in /stɑːpd/, /spɑːtt/, /rɑːbt/, and /stɑːpɪd/ do not occur in English. In the case of the first three realizations, although naturally impossible, they were included in order to check the participants' ability to discriminate the three –ed endings, one in relation to the other. The rationale for including trials in which the -ed is produced with an epenthetic vowel is that this is a common strategy employed by Brazilian learners of English to solve the problem of consonant clusters (Baptista & Silva Filho, 1997; Delatorre, 2005, 2006; Koerich, 2002).

The native speakers who recorded the input for the perception test had difficulties in producing the final -ed as in the disallowed realizations mentioned above and were asked to realize them either with a pause, as for instance in /aɪ ̩ stɑːp d ̩ ʲuː/, or with a glottal stop, as for instance in /aɪ ̩ rɑːkʔd ̩ ʲuː/ (Appendix K). These samples were, then, treated with the help of the software Praat in order to remove the pause and the glottal stop, thus resulting in the disallowed clusters. The sentences, designed so that the researcher could control for important variables such as phonological environment and type of –ed pronunciation, were then presented to 3 native speakers to indicate whether the -ed ending was produced as /pt/, /pd/ or /pɪd/. The native speakers reported that in order to discriminate which type of -ed was being realized they had to pay close attention to the realization, thus indicating that participants who would be able to do well in the test would show a high sensitivity in discriminating the -ed inflectional ending.

Before the participants performed the perception test, a training session (Appendices A and B) was conducted to make sure that they had understood the task. The training material consisted of the following instructions: *"You are going to hear sets of 3 phrases as 'I helped you' or 'I loved you'. If the first phrase is pronounced differently, check 'a', if the second phrase is pronounced differently, check 'b', if the third phrase is pronounced differently, check 'c', if all phrases are pronounced the same, check 'd'."* The trials of the training session and the answer grid were as follows:

Training session stimuli and answer grid

Sentences		Trials	
I helped you	/aɪ ̩ helpɪd ̩ ʲuː/	/aɪ ̩ helpt ̩ ʲuː/	/aɪ ̩ helpt ̩ ʲuː/

I helped you	/aɪ ˌhelpt ˌʲuː/	/aɪ ˌhelpɪd ˌʲuː/	/aɪ ˌhelpt ˌʲuː/
I helped you	/aɪ ˌhelpt ˌʲuː/	/aɪ ˌhelpt ˌʲuː/	/aɪ ˌhelpɪd ˌʲuː/
I helped you	/aɪ ˌhelpt ˌʲuː/	/aɪ ˌhelpt ˌʲuː/	/aɪ ˌhelpt ˌʲuː/

1	**a**	b	c	d
2	a	**b**	c	d
3	a	b	**c**	d
4	a	b	c	**d**

3.5 Procedures

The procedures adopted for the data collection were carried out in the following order: a) contact with participants and scheduling of the tests; b) application of the questionnaire; c) application of the production test; d) application of the perception test; e) analysis of the production test with Praat and scoring (Appendix H); f) analysis of the production test by native speakers and scoring (Appendices I and J); g) scoring of the perception test; and h) running the statistical tests (see section 3.5).

Before starting the data collection, the researcher met the participants in their classroom in order to invite them to participate in the test giving general information about the activities for data collection. The participants were paid for their contribution.

The questionnaire and the production test were administered in individual sessions in a quiet room at UFSC. The completion of the questionnaire took about five to ten minutes and it worked as an ice-breaker, before the application of the test. Participants were free to take a short break between the questionnaire and the production test.

The production test included the following steps: First, participants were asked

to sit in front of the computer screen where the Power Point file prepared for the test was already open. Secondly, participants were told to read the information displayed on the computer screen (see Section 3.3 and Appendix G) and ask any questions they had. The input displayed on the computer screen consisted of the carrier phrases (see Section 3.3), presented one at a time, and the participant himself could control when each phrase was to be displayed by pressing the enter key on the keyboard. There was no time limit for the participants to produce the sentences. If a participant changed the form of the verb presented in the input, the researcher asked him to create a sentence using the verb as it was being presented on the screen. For instance, if the input was *"take you"* and the participant created a sentence like *"she takes you where she wants"*, s/he was asked to create a new sentence using the verb as it was presented. The participants' performance was recorded with the help of a digital record player, saved in a pen drive in waveform format files, and later analyzed with the help of Praat. When a participant finished the test, s/he was asked if s/he could guess what the test was about. Some of the participants said it was about third person singular, indicating that the distractors included in the test had fulfilled their function properly.

The perception test was administered in the foreign language laboratory at UFSC during class time. Participants performed the test altogether in the same session. First, they were informed that they would undergo a training session before performing the test. The instructions and the stimuli of the training session were recorded by the same native speakers who recorded the stimuli of the test. After the instructions were given and the training session was performed, participants were asked if they had any questions about the procedures and test format. None of the participants had doubts after the training session. Second, they were told that the test was going to last 15 min

and that there was going to be a break of one minute in the middle of the session. Then, they were given the answer sheet and took the test. When they finished the test, they were asked if they knew what the test was about and none of them could guess the objective of the test.

After the data were collected, as presented above, the participants' performance on both tests were analyzed. For the production test the participants were scored by means of computer analysis (Praat, see Appendix H) and native speakers' analysis, whereas for the perception test, the researcher scored the participants' performance in terms of correct discrimination of the target sounds.

The analysis and scoring of the production test involved the following steps: a) a computer analysis of the participants' productions verifying whether in the pronunciation of the *-ed* endings (/t/, /d/, /ɪd/) the software could detect epenthesis in the case of the first two targets, that is, mispronunciations such as /aɪ ˌtɪpɪd ˈjuː/ ˌ for *"I tipped you"*, and epenthesis in the case of the third target, that is, correct pronunciation as, for instance, the realization of the sentence *"I godded you"* as /aɪ ˌgɑːdɪd ˈjuː/; b) the native speakers' analysis of the participants' productions, which was considered crucial, since the context of investigation is that of foreign language learners seeking to be able to interact with L2 speakers.

The native speakers were given instructions on what they should pay attention to, that is, to the correct pronunciation of the target sound. In order to facilitate the judgments the verbs were edited out from the carrier sentence and saved in waveform files in WAV format and burned into a CD (Appendix J). The native speakers' task was to listen to the target verbs and check "a" for correct pronunciation and "b" for incorrect

pronunciation in an answer sheet (Appendix I).

A comparison between the computer scores (obtained with Praat) and the judgment scores showed the rate of agreement of almost 100%. In the native speakers' judgments the criterion was agreement between two of the three judges. As for the perception test, the researcher scored the participants' performance by tallying their correct answers in the different trials.

Finally, after obtaining the scores for the participants' performance in both the perception and the production tests, the data were tabulated and organized for running the appropriate statistical tests in a way that the results would provide information to answer and discuss the research questions and hypotheses of the study.

3.6 Data Analysis

The comparison between the results of the computer analysis and the native speakers' judgments showed 98,31% of agreement, thus only the native speakers' judgment was considered in the study, because it was reasoned that it is a more appropriate measure than a computer analysis, since, as mentioned above, the context of investigation triggering this study was that of foreign language learners seeking to be able to interact with other speakers of the language.

The statistical procedures to investigate the research questions and hypotheses of this study were performed with the Statistical Package for Social Sciences (SPSS) for Windows (version 10.0). The data were analyzed quantitatively, that is, participants' scores in both the perception and production tests were analyzed in terms of correct answers.

Before running the tests, the descriptive statistics for each variable were run to check whether the variables were normally distributed. The analysis indicated that there was not a normal distribution for the production variables /t/, /d/, and /ɪd/, probably because of the small range of scores, from 0 to 8, associated with the small sample size.

Based on the lack of normal distribution for the production variables, the following four types of statistical tests were used to investigate the hypotheses: a) a Pearson Correlation test, to investigate the relationship between overall perception and production; b) several Spearman rho correlations, the non-parametric alternative for Pearson, which was used to correlate pairs of -ed ending types due to the normal distribution problems with the production variables; c) a Repeated-Measures ANOVA (with Bonferroni tests for pair-wise comparisons), a parametric test used to compare variables with more than two levels, which was used to compare the perception test means for the three –ed endings; and d) a Friedman test (with Wicoxon tests for pair-wise comparisons), a non-parametric alternative for the Repeated-Measures ANOVA, which was used with the production variables (not normally distributed). The data were analyzed in terms of significance and the results, having in mind the stated hypotheses, will be presented in the Results and Discussion Chapter.

The statistical significance level for this study was set at .05 in the analyses.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results of the data analysis of the perception and production tests carried out to investigate the relationship between perception and production of the –*ed* ending by Brazilian EFL learners. The results are presented according to the research questions and hypotheses set in the Method Chapter, referring both to theory and to empirical studies reviewed in Chapter 2. In order to facilitate the discussion in terms of analogies with previous research concerning -*ed* endings, and to organize the presentation of the results of this study, each of the hypotheses is presented and discussed separately, after presenting the overall results found in the perception and production tests.

4.2 Overall Results of the Perception and Production Tests

As mentioned previously, in order to investigate the hypotheses stated in Chapter 3, different statistical tests were run to verify whether or not the predictions made by the researcher were confirmed (see Chapter 3).

Table 4.1 shows the participants' scores in both the perception and the production tests in terms of correct answers in discriminating and producing the three -

ed ending types, besides the minimum and maximum scores, means and standard

deviation, as well as the percentages computed for that.

Table 4.1
Perception and Production tests scores

Participants	Perception Test				Production Test			
	/t/	/d/	/ɪd/	total	/t/	/d/	/ɪd/	total
1	26	22	30	78	2	0	8	10
2	31	30	33	94	8	7	8	23
3	21	17	24	62	0	0	7	7
4	24	18	25	67	0	0	8	8
5	29	24	30	83	8	0	8	16
6	28	22	29	79	7	4	3	14
7	25	22	26	73	2	0	7	9
8	23	24	31	78	2	0	8	10
9	33	30	34	97	8	8	8	24
10	25	21	26	72	0	0	8	8
11	18	13	20	51	0	0	6	6
12	24	18	25	67	0	0	8	8
13	31	24	32	87	8	1	8	17
14	29	24	30	83	5	1	8	14
15	27	24	28	79	6	0	8	14
16	26	20	27	73	1	0	8	9
17	30	23	31	84	5	4	8	17
18	29	23	30	82	2	4	8	14
19	23	16	26	65	0	0	8	8
20	29	28	30	87	8	7	4	19
21	27	18	30	75	1	0	8	9
22	31	27	32	90	8	6	8	22
23	26	24	33	83	4	4	8	16
24	21	15	27	63	0	0	8	8
25	23	19	33	75	1	0	8	9
26	27	24	28	79	3	2	5	10
27	25	20	26	71	0	0	8	8
28	28	26	29	83	8	0	8	16
29	28	24	29	81	5	1	8	14
30	22	18	23	63	0	0	8	8
31	29	26	31	86	7	3	8	18
32	28	21	29	78	0	2	8	10
Total	846	705	917	2468	109	54	240	403
Max.	33	30	34	97	8	8	8	24
Min.	18	13	20	51	0	0	3	3
Sd	3,44	4,13	3,24	10,04	3,26	2,48	1,24	5,02
Mean	26,44	22,03	28,66	77,13	3,41	1,69	7,50	12,59
%	73,44%	61,19%	79,61%	71,42%	42,63%	21,13%	93,75%	52,46%

The percentages represent the participants' correct scores in each variable.

The results show that a) the participants' overall performance on the perception

test was much better than their performance in the production test (71.42% versus

52.46%); b) the participants' performance in the discrimination of each of the three –*ed*

endings varied from 61.19%, to 73.44%, and then to 79.61%, for /d/, /t/ and /ɪd/,

respectively; and c) the participants' performance in the production of each of the three

-*ed* endings varied from 21,13%, to 42,63%, and then to 93,75%, for /d/, /t/ and /ɪd/,

respectively. The tendency indicated by the percentages is also confirmed by the means

that are also displayed in Table 4.1.

Thus, the overall results for the perception and production tests show that the

participants' performance is different in terms of perception and production, but that for

both tests, a similar pattern is found regarding each of the three –ed endings. Still, due

to differences in score points for the perception and the production test, the results

presented above only take into account the participants' scores in terms of percentages.

In the following sections each of the hypotheses raised in this study will be discussed

separately, departing from the results obtained trough the statistical analysis.

4.3 The Relationship between Perception and Production – HYPOTHESIS 1

Hypothesis 1 predicted that the overall perception and production of the -*ed*

endings would correlate positively. As mentioned in the review of the literature, studies

investigating the relationship between perception and production have pointed to

different directions, that is, the literature shows lack of agreement about whether

perception precedes production or whether production precedes perception, but a great

deal of studies show, at least, low or modest correlations between the two skills (Bohn

& Flege, 1989). Table 4.2 shows the statistical results obtained for the correlation between the total perception and production of the –ed ending. As can be seen, there was a highly significant positive relationship between the participants' overall performance in perceiving and producing the -ed endings r(32) = .90, p < .01. This means that the participants who had better scores in the perception test, had better scores in the production test, and the ones who had lower scores in the perception test, had lower scores in the production test.

Table 4.2
Correlation between perception and production

	/t/	/d/	/ɪd/	-ed total
Participants	32	32	32	32
Correlation	.83 (.0001)	.68 (.0001)	.30 (.086)	.90 (.0001)

For the column '-ed,' was run a Pearson correlation, and for the other columns, a non-parametric Spearman' correlation was used

In order to go deeper into the highly significant positive correlation presented above, individual correlations between the perception and production of each of the three -ed ending types were run, as can be seen in Table 4.2.

Regarding the correlations between perception and production for each of the three types of -ed endings, the results demonstrate a positive and highly significant correlation for /t/ (r(32) = .83, p < .01), a positive and highly significant, although moderate, correlation for /d/ (r(32) = .68, p < .01), and finally, a positive but weak correlation, which failed to reach statistical significance for /ɪd/ (r(32) = .30, p = .08). The findings obtained in the correlation of /ɪd/ corroborate the results found in the

correlations of /t/ and /d/, thus confirming the overall correlation of the *-ed* ending.

Nevertheless, the correlation coefficient obtained here indicates that the relationship between perception and production is less consistent with this *-ed* ending type. This lack of consistency may be due to a) possible maximum score allowed by the design of the test, that is, even though the correlations for /t/ and /d/ were statistically higher than that for /ɪd/, all three *-ed* ending types were not normally distributed, which might have been caused by the small range of minimum and maximum scores; and b) degree of difficulty, since the literature shows that the CVC syllable structure is easier for Brazilians to perform than VCC syllable structure (Carlisle, 1994).

The findings of the correlations between the participants' performance in perceiving and producing the target sounds offer evidence for analogies with the previous literature in terms of a) theory - the Speech Learning Model (Flege, 1995); b) empirical studies – effect of the phonological environment studied with vowels and consonants; and c) the question of which skill precedes the other, as mentioned above.

Regarding theory, the Speech Learning Model predicts that production eventually corresponds to properties specified in the phonetic category representation, implying a relationship between perception and production in which the development of the latter is preceded by the development of the former skill. In this sense, the findings of the present study can be seen as relevant empirical evidence giving support to his prediction, since the results show statistically significant correlation not only for the total *-ed* ending, but also for the correlation between perception and production of each of the *-ed* ending types (/t/, /d/, and /ɪd/), although the correlation for /ɪd/ is considered less consistent, as seen in Table 4.2.

Concerning empirical studies about the effect of the phonological environment investigating vowels and consonants, it can be stated that the results found in this study corroborate the ones found in Rebello (1997), Batista and Silva Filho (1997), and Delatorre (2004, 2005, 2006), which showed evidence for the influence of the preceding environment. Participants' performance in the perception and production tests was better after /t, d/ than after /p, b, k, g/, that is, results for the perception and production of the /ɪd/ -ed ending type, which occurs after the /t, d/ environment, was better than those for the perception and production of the /t/ and /d/ -ed ending types, which occur after the /p, k/ and /b, g/ environments, respectively.

In regard to the relationship between perception and production, the findings of this study corroborate several studies involving vowels For example, it corroborates the results of a) Bohn and Flege (1989) and Flege (1993), who found modest, but positive correlation between perception and production; and b) Newman (1998), Rochet (1995), and Flege, Bohn and Jang (1997), who found a strong correlation between perception and production.

Finally, going back to the question presented in the beginning of this discussion, that is, whether perception precedes production or production precedes perception, it would be possible to claim that perception precedes production for the following reason. As shown in Table 4.1, participants' performance in the production test ranged from 3 to 24, with a mean of 12.59, and 52,46% of correct production, whereas in the perception test, the results ranged from 51 to 97, with a mean of 77.13, thus representing 71,42% of correct perception. Therefore, if it is assumed that the perception skill is more developed, or was developed first, that is, it is possible to argue that the results here

show that perception precedes production.

In summary, the results of the present investigation confirm the hypothesis that there is a positive relationship between perception and production of the *-ed* ending, suggesting that the former precedes the latter.

4.4 The Perception of /ɪd/ versus /t/ and /d/ – HYPOTHESIS 2

Hypothesis 2 predicted that participants' perception of the *-ed* ending pronounced as /ɪd/ would be significantly better than of /t/ and /d/**.**

The results of a Repeated-Measures ANOVA (Table 4.3) confirmed that type of *-ed* ending plays a role regarding perception ($F(2,62) = 126.584$, $p < .01$). The multiple comparisons showed that the mean for /ɪd/ was significantly higher than those for /t/ (mean difference = 2.219, $p < .01$)   and /d/ (mean difference = 6.62, $p < .01$). In other words, the participants' performance in perceiving /ɪd/ was better than in perceiving /t/ and /d/**.**

Table 4.3
Repeated-Measures ANOVA comparing the perception test means for each –ed ending type.

/t/ vs. /d/ vs. /ɪd/	/t/ vs. /d/	/t/ vs. /ɪd/	/d/ vs. /ɪd/
F = 126.584	md = 4.406	md = -2.219	md = -6.625
p = .0001	p = .0001	p = .0001	p = .0001

Bonferoni tests were used for pair-wise comparisons.
md: mean difference.

This finding can be related to a) Carlisle's (1994) study; b) the syllable

structure differences between AE and BP; and c) Eckman's (1991) Markedness Differential Hypothesis, as discussed below.

Regarding Carlisle's (1994) study, the findings presented for this hypothesis corroborate what the author stated in terms of preference for less marked syllable structures, in this case the CVC structure over the VCC syllable structure.

Similarly, as regards the differences between the syllable structures of English and Brazilian Portuguese (see Chapter 2), the results of this study can be related to Brazilian Portuguese speakers' preference for the VC syllable pattern, since they both perceived and produced the /ɪd/ ending more successfully than the /t/ and /d/ endings.

In this sense, the present findings are again empirical evidence for what is predicted in the theory, that is, there is the preference for the realization of simpler syllable structures over more complex syllable structures.

Finally, the findings of the present study get theoretical support from Eckman's (1977, 1987) Markedness Relations Hypothesis, which predicts that L2 structures which are different and more marked than L1 structures are more difficult to be realized. The results here showed that the realization of /ɪd/ was preferred over the realization of /t/ and /d/, which provides empirical evidence for the author's theoretical predictions.

Furthermore, the results obtained here corroborate previous empirical studies, such as the study by Baptista (2001), who claimed that the realization of the *-ed* ending is a problem for Brazilian EFL learners, since Brazilian Portuguese does not allow for the realization of consonant clusters in syllable final position, as mentioned in Chapter 1. This claim leads to the conclusion that the participants would better discriminate /ɪd/ than /t/ and /d/, thus being evidence for Brazilian Portuguese learners' greater difficulty

in realizing /t/ and /d/ in relation to /ɪd/.

In summary, the prediction that the participants' perception of the *-ed* ending pronounced as /ɪd/ would be significantly higher than for the endings pronounced as /t/ and /d/ stated in Hypothesis 2, was confirmed.

4.5 The Perception of /t/ versus /d/ – HYPOTHESIS 3

Hypothesis 3 predicted that the participants' perception for the *-ed* ending pronounced as /t/ would be higher than that for /d/, and that this difference would be statistically significant.

Table 4.3 shows that the mean for /t/ is significantly higher than the mean for /d/ (mean difference = 4.406, p < .01). The participants were able to discriminate 73.44% of the *-ed* endings pronounced as /t/ and 61.19% of the ending as /d/, as shown in Table 4.1. These results can be related to a) Eckman's (1977, 1987) Markedness Relations Hypothesis, Selkirk's (1984) Sonority Sequencing Generalization, Hooper's (1976) Hierarchy of Strength; and b) to previous empirical studies – Koerich (2002) and Silveira (2004) as discussed in the following paragraphs.

As mentioned in the review of the literature (see Chapter 2), the results for the perception of /t/, whose mean was found to be higher and statistically significant than for /d/, are supported by the theoretical prediction stated in Eckman's (1977, 1987) Markedness Relations Hypothesis, according to which /d/ would be more difficult to be

perceived than /t/ because the former is more marked than the latter.

Regarding theory related to sonority relations, the present findings can be related to both Hooper's (1976) Hierarchy of Strength and Selkirk's (1984) Sonority Sequencing Generalization. Both authors claim that voiced oral stops are more difficult to be realized than voiceless oral stops. In this study the participants' performance in perception and production was more successful with /t/ than with /d/.

Concerning previous empirical research in terms of the perception of voiced and voiceless oral stops, the results found here corroborate the findings reported by Koerich (2002) and Silveira (2004). Both authors investigated the occurrence of vowel epenthesis in word-final consonant codas in terms of the influence of voicing, among other variables, and found greater occurrence of epenthesis after voiced than after voiceless targets.

In summary, the prediction that the participants' ability to discriminate /t/ would be statistically significant and higher than /d/ was confirmed, as stated in Hypothesis 3, corroborating the theory (Best, 1995; Eckman, 1991; Hooper, 1976; Selkirk, 1984) and previous empirical studies (Koerich, 2002; Silveira, 2004)

4.6 The Production of /ɪd/ versus /t/ and /d/ – HYPOTHESIS 4

Hypothesis 4 predicted that the participants' means for the production of /Id/ would be significantly higher than those for /t/ and /d/.

As the production variables did not satisfy the assumption of normality, a non-parametric ANOVA – Friedman test – was used to verify whether the three means for the *-ed* endings were significantly different; for pair-wise comparisons, multiple Wilcoxon tests were run (see Table 4.4). The overall results indicate a significant difference for the three means (X^2 (2, N = 32) = 40.018, p < .01. The multiple comparisons for the three *-ed* endings show that the mean for /ɪd/ was statistically significant and higher than the means for /t/ (mean difference = 4.09, p < .01)   and /d/ (mean difference = 5.81, p < .01). In other words, participants were able to produce 93.75% of the /ɪd/ *-ed* ending type correctly and 42.63% and 21.13% of the /t/ and /d/ *-ed* ending types, respectively.

Table 4.4
Friedman test comparing the production test means for each –ed ending type.

/t/ vs. /d/ vs. /ɪd/	/t/ vs. /d/	/t/ vs. /ɪd/	/d/ vs. /ɪd/
X^2 = 40.018	md = 1.72	md = -4.09	md = -5.81
p = .0001	p = .001	p = .0001	p = .0001

Wilcoxon tests were used for pair-wise comparisons.
md: mean difference

These results can be related to a) theory – Eckman's (1977, 1987) Markedness Relations Hypothesis, and preference for simpler syllable structures; and b) empirical studies – Baptista (2001) and Delatorre (2006).

Regarding markedness, the results of this study corroborate the prediction stated by Eckman's (1977, 1987) Markedness Relations Hypothesis that more marked sounds are more difficult to be realized than less marked ones. In other words, the results found here give support to the hypothesis showing that /ɪd/ is less marked and therefore easier to be produced than the /t/ and /d/ *-ed* ending types.

Concerning syllable structure, the results found in the present study get support in the preference for the CVC syllable structure over the VCC syllable structure, which is one of the differences between English and Brazilian Portuguese syllable structures (see Chapter 2). In other words, due to the fact that Brazilian EFL learners give preference to the realization of the CV syllable structure, and to the fact that BP does not allow consonant clusters in syllable final position and English does, the production of /ɪd/ is claimed to be better than the productions of /t/ and /d/.

Finally, the present findings corroborate empirical studies such as Baptista (2001) and Delatorre (2006). Baptista reported frequent Brazilian learners' errors, and stated that the *-ed* ending is a problem because Brazilian Portuguese does not have the CVCC structure, tending to insert an extra vowel between the consonant cluster, thus leading to the conclusion that /ɪd/ is much easier to be produced than /t/ and /d/. Similarly, Delatorre (2006), in investigating the *-ed* ending, reported that Brazilians demonstrated greater difficulty in producing /t/ and /d/ than /ɪd/.

In summary, the prediction that the participants' mean of correct production for the /ɪd/ *-ed* ending type would be significantly higher than the means for the /t/ and /d/ endings was confirmed. This prediction, as stated in Hypothesis 4, corroborates previous literature in terms of both theory (Eckman, 1991) and previous empirical evidence (Baptista, 2001; Delatorre, 2006).

4.7 The Production of /t/ versus /d/ – HYPOTHESIS 5

Hypothesis 5 predicted that the participants' perception for the /t/ -ed ending type would be significantly higher than that for /d/.

Table 4.4 shows that the mean for the production of /t/ is significantly higher than the mean for /d/ (mean difference = 1.72, p < .01). In other words, the participants were able to produce 42.63% of the /t/ -ed ending type, and 21.13% of the /d/ -ed ending type correctly. These results can be related to a) theory – Hooper's (1976) Hierarchy of Strength, Selkirk's (1984) Sonority Sequencing Generalization, Eckman's (1977, 1987) Markedness Relations Hypothesis; and b) by previous empirical research – Koerich (2002) and Silveira (2004).

Regarding theory in terms of markedness and sonority relations, the literature claims that voiced oral stops are more marked and therefore more difficult to be produced than voiceless oral stops (Eckman, 1991; Hooper, 1976; Selkirk, 1984). In this sense, the results showing that the participants' ability to produce /t/ better than /d/ can be related to the literature reviewed in Chapter 2, since Hooper (1976) and Selkirk (1984) attribute higher levels of difficulty to /d/ than to /t/, as well as what is predicted by Eckman (1991), when he says that /d/ is more marked and therefore more difficult to be produced than /t/.

Concerning empirical studies, the results found for the production of /t/ and /d/ corroborate the findings reported in Koerich (2002) and Silveira (2004). Both authors investigated the relationship between perception and production in terms of voicing, among other variables, and reported better results for the production of voiceless than to

voiced consonants.

4.8 Conclusion

This chapter aimed at reporting the results found in the present study and it discussed them in relation to both theory and previous empirical studies. All hypotheses were confirmed and supported by the literature, that is; a) a statistically significant and positive relationship between the perception and production of the -e*d* ending was found; b) the mean for the perception of /ɪd/ was significantly higher than those for /t/ and /d/; c) the mean for the perception of /t/ was significantly higher than the mean for /d/; d) the mean for the production of /ɪd/ was significantly higher than those for /t/ and /d/; and e) the mean for the production of /t/ was significantly higher than that for /d/.

Besides that, the results seem to indicate that the perception of the final -*ed* precedes production in the sense that the participants' performance in perceiving the three realizations was better than their production (71.42% and 52.46%, respectively).

CHAPTER 5

CONCLUSION

5.1 Final Remarks

The present study aimed at investigating the relationship between perception and production of the *-ed* inflectional ending by Brazilian advanced EFL learners. Two tests were carried out in order to gather data to examine the hypotheses: a) a perception test, based on the CDT (Flege, 1999), which assessed the participants' ability to discriminate the three *-ed* ending types; and b) a production test, whose purpose was to assess the participants' ability to produce the *-ed* endings. The data was analyzed quantitatively and two types of statistical tests were conducted to verify the predictions stated in the hypotheses: The One-Way Anova, and the Spearman correlation test. The results of this study are summarized below, related to each hypothesis.

Regarding the link between perception and production - Hypothesis 1 – the results showed a highly significant and positive relationship between the two skills not only in terms of overall scores, but also for the /t/ and /d/-*ed* ending types. The results showed evidence for a statistically significant and positive relationship between speech perception and speech production (r(32) = .90, p < .01) not only in terms of the overall comparison, but also for the individual correlations between the perception and production of /t/ (r(32) = .83, p < .01) and of /d/ (r(32) = .68, p < .01). The correlation between the perception and production of /ɪd/, whose results demonstrate a weak, positive relationship, failed to reach statistical significance (r(32) = .30, p = .08).

Concerning the multiple comparisons between the perception of /t/, /d/ and /ɪd/ - Hypothesis 2 and Hypothesis 3 - statistically significant different results were found for each *-ed* type in the following order: /ɪd, /t/and /d/. The results showed that the participants accurately discriminated 79.61% of the /ɪd/ *-ed* ending type, 73.44% of the /t/type, and 61.19% of /d/type. Results for the three *-ed* ending types were statistically significant (p < .05).

In relation to the predictions about the multiple comparisons between the production of /t/, /d/and /ɪd/ - Hypothesis 4 and Hypothesis 5 - both hypotheses were confirmed. The results showed that the participants accurately produced 93.75% of the /ɪd/ *-ed* ending type, 42.63% of the /t/type, and 21.13% of the /d/type, and the differences were statistically significant (p < .05).

Furthermore, the results showed that the participants' performance in the perception test was much better than their performance in the production test, computing 71.42% and 52.46% of accuracy, respectively. Considering these results, it seems reasonable to say that for the advanced learners investigated in the present study, perception of *–ed* was further developed than production, that is, perception preceded production. This finding corroborates previous studies investigating the relationship perception and production with Brazilians (Koerich, 2002; Silveira, 2004). Koerich investigated the relationship between perception and production of word final consonants in terms of voicing, and sonority relations across syllables, and found statistically significant results for the relationship between the two abilities. Similarly, Silveira investigated the relationship between perception and production of word final

consonants and the influence of perception instruction on production, and found that there was a significant correlation between the results of the perception and production post tests.

It is important to highlight that regarding the highly significant results found in the present study, along with inconclusive evidence pointing to different directions in terms of the relationship between perception and production of vowels and consonants, involving participants from different levels of proficiency, besides the fact that literature has presented investigations of different phonological contexts, it is perfectly acceptable to argue that the relationship between perception and production behaves differently depending on variables such as a) type of target sound; b) participants' proficiency level; and c) preceding and following phonological contexts.

5.2 Theoretical Implications

Based on the results reported above, the present study might present the following theoretical contributions: Firstly, the results of the investigation of Hypothesis 1 a) provide empirical evidence for the claims in Flege's (1995) Speech Learning Model, which predicts that there is a relationship between speech perception and production, since the degree of correlation was highly statistically significant not only in terms of overall results ($r(32) = .90$, $p < .01$), but also for the individual correlations between the perception and production of /t/ ($r(32) = .83$, $p < .01$) and of (/d/ $r(32) = .68$, $p < .01$); b) support the findings reported in the studies by Rebello (1997), Batista and Silva Filho (1997), and Delatorre (2004, 2005, 2006), which showed

evidence for the influence of the preceding environment, since the difference in the participants' performance in each of the three –*ed* ending types was statistically significant; and c) provide evidence for the claim that perception precedes production, since the results showed that participants accurately perceived 71.42% of the –*ed* endings and produced only 52.46% of them accurately.

Secondly, the results found concerning Hypothesis 2 can be said to a) provide evidence for Best's (1995) proposal in the Perceptual Assimilation Model, which states that when two L2 sounds are assimilated to different L1 phonetic categories, discrimination is excellent, since the difference between the means for the perception of the /ɪd/ -*ed* ending type and of /t/ and /d/ was statistically significant; b) corroborate

the predictions stated in Eckman's (1977, 1987) Markedness Relations Hypothesis that more marked structures are more difficult, since /ɪd/ is more marked than /t/ and /d/;

and c) confirms that Brazilian EFL learners give preference to the CVC syllable structure over the CVCC syllable structure, since Brazilian Portuguese does not allow consonant clusters in syllable final position (Koerich, 2002).

Thirdly, the results found in Hypothesis 3 can be said to corroborate both a) theory – Best's (1995) Perceptual Assimilation Model, Eckman's (1977, 1987) Markedness Relations Hypothesis, Selkirk's (1984) Sonority Sequencing Generalization, Hooper's (1976) Hierarchy of Strength; and b) previous empirical studies – Koerich (2002) and Silveira (2004), since the mean for the perception of /t/ was found to be statistically significant and higher than the mean for the /d/ -*ed* ending type.

Fourth, results found in Hypothesis 4 corroborate the predictions in Eckman's

(1977, 1987) Markedness Relations Hypothesis, and the findings reported in Baptista (2001) and Delatorre (2006), since the /ɪd/ -ed ending type is less marked and thus less difficult to be produced than the /t/ and /d/ -ed ending types.

Finally, the results found in Hypotheses 3 and 5 corroborate the findings of previous studies such as the ones carried out by Koerich (2002) and Silveira (2004), who found more epenthesis production on voiced than on voiceless consonants, since the mean for the perception and production of the /t/ -ed ending type was statistically significant and higher than the mean for the perception and production of the /d/ -ed ending type.

5.3 Pedagogical Implications

Concerning pedagogical implications, the findings of this study might give the following contributions.

Based on the highly significant, positive correlation found between speech perception and production - Hypothesis 1 - and the claim that perception precedes production, it provides data for the elaboration of teaching materials, based on the principles that a) materials should bring activities focusing on developing perception first, that is, listening exercises, and then production, that is, speaking exercises; b) activities should concentrate on the perception and production of syllable final clusters.

Furthermore, the results provide insights for English teachers about pronunciation instruction, suggesting that a) formal instruction on the perception and

production of the *-ed* inflectional endings is needed, specially for the /t/ and /d/ *-ed* ending types, since the participants demonstrated low performance in both perceiving and producing these sounds; and b) emphasis on the perception and production of syllable final consonant clusters is required, since the results demonstrate that the participants had difficulty in accurately perceiving and producing the target sounds.

5.4 Limitations and Suggestions for Further Research

This study has limitations, and these limitations give room for suggestions for further research, as follows:

1. There is evidence for the relationship between speech perception and production, as demonstrated in this study, but future studies should investigate the relationship between the four language skills, that is, not only oral perception and production, but also reading and writing in order to possibly bring clearer results for the link between the two skills;

2. The statistical analysis of the participants' performance in the production variables was not normally distributed, thus being impossible to run the parametric Pearson test and requiring the use of the non-parametric Spearman test, and the results were statistically significant for /t/ and /d/, but the level of correlation was considered to be poor for /ɪd/ (r(32) = .30, p = .08). This happened probably because scores ranged from 0 to 8 and the test was relatively easy. Therefore, future research is needed regarding the production of /ɪd/ with a larger possibility of scores in more complex modes such as free speech;

3. This study investigated the relationship between perception and production of the *-ed* inflectional ending only after /p,t,k,b,d,g/, and the results showed different performance both in terms of perception and production of the target sound. Thus, future studies should investigate how speech perception and production relate with different preceding phonological environments such as fricatives and vowels, for example;

4. Similarly, the only following phonological context in which the *-ed* endings were tested perceptually and productively was the semi-vowel /ʲ/. Future studies should investigate perception and production with different following contexts in order to check if the results would follow the same line as the results found here;

5. As argued above, it is possible that the explanation for the inconsistent results provided in the literature concerning the relationship between perception and production are due to differences within the variables examined, suggesting further research investigating the link between the two skills with participants from different levels of proficiency and different target sounds and structures;

6. Finally, regarding the fact that this is the first study investigating the relationship between perception and production of the *-ed* inflectional endings, along with the significant results found here, further research is needed on *-ed* endings and syllable final consonant clusters in order to confirm or question the present findings.

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APPENDICES

Appendix A

Universidade Federal de Santa Catarina
Curso de Pós-Graduação em Inglês e Literaturas Correspondentes
Researcher: Rudinei Aldini Frese
Adviser: Prof[a] Dr[a] Rosana Denise Koerich

Participant:

Perception Test Training Session

Name: _____   Date: _____/_____/_____

"you are going to hear sets of 03 phrases as 'I helped you' or 'I loved you'. If the first phrase is pronounced differently, check 'a', if the second phrase is pronounced differently, check 'b', if the third phrase is pronounced differently, check 'c', if all phrases are pronounced the same, check 'd'."

Example:

Hear the 04 sets of 04 phrases. The answers have been marked for you.

1	**a**	b	c	d
2	a	**b**	c	d
3	a	b	**c**	d
4	a	b	c	**d**

Now you are going to hear 04 sets of phrases. Mark your answers in the chart bellow. This is a short training to the activity.

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d

Appendix B

Universidade Federal de Santa Catarina
Curso de Pós-Graduação em Inglês e Literaturas Correspondentes
Researcher: Rudinei Aldini Frese
Adviser: Profª Drª Rosana Denise Koerich

Perception Test Training Session Stimuli Transcript

1. I helped /ɪd/ you. I helped /t/ you. I helped /t/ you.

2. I helped /t/ you. I helped /ɪd/ you. I helped /t/ you.

3. I helped /t/ you. I helped /t/ you. I helped /ɪd/ you.

4. I helped /t/ you. I helped /t/ you. I helped /t/ you.

1. I loved /d/ you. I loved /d/ you. I loved /t/ you.

2. I loved /d/ you. I loved /ɪd/ you. I loved /d/ you.

3. I loved /ɪd/ you. I loved /d/ you. I loved /d/ you.

4. I loved /d/ you. I loved /d/ you. I loved /d/ you.

Appendix C

Universidade Federal de Santa Catarina
Curso de Pós-Graduação em Inglês e Literaturas Correspondentes
Researcher: Rudinei Aldini Frese
Adviser: Prof[a] Dr[a] Rosana Denise Koerich

Participant:

Perception Test Answer Sheet

Name: _____   Date: _____/_____/_____

As in the previous training "you are going to hear sets of 03 phrases. If the first phrase is pronounced differently, check 'a', if the second phrase is pronounced differently, check 'b', if the third phrase is pronounced differently, check 'c', if all phrases are pronounced the same, check 'd'."

1

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

↓

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

↓

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d

| 9 | a | b | c | d |
| 10 | a | b | c | d |

2

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

↓

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

↓

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d

7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

3

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

↓

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

↓

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d

5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

4

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

↓

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

↓

| 1 | a | b | c | d |
| 2 | a | b | c | d |

3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d

↓

5

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

↓

1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

↓

Appendix D

Universidade Federal de Santa Catarina
Curso de Pós-Graduação em Inglês e Literaturas Correspondentes
Researcher: Rudinei Aldini Frese
Adviser: Prof[a] Dr[a] Rosana Denise Koerich

Perception Test Stimuli Transcript

1. I rocked /t/ you. I rocked /t/ you. I rocked /t/ you.

2. I spotted /ɪd/ you. I spotted /ɪd/ you. I spotted /ɪd/ you.

3. I rocked /t/ you. I rocked /t/ you. I rocked /ɪd/ you.

4. I rocked /ɪd/ you. I rocked /ɪd/ you. I rocked /ɪd/ you.

5. I rocked /d/ you. I rocked /t/ you. I rocked /t/ you.

6. I rocked /d/ you. I rocked /ɪd/ you. I rocked /ɪd/ you.

7. I logged /t/ you. I logged /ɪd/ you. I logged /ɪd/ you.

8. I stopped /t/ you. I stopped /t/ you. I stopped /t/ you.

9. I spotted /t/ you. I spotted /d/ you. I spotted /t/ you.

10. I rocked /t/ you. I rocked /d/ you. I rocked /d/ you.

1. I logged /t/ you. I logged /d/ you. I logged /d/ you.

2. I spotted /d/ you. I spotted /d/ you. I spotted /d/ you.

3. I rocked /ɪd/ you. I rocked /ɪd/ you. I rocked /ɪd/ you.

4. I spotted /ɪd/ you. I spotted /ɪd/ you. I spotted /ɪd/ you.

5. I stopped /ɪd/ you. I stopped /d/ you. I stopped /d/ you.

6. I logged /ɪd/ you. I logged /ɪd/ you. I logged /ɪd/ you.

7. I rocked /ɪd/ you. I rocked /t/ you. I rocked /t/ you.

8. I godded /ɪd/ you. I godded /ɪd/ you. I godded /ɪd/ you.

9. I rocked /ɪd/ you. I rocked /t/ you. I rocked /ɪd/ you.

10. I spotted /t/ you. I spotted /ɪd/ you. I spotted /t/ you.

1. I logged /ɪd/ you. I logged /t/ you. I logged /t/ you.

2. I godded /d/ you. I godded /t/ you. I godded /t/ you.

3. I rocked /ɪd/ you. I rocked /ɪd/ you. I rocked /d/ you.

4. I spotted /d/ you. I spotted /d/ you. I spotted /ɪd/ you.

5. I robbed /d/ you. I robbed /t/ you. I robbed /d/ you.

6. I godded /t/ you. I godded /d/ you. I godded /d/ you.

7. I stopped /d/ you. I stopped /d/ you. I stopped /t/ you.

8. I godded /ɪd/ you. I godded /ɪd/ you. I godded /ɪd/ you.
9. I robbed /ɪd/ you. I robbed /ɪd/ you. I robbed /ɪd/ you.
10. I godded /d/ you. I godded /ɪd/ you. I godded /d/ you.

1. I rocked /ɪd/ you. I rocked /d/ you. I rocked /d/ you.
2. I stopped /t/ you. I stopped /t/ you. I stopped /t/ you.
3. I logged /t/ you. I logged /d/ you. I logged /t/ you.
4. I robbed /d/ you. I robbed /ɪd/ you. I robbed /d/ you.
5. I stopped /ɪd/ you. I stopped /ɪd/ you. I stopped /t/ you.
6. I stopped /d/ you. I stopped /d/ you. I stopped /ɪd/ you.
7. I logged /ɪd/ you. I logged /d/ you. I logged /d/ you.
8. I stopped /d/ you. I stopped /t/ you. I stopped /t/ you.
9. I logged /ɪd/ you. I logged /ɪd/ you. I logged /d/ you.
10. I robbed /t/ you. I robbed /t/ you. I robbed /t/ you.

1. I godded /ɪd/ you. I godded /ɪd/ you. I godded /d/ you.
2. I robbed /ɪd/ you. I robbed /ɪd/ you. I robbed /ɪd/ you.
3. I godded /t/ you. I godded /t/ you. I godded /d/ you.
4. I stopped /ɪd/ you. I stopped /ɪd/ you. I stopped /d/ you.
5. I godded /ɪd/ you. I godded /t/ you. I godded /ɪd/ you.
6. I spotted /ɪd/ you. I spotted /d/ you. I spotted /ɪd/ you.
7. I rocked /d/ you. I rocked /ɪd/ you. I rocked /d/ you.
8. I godded /t/ you. I godded /ɪd/ you. I godded /t/ you.
9. I stopped /d/ you. I stopped /ɪd/ you. I stopped /ɪd/ you.
10. I stopped /t/ you. I stopped /d/ you. I stopped /t/ you.

1. I stopped /t/ you. I stopped /d/ you. I stopped /d/ you.
2. I logged /d/ you. I logged /d/ you. I logged /t/ you.
3. I robbed /d/ you. I robbed /d/ you. I robbed /d/ you.
4. I logged /d/ you. I logged /d/ you. I logged /ɪd/ you.
5. I spotted /ɪd/ you. I spotted /t/ you. I spotted /ɪd/ you.
6 I stopped /t/ you. I stopped /ɪd/ you. I stopped /ɪd/ you.
7. I logged /ɪd/ you. I logged /ɪd/ you. I logged /t/ you.
8. I robbed /d/ you. I robbed /t/ you. I robbed /t/ you.
9. I spotted /t/ you. I spotted /t/ you. I spotted /t/ you.
10. I godded /d/ you. I godded /d/ you. I godded /d/ you.

1. I stopped /t/ you. I stopped /ɪd/ you. I stopped /t/ you.
2. I logged /t/ you. I logged /t/ you. I logged /ɪd/ you.
3. I robbed /ɪd/ you. I robbed /d/ you. I robbed /ɪd/ you.
4. I spotted /t/ you. I spotted /d/ you. I spotted /d/ you.
5. I robbed /t/ you. I robbed /ɪd/ you. I robbed /t/ you.
6. I logged /ɪd/ you. I logged /d/ you. I logged /ɪd/ you.
7. I robbed /t/ you. I robbed /t/ you. I robbed /d/ you.
8. I stopped /t/ you. I stopped /t/ you. I stopped /ɪd/ you.
9. I spotted /d/ you. I spotted /ɪd/ you. I spotted /d/ you.
10. I rocked /d/ you. I rocked /d/ you. I rocked /d/ you.

1. I godded /ɪd/ you. I godded /t/ you. I godded /t/ you.
2. I logged /t/ you. I logged /t/ you. I logged /t/ you.
3. I spotted /t/ you. I spotted /t/ you. I spotted /t/ you.
4. I robbed /ɪd/ you. I robbed /t/ you. I robbed /ɪd/ you.
5. I godded /d/ you. I godded /d/ you. I godded /d/ you.
6. I rocked /t/ you. I rocked /t/ you. I rocked /d/ you.
7. I godded /t/ you. I godded /t/ you. I godded /t/ you.
8. I logged /d/ you. I logged /t/ you. I logged /t/ you.
9. I spotted /d/ you. I spotted /d/ you. I spotted /t/ you.
10. I godded /ɪd/ you. I godded /d/ you. I godded /ɪd/ you.

1. I rocked /t/ you. I rocked /t/ you. I rocked /t/ you.
2. I godded /d/ you. I godded /d/ you. I godded /t/ you.
3. I robbed /d/ you. I robbed /d/ you. I robbed /d/ you.
4. I rocked /d/ you. I rocked /t/ you. I rocked /d/ you.
5. I stopped /t/ you. I stopped /t/ you. I stopped /d/ you.
6. I spotted /d/ you. I spotted /t/ you. I spotted /t/ you.
7. I rocked /t/ you. I rocked /ɪd/ you. I rocked /t/ you.
8. I logged /d/ you. I logged /ɪd/ you. I logged /d/ you.
9. I rocked /t/ you. I rocked /ɪd/ you. I rocked /ɪd/ you.
10. I logged /d/ you. I logged /t/ you. I logged /d/ you.

1. I stopped /ɪd/ you. I stopped /t/ you. I stopped /t/ you.
2. I logged /d/ you. I logged /ɪd/ you. I logged /ɪd/ you.

3. I godded /d/ you. I godded /t/ you. I godded /d/ you.

4. I logged /t/ you. I logged /ɪd/ you. I logged /t/ you.

5. I godded /t/ you. I godded /t/ you. I godded /t/ you.

6. I rocked /ɪd/ you. I rocked /d/ you. I rocked /ɪd/ you.

7. I godded /d/ you. I godded /d/ you. I godded /ɪd/ you.

8. I godded /t/ you. I godded /d/ you. I godded /t/ you.

9. I spotted /ɪd/ you. I spotted /t/ you. I spotted /t/ you.

10. I robbed /t/ you. I robbed /ɪd/ you. I robbed /ɪd/ you.

1. I robbed /t/ you. I robbed /d/ you. I robbed /t/ you.

2. I robbed /t/ you. I robbed /d/ you. I robbed /d/ you.

3. I logged /ɪd/ you. I logged /t/ you. I logged /ɪd/ you.

4. I godded /d/ you. I godded /ɪd/ you. I godded /ɪd/ you.

5. I rocked /ɪd/ you. I rocked /ɪd/ you. I rocked /t/ you.

6. I spotted /d/ you. I spotted /ɪd/ you. I spotted /ɪd/ you.

7. I stopped /ɪd/ you. I stopped /ɪd/ you. I stopped /ɪd/ you.

8. I spotted /t/ you. I spotted /ɪd/ you. I spotted /ɪd/ you.

9. I robbed /d/ you. I robbed /ɪd/ you. I robbed /ɪd/ you.

10. I spotted /ɪd/ you. I spotted /d/ you. I spotted /d/ you.

1. I stopped /d/ you. I stopped /t/ you. I stopped /d/ you.

2. I logged /ɪd/ you. I logged /ɪd/ you. I logged /ɪd/ you.

3. I godded /ɪd/ you. I godded /ɪd/ you. I godded /t/ you.

4. I spotted /d/ you. I spotted /d/ you. I spotted /d/ you.

5. I stopped /d/ you. I stopped /ɪd/ you. I stopped /d/ you.

6. I rocked /d/ you. I rocked /d/ you. I rocked /ɪd/ you.

7. I stopped /ɪd/ you. I stopped /ɪd/ you. I stopped /ɪd/ you.

8. I robbed /ɪd/ you. I robbed /d/ you. I robbed /d/ you.

9. I spotted /t/ you. I spotted /t/ you. I spotted /d/ you.

10. I robbed /t/ you. I robbed /t/ you. I robbed /ɪd/ you.

1. I spotted /ɪd/ you. I spotted /ɪd/ you. I spotted /t/ you.

2. I logged /t/ you. I logged /t/ you. I logged /t/ you.

3. I robbed /d/ you. I robbed /d/ you. I robbed /t/ you.

4. I godded /ɪd/ you. I godded /d/ you. I godded /d/ you.

5. I spotted /ɪd/ you. I spotted /ɪd/ you. I spotted /d/ you.

6. I stopped /d/ you. I stopped /d/ you. I stopped /d/ you.

7. I robbed /ɪd/ you. I robbed /t/ you. I robbed /t/ you.

8. I robbed /ɪd/ you. I robbed /ɪd/ you. I robbed /t/ you.

9. I spotted /d/ you. I spotted /t/ you. I spotted /d/ you.

10. I stopped /ɪd/ you. I stopped /d/ you. I stopped /ɪd/ you.

1. I stopped /d/ you. I stopped /d/ you. I stopped /d/ you.

2. I rocked /d/ you. I rocked /d/ you. I rocked /t/ you.

3. I godded /t/ you. I godded /ɪd/ you. I godded /ɪd/ you.

4. I logged /d/ you. I logged /d/ you. I logged /d/ you.

5. I robbed /d/ you. I robbed /d/ you. I robbed /ɪd/ you.

6. I robbed /ɪd/ you. I robbed /ɪd/ you. I robbed /d/ you.

7. I logged /d/ you. I logged /d/ you. I logged /d/ you.

8. I rocked /t/ you. I rocked /d/ you. I rocked /t/ you.

9. I logged /t/ you. I logged /t/ you. I logged /d/ you.

10. rock I rocked /d/ you. I rocked /d/ you. I rocked /d/ you.

1. I stopped /ɪd/ you. I stopped /t/ you. I stopped /ɪd/ you.

2. I spotted /t/ you. I spotted /t/ you. I spotted /ɪd/ you.

3. I robbed /t/ you. I robbed /t/ you. I robbed /t/ you.

4. I godded /t/ you. I godded /t/ you. I godded /ɪd/ you.

Appendix E

Different trials and Catch trials with the verb *stop*

Sentence	Different trials and Catch trials		
01. I stopped you	/aɪ ˌstɑːpt ˌʲuː/	/aɪ ˌstɑːpd ˌʲuː/	/aɪ ˌstɑːpd ˌʲuː/
02. I stopped you	/aɪ ˌstɑːpd ˌʲuː/	/aɪ ˌstɑːpt ˌʲuː/	/aɪ ˌstɑːpd ˌʲuː/
03. I stopped you	/aɪ ˌstɑːpd ˌʲuː/	/aɪ ˌstɑːpd ˌʲuː/	/aɪ ˌstɑːpt ˌʲuː/
04. I stopped you	/aɪ ˌstɑːpd ˌʲuː/	/aɪ ˌstɑːpd ˌʲuː/	/aɪ ˌstɑːpd ˌʲuː/
05. I stopped you	/aɪ ˌstɑːpt ˌʲuː/	/aɪ ˌstɑːpɪd ˌʲuː/	/aɪ ˌstɑːpɪd ˌʲuː/
06. I stopped you	/aɪ ˌstɑːpɪd ˌʲuː/	/aɪ ˌstɑːpt ˌʲuː/	/aɪ ˌstɑːpɪd ˌʲuː/
07. I stopped you	/aɪ ˌstɑːpɪd ˌʲuː/	/aɪ ˌstɑːpɪd ˌʲuː/	/aɪ ˌstɑːpt ˌʲuː/
08. I stopped you	/aɪ ˌstɑːpɪd ˌʲuː/	/aɪ ˌstɑːpɪd ˌʲuː/	/aɪ ˌstɑːpɪd ˌʲuː/
09. I stopped you	/aɪ ˌstɑːpd ˌʲuː/	/aɪ ˌstɑːpt ˌʲuː/	/aɪ ˌstɑːpt ˌʲuː/
10. I stopped you	/aɪ ˌstɑːpt ˌʲuː/	/aɪ ˌstɑːpd ˌʲuː	/aɪ ˌstɑːpt ˌʲuː/
11. I stopped you	/aɪ ˌstɑːpt ˌʲuː/	/aɪ ˌstɑːpt ˌʲuː/	/aɪ ˌstɑːpd ˌʲuː/
12. I stopped you	/aɪ ˌstɑːpt ˌʲuː/	/aɪ ˌstɑːpt ˌʲuː/	/aɪ ˌstɑːpt ˌʲuː/
13. I stopped you	/aɪ ˌstɑːpd ˌʲuː/	/aɪ ˌstɑːpɪd ˌʲuː/	/aɪ ˌstɑːpɪd ˌʲuː/

14. I stopped you	/aɪˌstɑːpɪdˌ ʲuː/	/aɪˌstɑːpdˌ ʲuː/	/aɪˌstɑːpɪdˌ ʲuː/
15. I stopped you	/aɪˌstɑːpɪdˌ ʲuː/	/aɪˌstɑːpɪdˌ ʲuː/	/aɪˌstɑːpdˌ ʲuː/
16. I stopped you	/aɪˌstɑːpɪdˌ ʲuː/	/aɪˌstɑːpɪdˌ ʲuː/	/aɪˌstɑːpɪdˌ ʲuː/
17. I stopped you	/aɪˌstɑːpɪdˌ ʲuː/	/aɪˌstɑːpdˌ ʲuː/	/aɪˌstɑːpdˌ ʲuː/
18. I stopped you	/aɪˌstɑːpdˌ ʲuː/	/aɪˌstɑːpɪdˌ ʲuː/	/aɪˌstɑːpdˌ ʲuː/
19. I stopped you	/aɪˌstɑːpdˌ ʲuː/	/aɪˌstɑːpdˌ ʲuː/	/aɪˌstɑːpɪdˌ ʲuː/
20. I stopped you	/aɪˌstɑːpdˌ ʲuː/	/aɪˌstɑːpdˌ ʲuː/	/aɪˌstɑːpdˌ ʲuː/
21. I stopped you	/aɪˌstɑːpɪdˌ ʲuː/	/aɪˌstɑːptˌ ʲuː/	/aɪˌstɑːptˌ ʲuː/
22. I stopped you	/aɪˌstɑːptˌ ʲuː/	/aɪˌstɑːpɪdˌ ʲuː/	/aɪˌstɑːptˌ ʲuː/
23. I stopped you	/aɪˌstɑːptˌ ʲuː/	/aɪˌstɑːptˌ ʲuː/	/aɪˌstɑːpɪdˌ ʲuː/
24. I stopped you	/aɪˌstɑːptˌ ʲuː/	/aɪˌstɑːptˌ ʲuː/	/aɪˌstɑːptˌ ʲuː/

Appendix F

Participants' Profile – Questionnaire Results

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35
1	N	20	M	A	1	RJ	RJ	Y	11	Y	Y	1	N	–	–	–	–	–	Y	N	N	N	Y	S	N	N	N	N	N	–	–	N	–	–
2	N	22	W	A	1	SP	SP	Y	8	Y	Y	1	Y	V	1	N	14	–	N	N	N	N	Y	S	Y	Y	Y	S	Y	S	C	Y	E	1
3	N	20	W	A	1	SP	SP	Y	12	Y	Y	1	N	–	–	–	–	–	N	R	Y	S	N	N	N	N	N	N	N	–	–	N	–	–
4	N	18	W	A	1	SC	SC	Y	10	Y	Y	2	N	–	–	–	–	–	N	N	N	N	N	N	N	N	N	N	N	–	–	N	–	–
5	N	18	M	A	1	SC	SC	Y	8	Y	Y	3	Y	V	1	N	15	–	N	N	N	N	Y	S	N	N	N	N	N	–	–	N	–	1
6	N	21	M	A	1	SP	SP	Y	11	Y	Y	1	N	–	–	–	–	–	N	N	N	N	Y	S	Y	N	N	N	N	–	–	N	–	–
7	N	29	W	A	1	RJ	RJ	Y	10	Y	Y	1	N	–	–	–	–	–	N	N	N	N	N	N	N	N	N	N	N	–	–	N	–	–
8	N	21	M	A	1	SC	SC	Y	11	Y	Y	1	N	–	–	–	–	–	Y	R	N	N	Y	S	N	N	N	N	N	–	–	N	–	–
9	N	21	M	A	1	SC	SC	Y	12	Y	Y	2	Y	V	1	N	16	–	Y	N	N	N	Y	S	Y	Y	Y	S	Y	S	C	Y	E	1
10	N	18	M	A	1	SP	SP	Y	10	Y	Y	1	N	–	–	–	–	–	N	R	Y	S	N	N	N	N	N	N	N	–	–	N	–	–
11	N	20	W	A	1	PR	PR	Y	9	Y	Y	1	N	–	–	–	–	–	N	N	N	N	N	N	N	N	N	N	N	–	–	N	–	–
12	N	21	M	A	1	SC	SC	Y	11	Y	Y	3	N	–	–	–	–	–	N	N	N	N	N	N	N	N	N	N	N	–	–	N	–	–
13	N	25	M	A	1	SC	SC	Y	11	Y	Y	3	Y	V	2	N	14	–	N	N	N	N	Y	S	Y	Y	N	N	Y	I	C	Y	E	1
14	N	22	M	A	1	SC	SC	Y	9	Y	Y	2	N	–	–	–	–	–	N	N	N	N	Y	S	Y	N	N	N	N	–	–	N	–	–
15	N	19	W	A	1	RJ	RJ	Y	8	Y	Y	1	N	–	–	–	–	–	Y	R	N	N	N	N	N	N	N	N	N	–	–	N	–	–
16	N	27	M	A	1	RS	RS	Y	12	Y	Y	1	N	–	–	–	–	–	Y	R	N	N	N	N	N	N	N	N	N	–	–	N	–	1
17	N	19	W	A	1	BA	BA	Y	12	Y	Y	1	Y	V	2	N	15	–	N	N	N	N	Y	S	Y	N	N	N	N	–	–	N	–	–
18	N	24	M	A	1	GO	GO	Y	11	Y	Y	1	N	–	–	–	–	–	N	N	N	N	Y	S	N	N	N	N	N	–	–	N	–	–
19	N	23	M	A	1	GO	GO	Y	10	Y	Y	1	N	–	–	–	–	–	N	N	N	N	N	N	N	N	N	N	N	–	–	N	–	–
20	N	18	M	A	1	SC	SC	Y	10	Y	Y	2	Y	V	1	N	16	–	N	N	N	N	Y	S	Y	Y	N	N	Y	S	C	Y	E	1
21	N	19	M	A	1	SC	SC	Y	9	Y	Y	3	N	–	–	–	–	–	Y	R	N	N	N	N	N	N	N	N	N	–	–	N	–	–
22	N	21	W	A	1	PR	PR	Y	8	Y	Y	1	N	V	1	N	16	–	N	N	N	N	Y	S	Y	Y	Y	S	Y	I	C	Y	E	1
23	N	23	W	A	1	PR	PR	Y	11	Y	Y	1	N	–	–	–	–	–	Y	R	Y	S	Y	S	N	N	N	N	N	–	–	N	–	–

24	N	25	M	A	1	RJ	RJ	Y	12	Y	Y	1	N	–	–	–	–	–	N	N	N	N	N	N	N	N	N	N	N	–	–	N	–	–
25	N	19	W	A	1	SP	SP	Y	12	Y	Y	1	N	–	–	–	–	–	N	N	N	N	N	N	N	N	N	N	N	–	–	N	–	1
26	N	20	W	A	1	SP	SP	Y	11	Y	Y	1	N	–	–	–	–	–	N	N	N	N	N	N	N	N	N	N	N	–	–	N	–	1
27	N	21	M	A	1	SC	SC	Y	10	Y	Y	2	N	–	–	–	–	–	Y	R	N	N	N	N	N	N	N	N	N	–	–	N	–	–
28	N	20	M	A	1	SC	SC	Y	10	Y	Y	2	Y	V	1	N	14	–	N	N	N	N	Y	S	Y	N	N	N	N	–	–	N	–	–
29	N	22	W	A	1	SC	SC	Y	9	Y	Y	1	N	–	–	–	–	–	N	N	N	N	Y	S	Y	N	N	N	N	–	–	N	–	–
30	N	20	W	A	1	SC	SC	Y	8	Y	Y	1	N	–	–	–	–	–	Y	R	N	N	N	N	N	N	N	N	N	–	–	N	–	–
31	N	21	M	A	1	PR	PR	Y	9	Y	Y	1	N	–	–	–	–	–	N	N	N	N	Y	S	Y	Y	N	N	Y	F	C	Y	E	1
32	N	18	M	A	1	PR	PR	Y	11	Y	Y	1	Y	V	1	N	14	–	N	N	N	N	N	N	N	N	N	N	–	–	N	–	–

Key to Questionnaire Results

Q2 – N = November 2005
Q4 – M = Man
    W = Woman
Q5 – A = Advanced
Q6 – 1 = between 400 and 500
Q7 – SC = Santa Catarina
    SP = São Paulo
    PR = Paraná
    RJ = Rio de Janeiro
    GO = Goiás
    BA = Bahia
    RS = Rio Grande
Q8 – SC = Santa Catarina
    SP = São Paulo
    PR = Paraná
    RJ = Rio de Janeiro
    GO = Goiás

BA = Bahia
RS = Rio Grande
Q9 – Y = Yes
    N = No
Q11 – Y = Yes
    N = No
Q12 – Y = Yes
    N = No
Q13 – 1 – around 100
    2 – around 200
    3 – around 300
Q14 – Y = Yes
    N = No
Q15 – V = Vacation
Q16 – 1 = one month
    2 = two months
Q17 – Y = Yes
    N = No
Q20 – Y = Yes
    N = No
Q21 – R = Rarely
    N = Never
Q22 – Y = Yes
    N = No
Q23 – S = Sometimes
    N = Never
Q24 – Y = Yes
    N = No
Q25 – S = Sometimes
    N = Never

Q26 – Y = Yes
      N = No
Q27 – Y = Yes
      N = No
Q28 – Y = Yes
      N = No
Q29 – S = Sometimes
      N = Never
Q30 – Y = Yes
      N = No
Q31 – S = Spanish
      F = French
      I = Italian
Q32 – C = Classroom
Q33 – Y = Yes
      N = No
Q34 – E = English
Q35 – 1 = Want to travel abroad

Appendix G

Universidade Federal de Santa Catarina
Curso de Pós-Graduação em Inglês e Literaturas Correspondentes
Researcher: Rudinei Aldini Frese
Adviser: Prof[a] Dr[a] Rosana Denise Koerich

Participant:

Participants' Profile Questionnaire

This questionnaire aims at gathering information that might help in the analysis of this research data. Under no circumstances the names and information of the participants will be used for other purposes but this quantitative research.

1. Name:
2. Date:
3. Age:
4. Sex:
5. Level:
6. Hours of Instruction:
7. Where are you from?
8. Where did you grow up?
9. Did you study English in elementary school/high school?
10. How old were you when you started studying English?
11. Did classes developed reading, writing, listening and speaking skills?
12. Have you taken any language course before Extracurricular?
13. How many hours of instruction did you have?
14. How ever been to an English speaking country?
15. What for?
16. How long did you stay?
18. How old were you at the time?
17. Did you attend English classes there?
19. What kind of classes:
20. Do you often speak English with other Brazilians?   21. How often?
22. Do you often speak English with native speakers?   23. How often?
24. Do you often listen to music in English?   25. How often?
26. Do you try to understand the lyrics?
27. Do you try to transcribe the lyrics?
28. Do you often watch films in English without subtitles?   29. How often?
30. Do you speak/have you had contact with/do you have contact with any other languages besides Portuguese and English?

31. What language?
32. In what context?
33. Does anybody in your family speak other language besides Portuguese?
34. What language?
35. What other information about your contact with English do you consider important.

Appendix H

Universidade Federal de Santa Catarina
Curso de Pós-Graduação em Inglês e Literaturas Correspondentes
Researcher: Rudinei Aldini Frese
Adviser: Prof[a] Dr[a] Rosana Denise Koerich

Production Test Stimuli Transcript

Use the information given and create sentences. For example:
1) loves you – possible sentence: I know she loves you a lot.
2) called you – possible sentence: I called you last night, but you weren't at home.

teach you

hotted you

understands you

wetted you

locked you

get you

added you

reads you

rocked you

forgives you

blocked you

build you

skipped you

draw you

forgets you

see you

tipped you

knows you

dotted you

give you

logged you

teaches you

begged you

pay you

hugged you

shocked you

speeded you

let you

drugged you

take you

stopped you

drives you

dropped you

gives you

spotted you

makes you

tell you

robbed you

has you

hurts you

grabbed you

do you

dobbed you

buy you

mobbed you

godded you

pays you

prodded you

Appendix I[6]
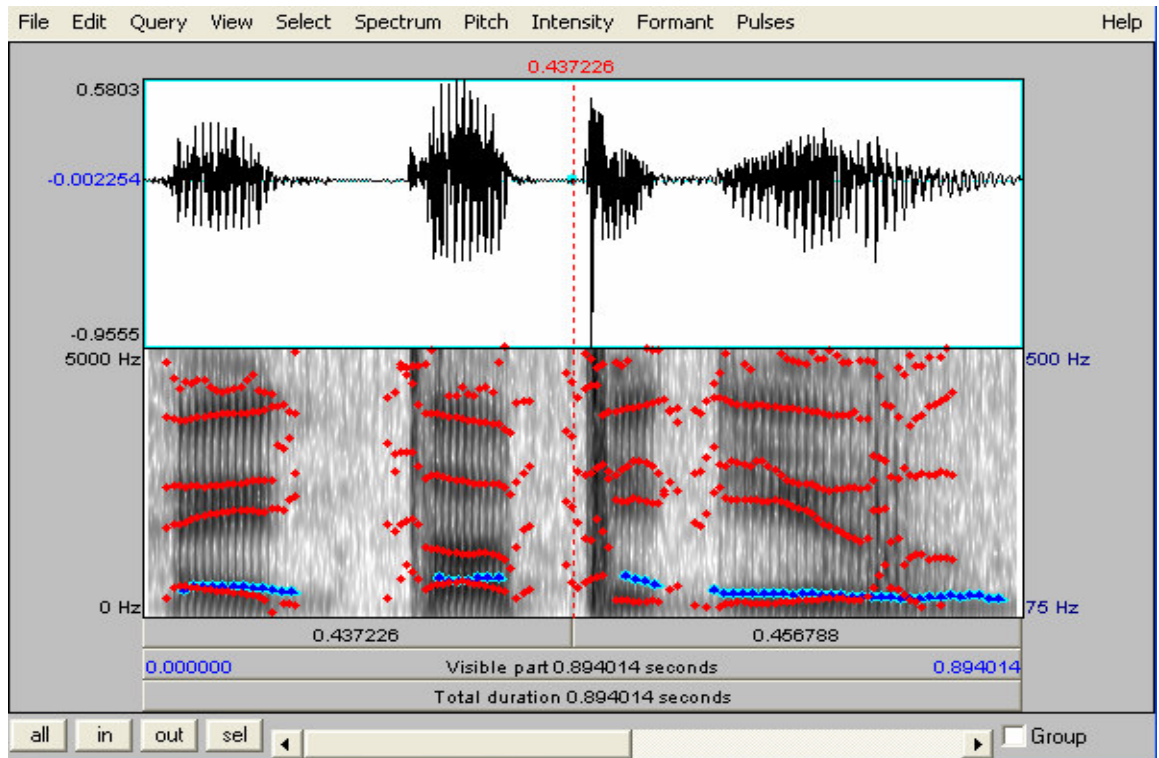
I stopped you
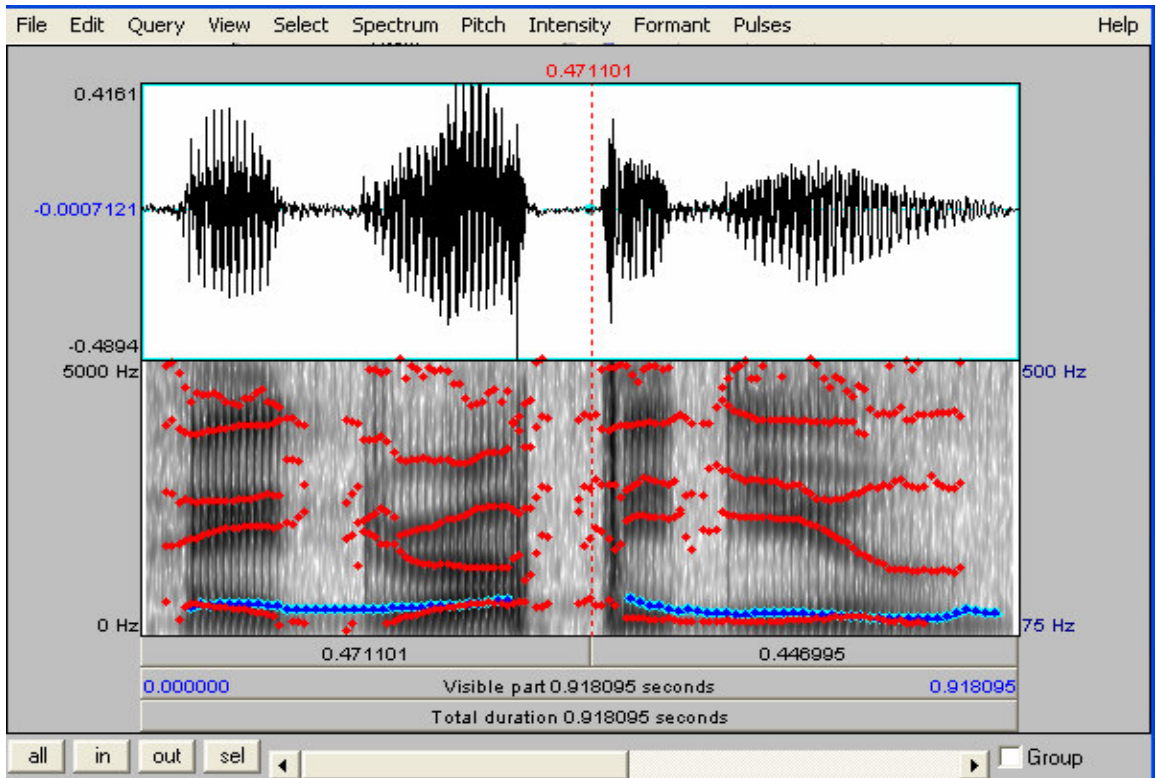
I dropped you
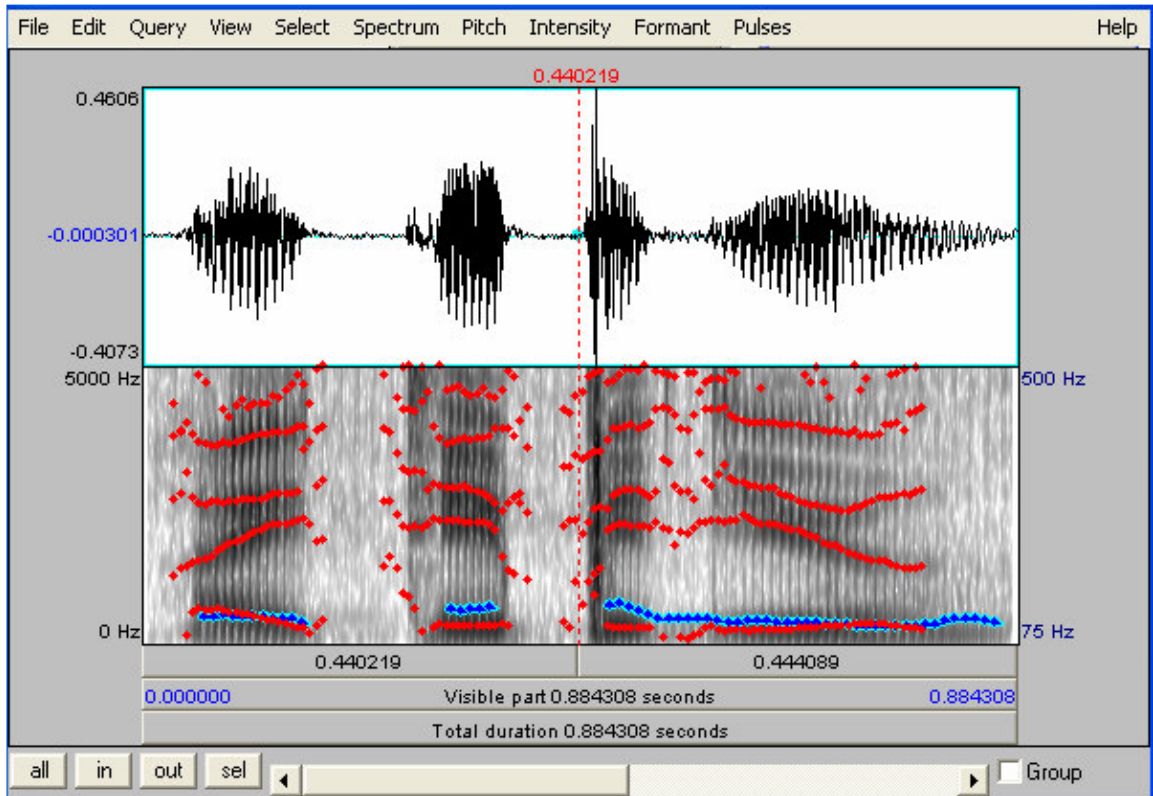
I tipped you
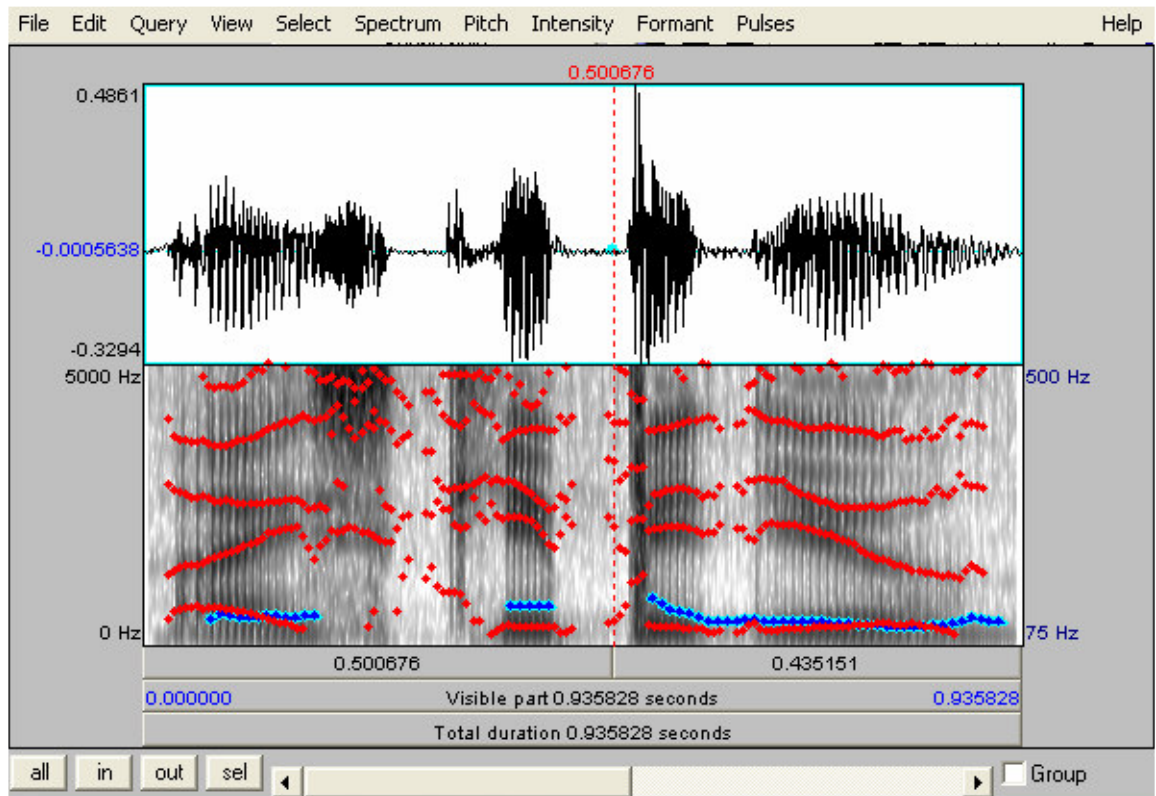
I skipped you
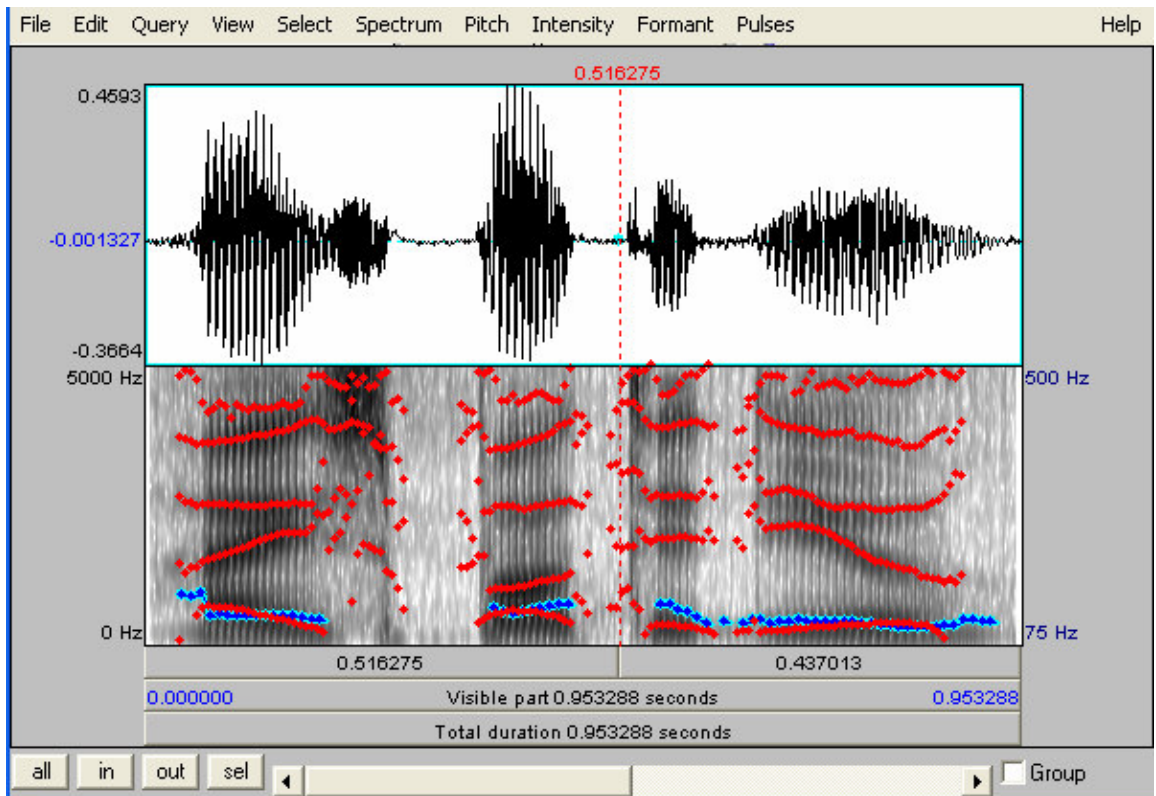
I spotted you
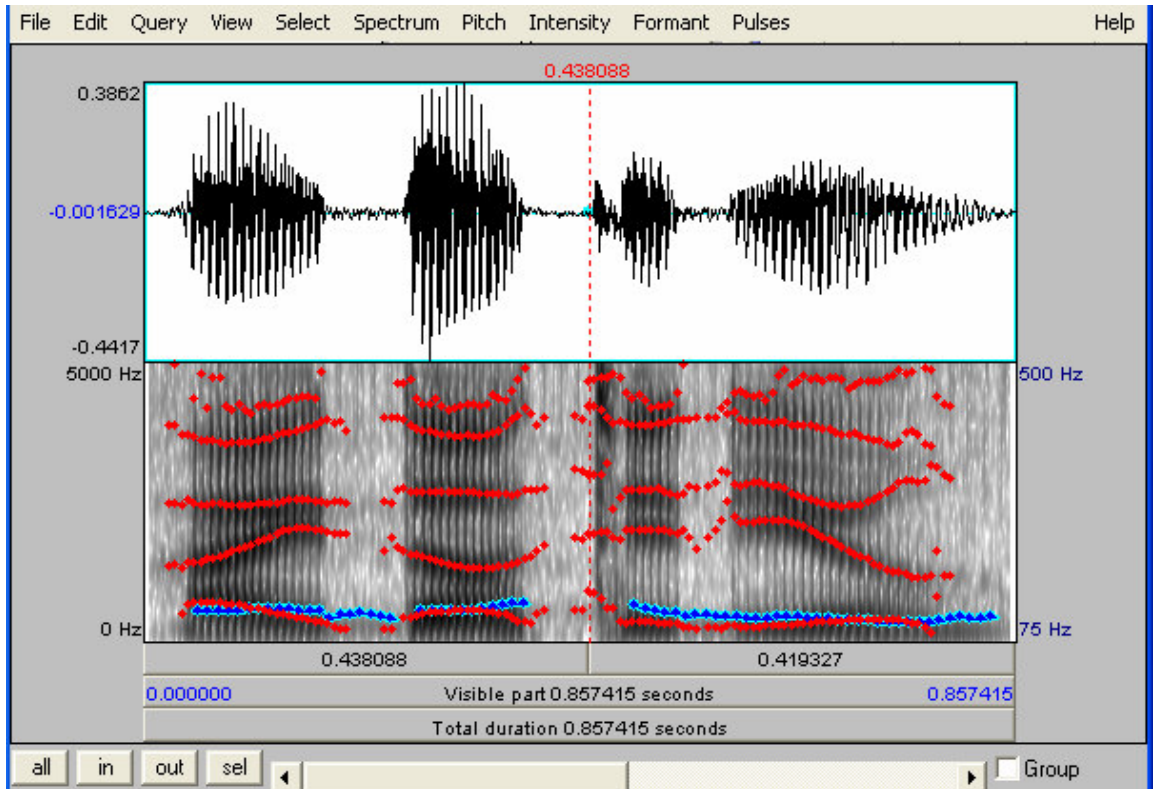
I dotted you
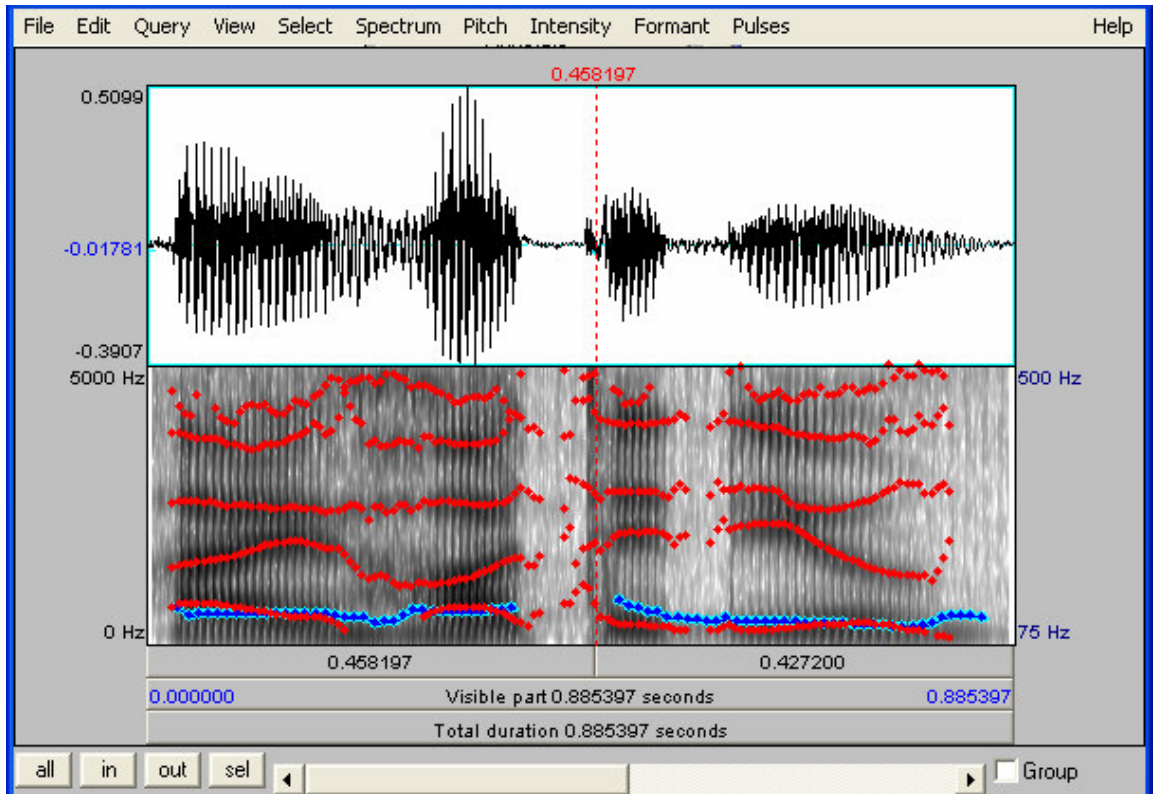
I hotted you
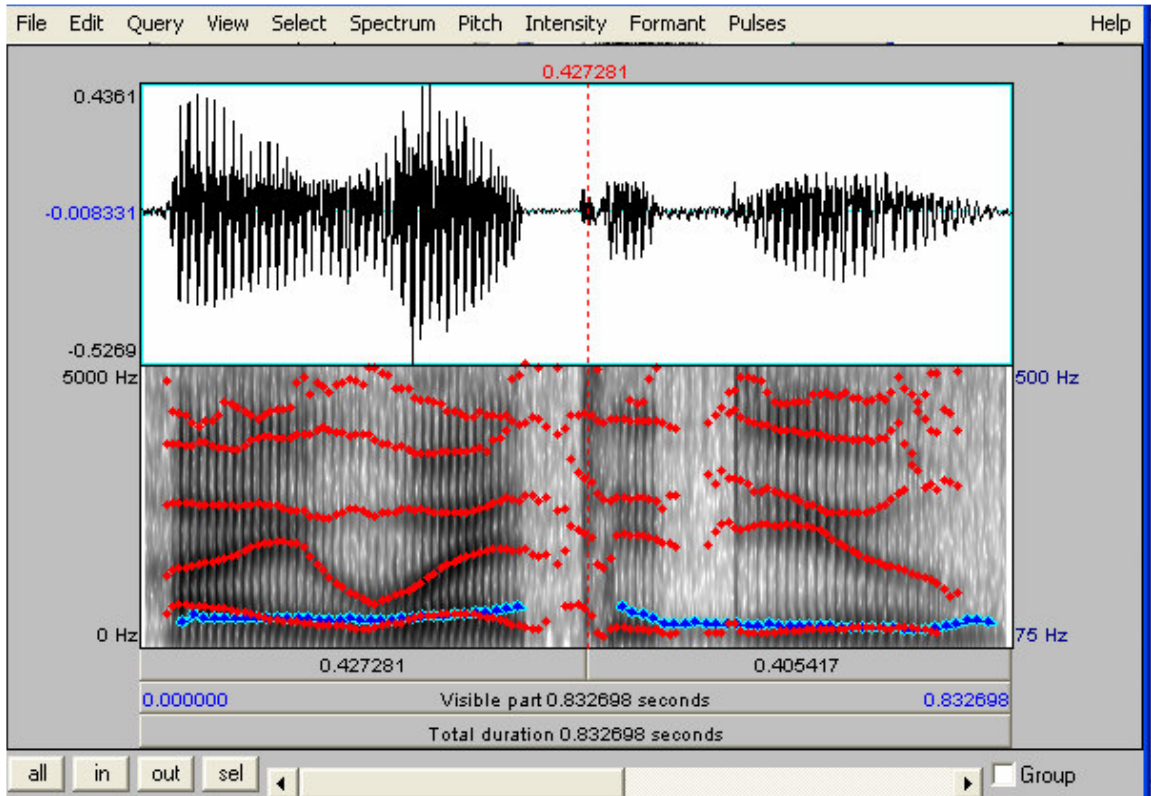
I wetted you
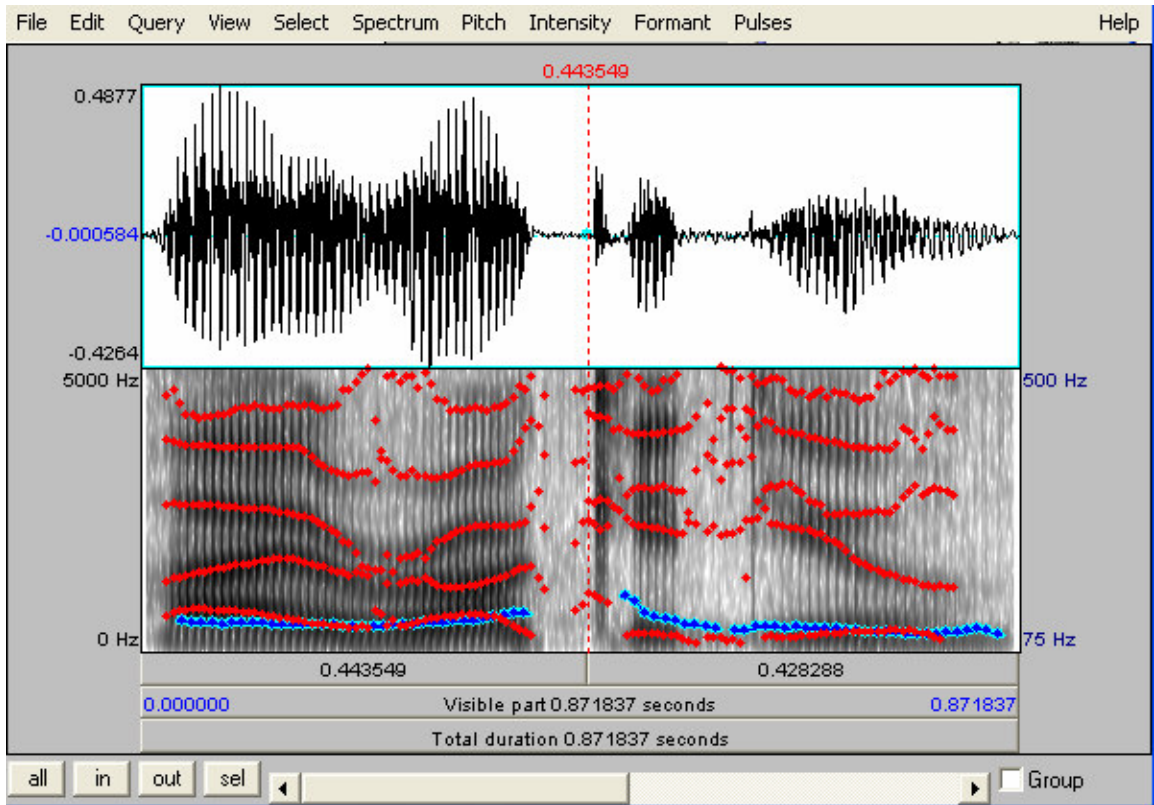
I rocked you
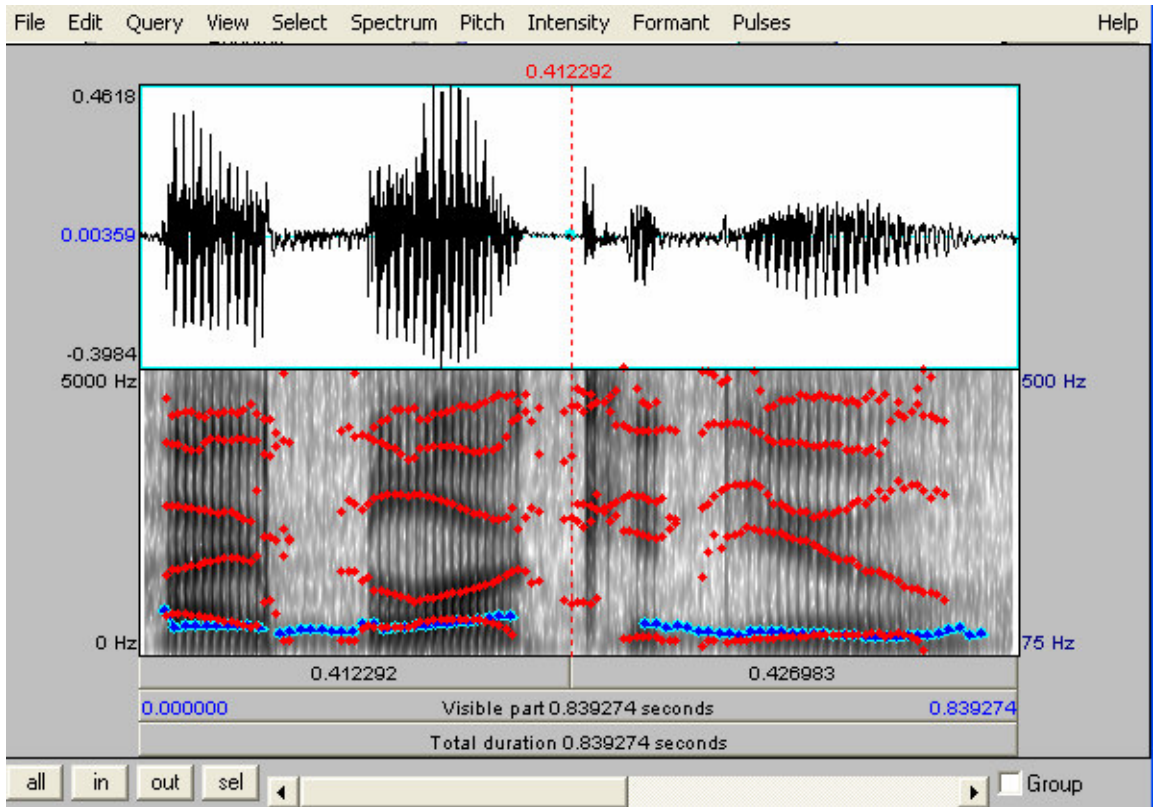
I blocked you
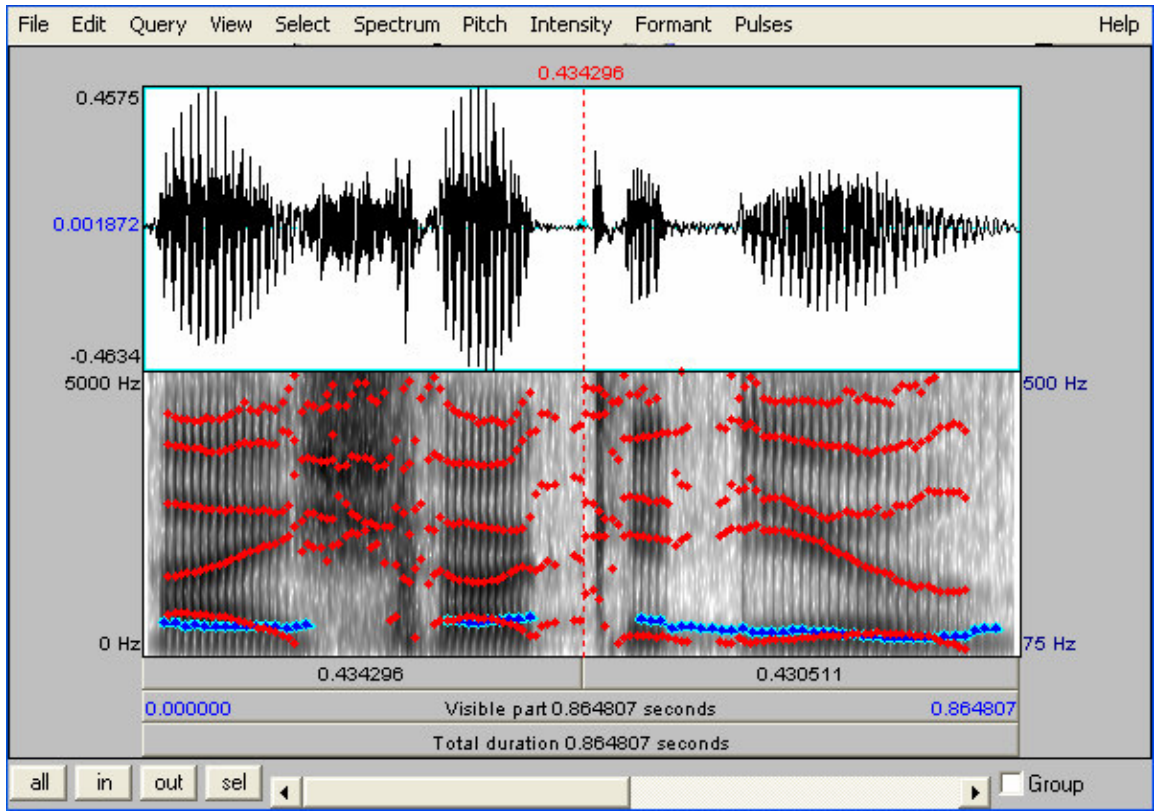
I shocked you
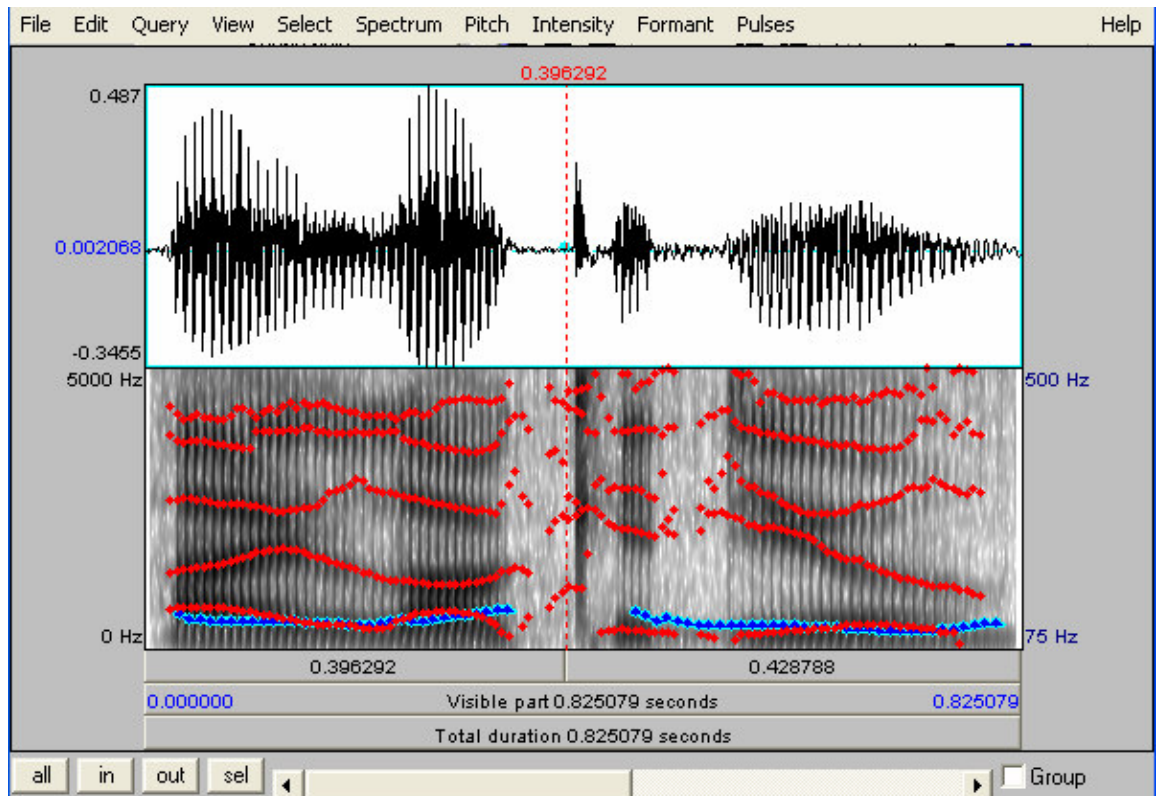
I locked you
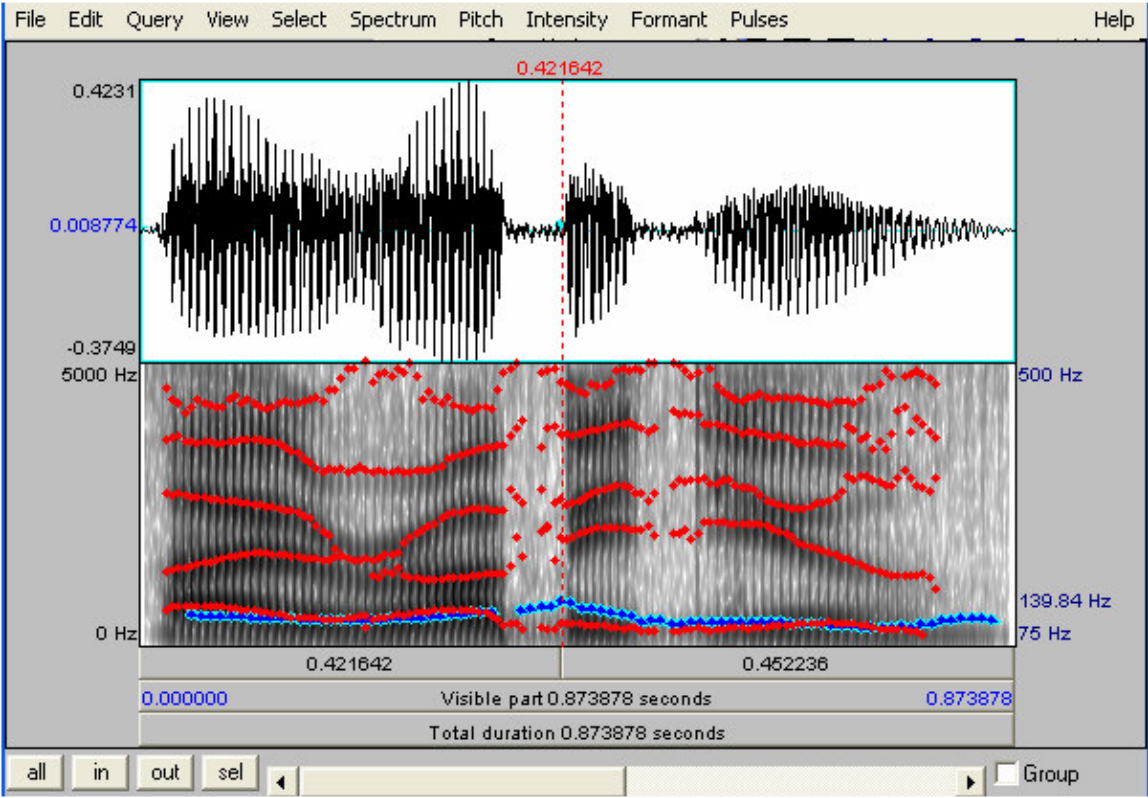
I robbed you
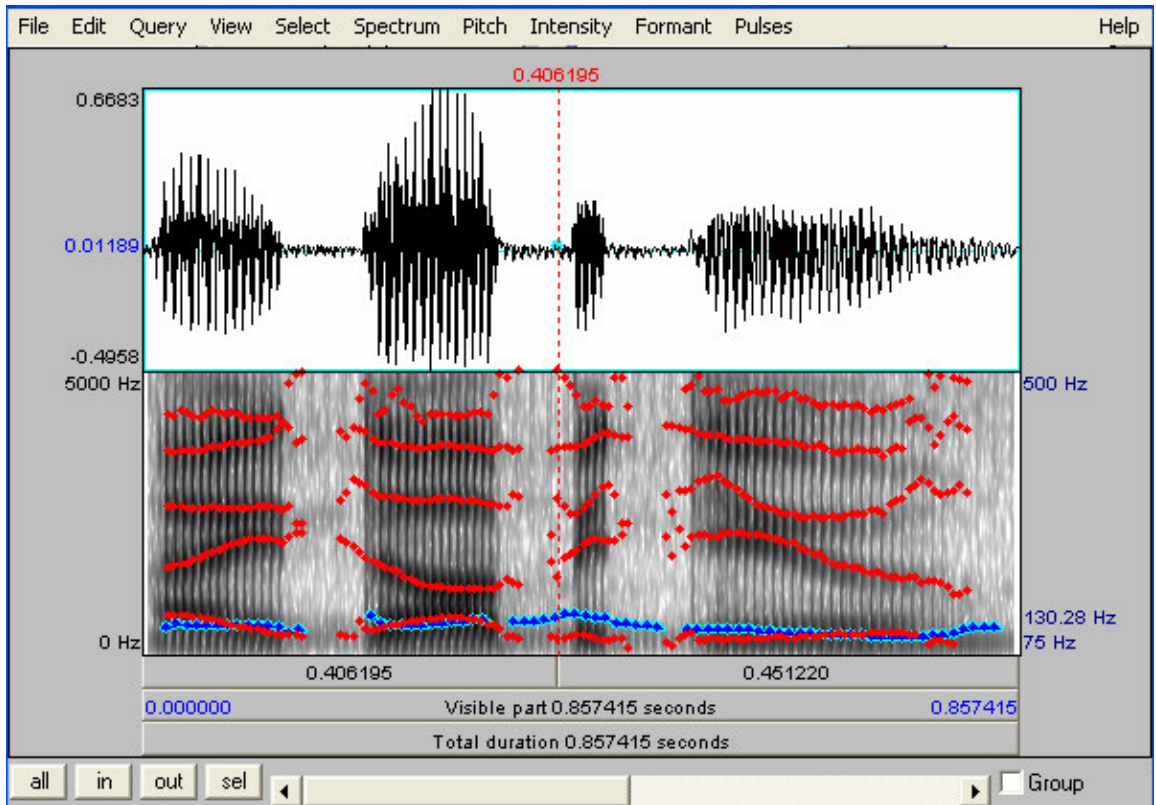
I dobbed you
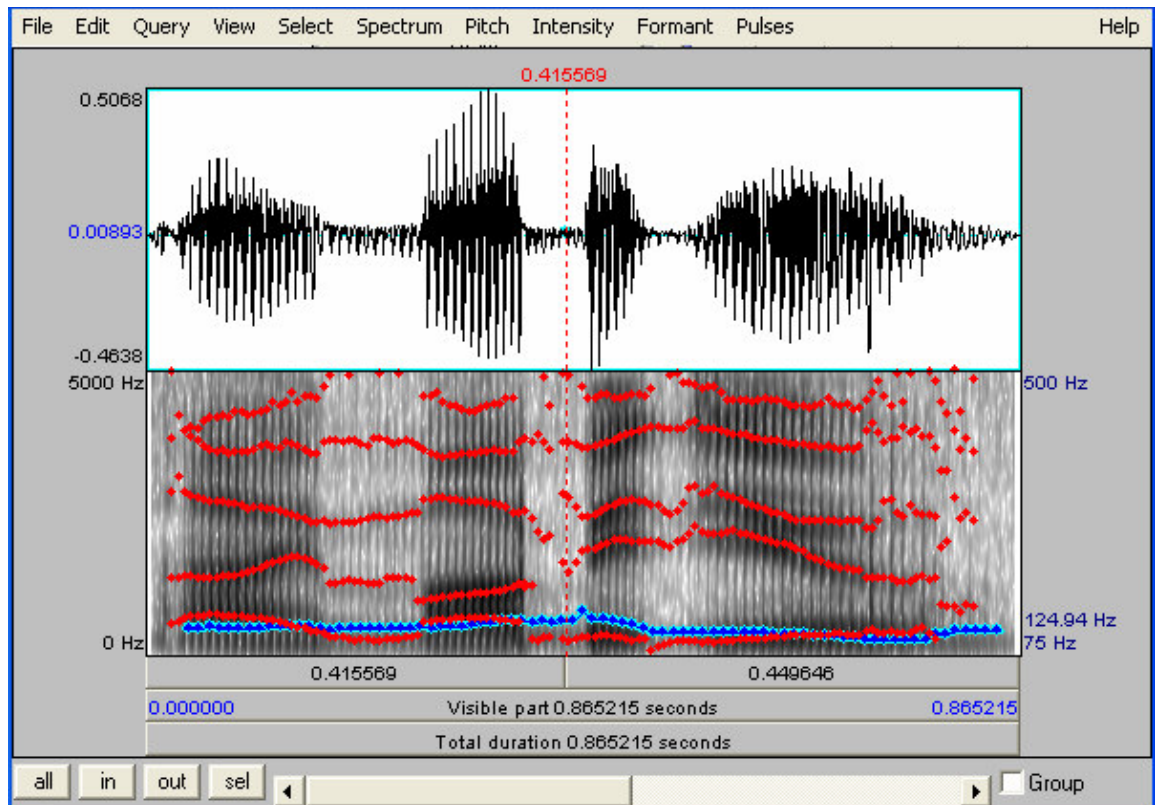
I mobbed you
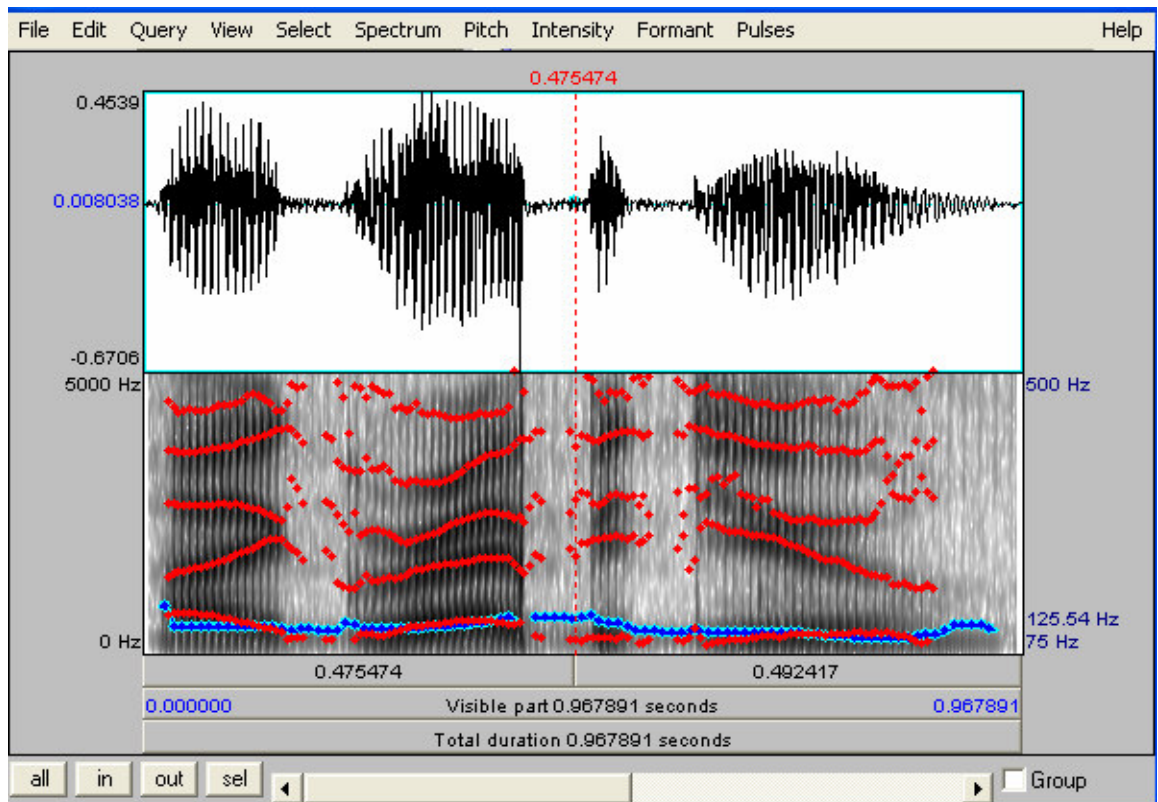
I grabbed you
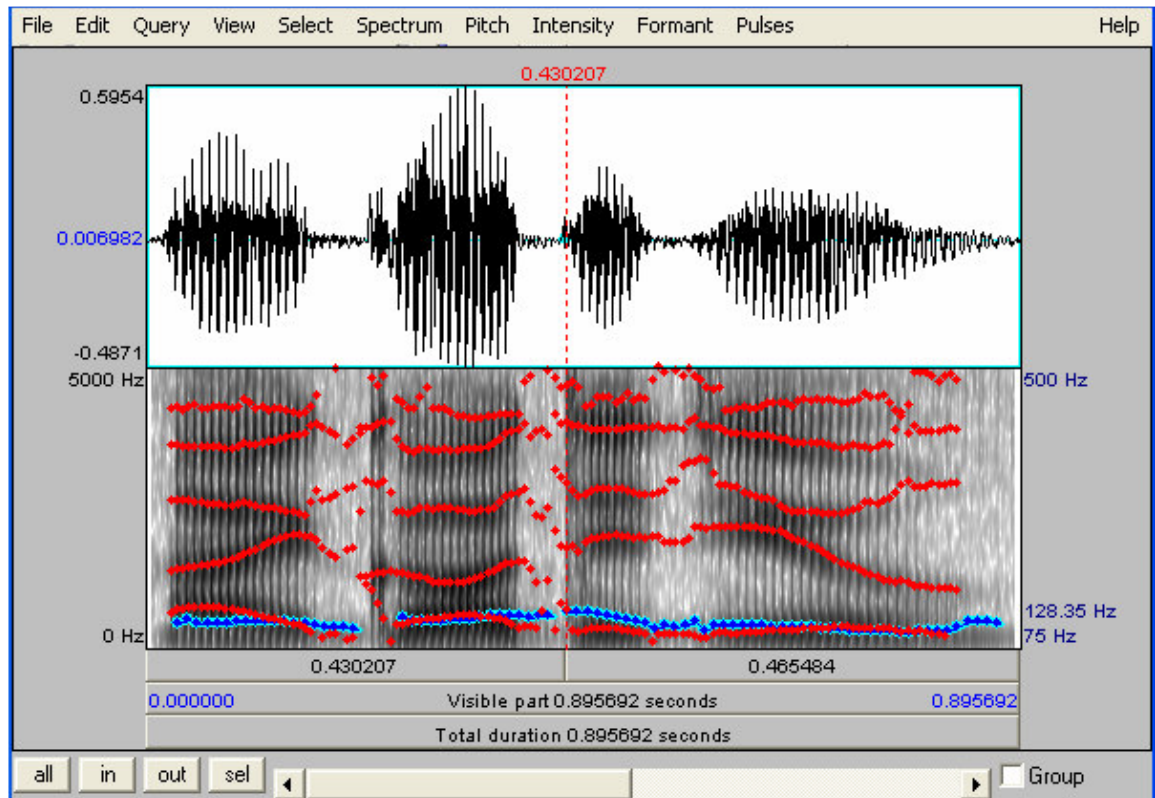
I godded you
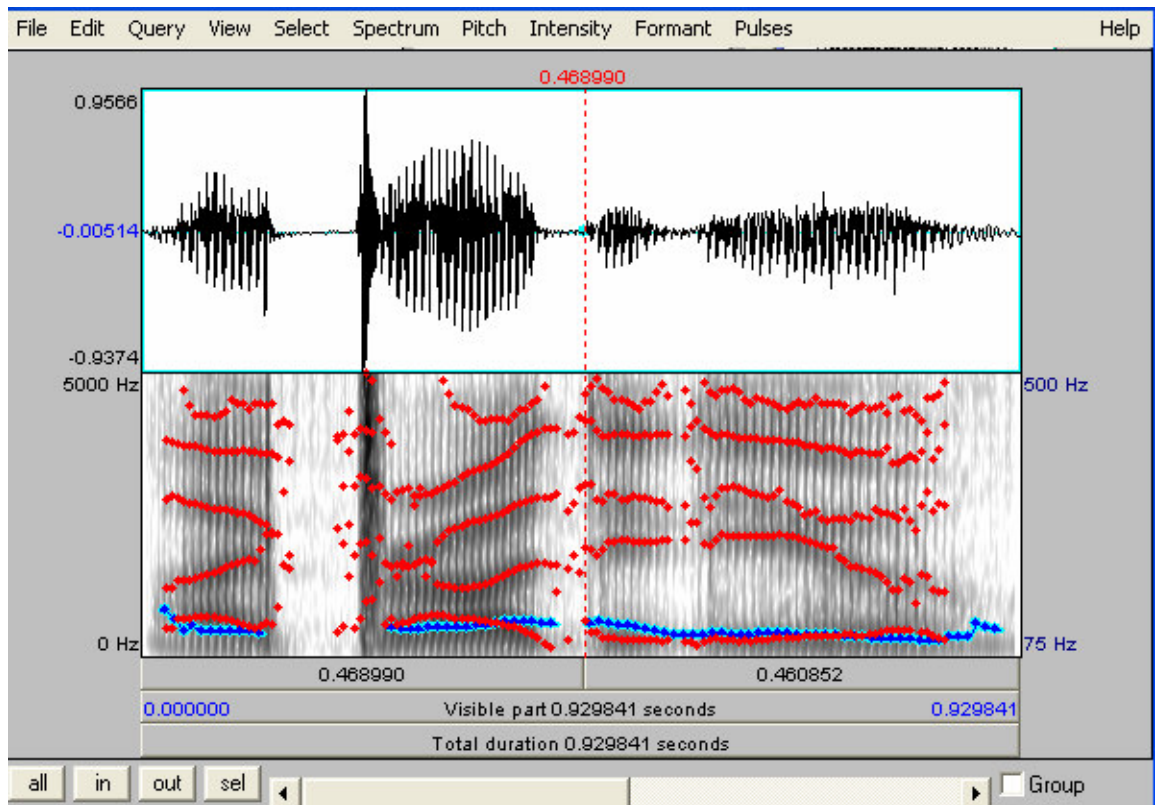
I prodded you
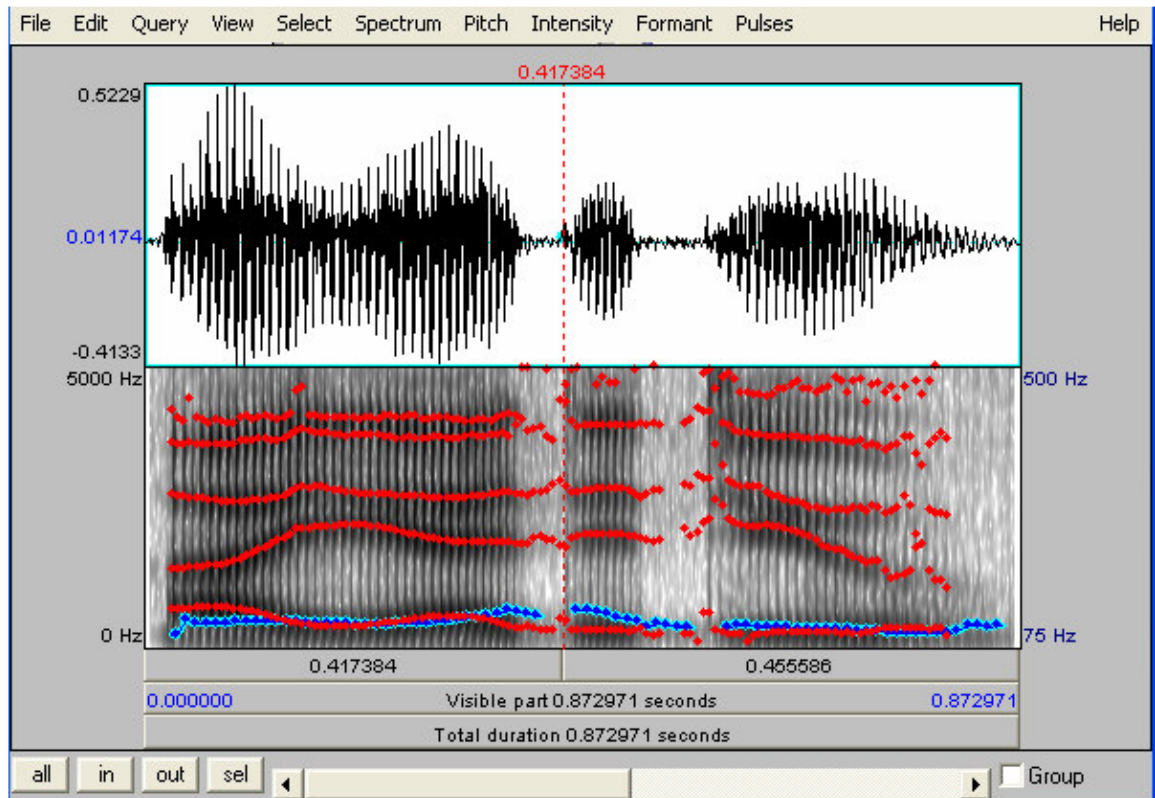
I added you
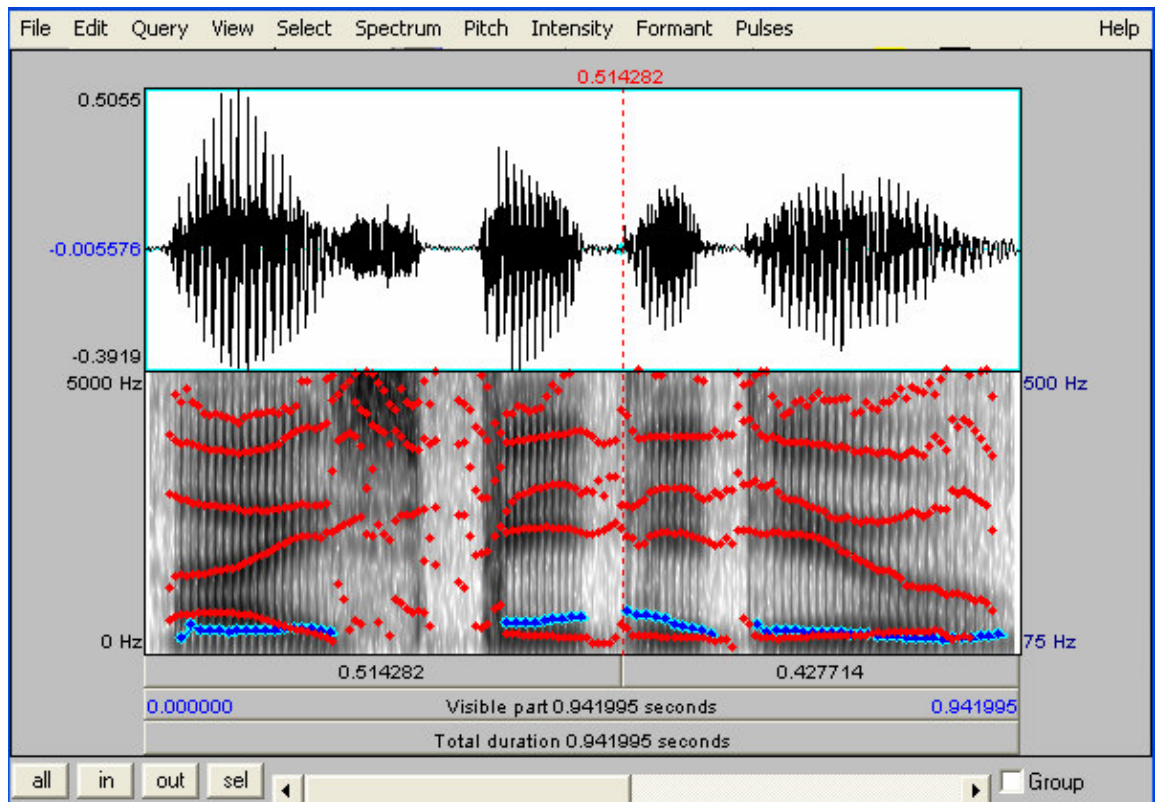
I speeded you
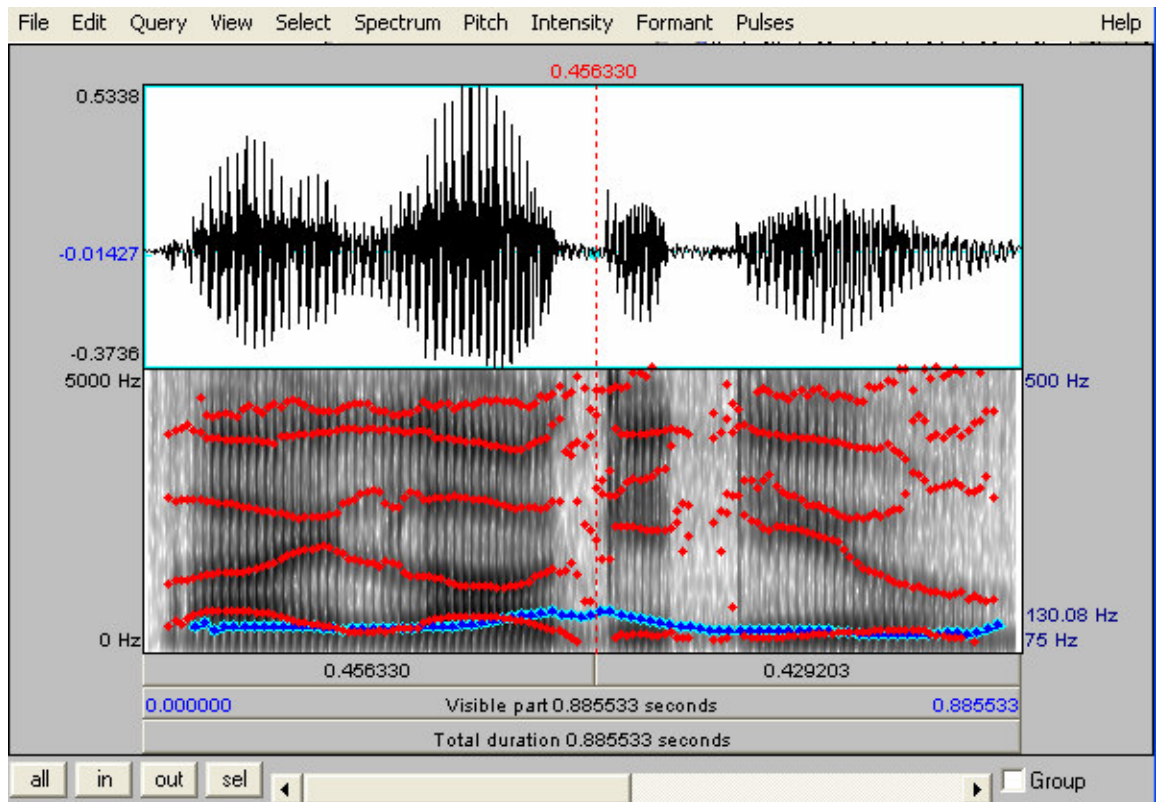
I logged you
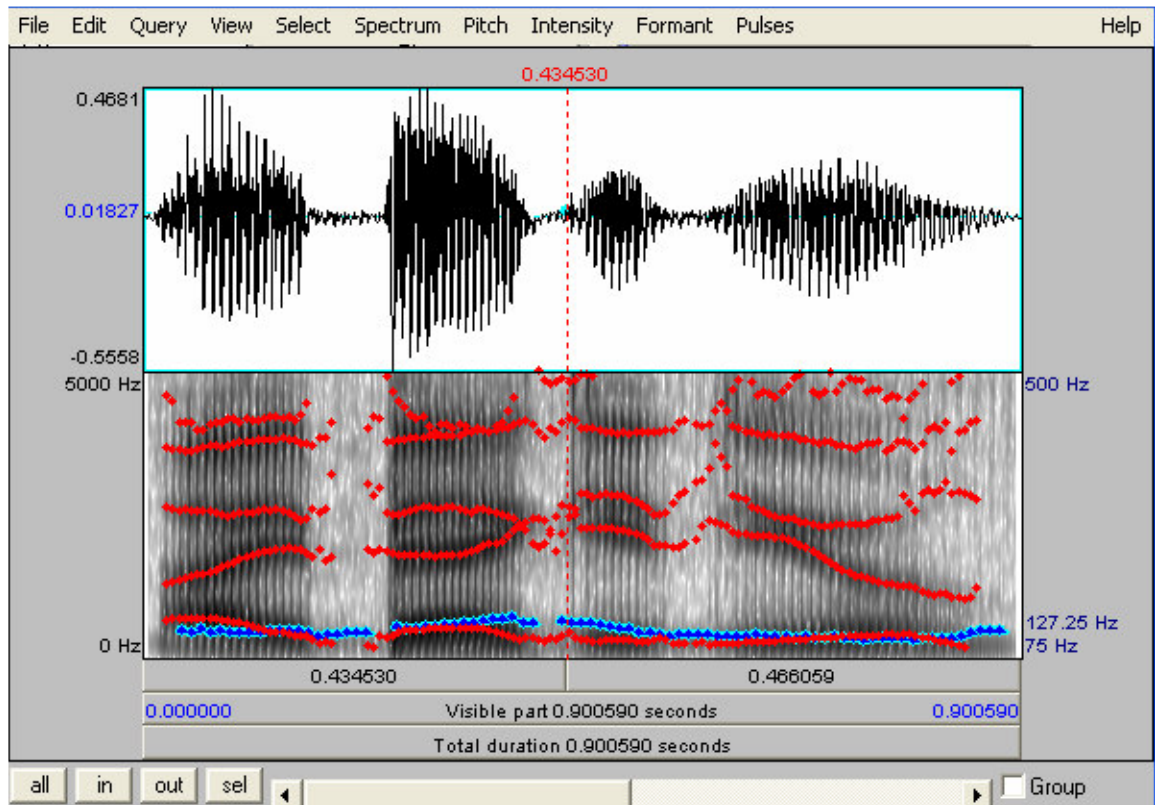
I begged you
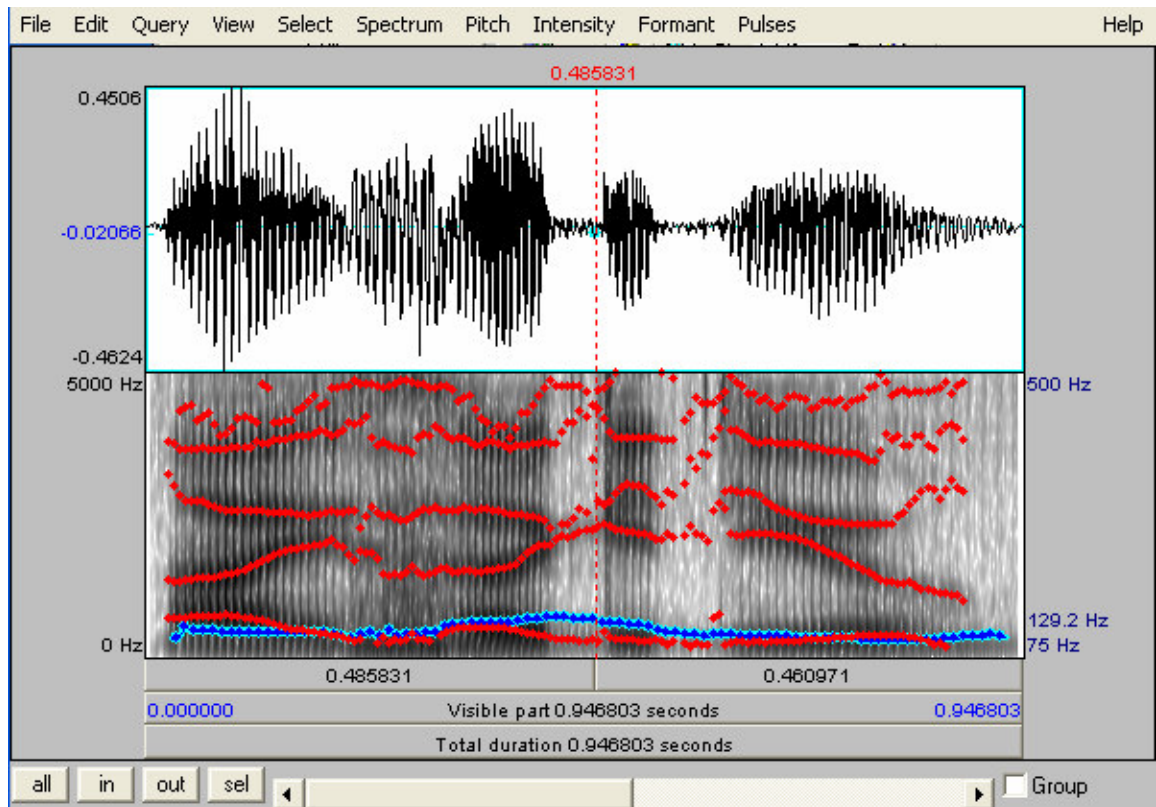
I hugged you
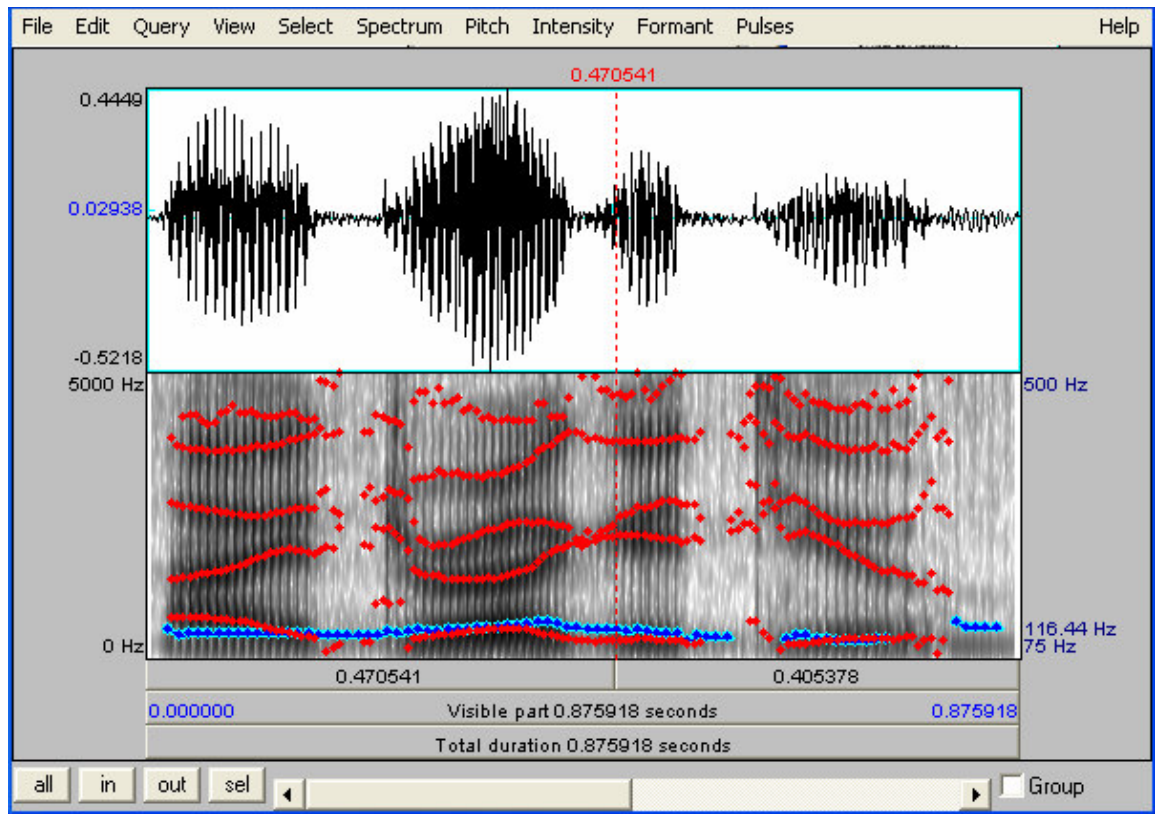
I drugged you

Appendix J

Carrier phrases for the production test

Target carrier phrases	Distractor phrases
hotted you	teach you
wetted you	understands you
locked you	get you
added you	reads you
rocked you	forgives you
blocked you	build you
skipped* you	draw you
tipped you	forgets you
dotted you	see you
logged you	knows you
begged you	give you
hugged you	teaches you
shocked you	pay you
speeded you	let you
drugged you	take you
stopped you	drives you
dropped you	gives you
spotted** you	makes you
robbed you	tell you
grabbed you	has you

dobbed*** you	hurts you
mobbed**** you	do you
godded you	buy you
prodded***** you	pays you

* to leave out or to jump somebody or something;

** to see or to notice somebody or something;

*** to secretly tell somebody that somebody else has done something wrong;

**** to crowd around or to attack somebody;

***** to push something or someone with your finger or with a pointed object or to encourage someone to take action.

Appendix K

Universidade Federal de Santa Catarina
Curso de Pós-Graduação em Inglês e Literaturas Correspondentes
Researcher: Rudinei Aldini Frese
Adviser: Profª Drª Rosana Denise Koerich

Judges Production Test Answer Sheet

According to the instructions you have received, check "a" if the target sound is pronounced correctly or check "b" if it is pronounced incorrectly.

Participant 01					
1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 02					
1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 03					
1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 04					
1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 05					
1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 06					
1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 07					
1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 08					
1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 09

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 10

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 11

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 12

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 13

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 14

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 15

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 16

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 17

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 18

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 19

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 20

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 21

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 22

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 23

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 24

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 25

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 26

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 27

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 28

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Participant 29

1	a	b	13	a	b
2	a	b	14	a	b
3	a	b	15	a	b
4	a	b	16	a	b
5	a	b	17	a	b
6	a	b	18	a	b
7	a	b	19	a	b
8	a	b	20	a	b
9	a	b	21	a	b
10	a	b	22	a	b
11	a	b	23	a	b
12	a	b	24	a	b

Appendix L

Judges Production Test Stimuli Transcript

Participant 01	**Participant 02**	**Participant 03**
1. I stopped you.	1. I stopped you.	1. I stopped you.
2. I dropped you.	2. I dropped you.	2. I dropped you.
3. I tipped you.	3. I tipped you.	3. I tipped you.
4. I skipped you.	4. I skipped you.	4. I skipped you.
5. I spotted you.	5. I spotted you.	5. I spotted you.
6. I dotted you.	6. I dotted you.	6. I dotted you.
7. I hotted you.	7. I hotted you.	7. I hotted you.
8. I wetted you.	8. I wetted you.	8. I wetted you.
9. I rocked you.	9. I rocked you.	9. I rocked you.
10. I blocked you.	10. I blocked you.	10. I blocked you.
11. I shocked you.	11. I shocked you.	11. I shocked you.
12. I locked you.	12. I locked you.	12. I locked you.
13. I robbed you.	13. I robbed you.	13. I robbed you.
14. I dobbed you.	14. I dobbed you.	14. I dobbed you.
15 I mobbed you.	15 I mobbed you.	15 I mobbed you.
16. I grabbed you.	16. I grabbed you.	16. I grabbed you.
17. I godded you.	17. I godded you.	17. I godded you.
18. I prodded you.	18. I prodded you.	18. I prodded you.
19. I added you.	19. I added you.	19. I added you.
20. I speeded you.	20. I speeded you.	20. I speeded you.
21. I logged you.	21. I logged you.	21. I logged you.
22. I begged you.	22. I begged you.	22. I begged you.
23. I hugged you.	23. I hugged you.	23. I hugged you.
24. I drugged you.	24. I drugged you.	24. I drugged you.

Participant 04	Participant 05	Participant 06
1. I stopped you.	1. I stopped you.	1. I stopped you.
2. I dropped you.	2. I dropped you.	2. I dropped you.
3. I tipped you.	3. I tipped you.	3. I tipped you.
4. I skipped you.	4. I skipped you.	4. I skipped you.
5. I spotted you.	5. I spotted you.	5. I spotted you.
6. I dotted you.	6. I dotted you.	6. I dotted you.
7. I hotted hot you.	7. I hotted hot you.	7. I hotted hot you.
8. I wetted you.	8. I wetted you.	8. I wetted you.
9. I rocked you.	9. I rocked you.	9. I rocked you.
10. I blocked you.	10. I blocked you.	10. I blocked you.
11. I shocked you.	11. I shocked you.	11. I shocked you.
12. I locked you.	12. I locked you.	12. I locked you.
13. I robbed you.	13. I robbed you.	13. I robbed you.
14. I dobbed you.	14. I dobbed you.	14. I dobbed you.
15 I mobbed you.	15 I mobbed you.	15 I mobbed you.
16. I grabbed you.	16. I grabbed you.	16. I grabbed you.
17. I godded you.	17. I godded you.	17. I godded you.
18. I prodded you.	18. I prodded you.	18. I prodded you.
19. I added you.	19. I added you.	19. I added you.
20. I speeded you.	20. I speeded you.	20. I speeded you.
21. I logged you.	21. I logged you.	21. I logged you.
22. I begged you.	22. I begged you.	22. I begged you.
23. I hugged you.	23. I hugged you.	23. I hugged you.
24. I drugged you.	24. I drugged you.	24. I drugged you.

Participant 07	**Participant 08**	**Participant 09**
1. I stopped you.	1. I stopped you.	1. I stopped you.
2. I dropped you.	2. I dropped you.	2. I dropped you.
3. I tipped you.	3. I tipped you.	3. I tipped you.
4. I skipped you.	4. I skipped you.	4. I skipped you.
5. I spotted you.	5. I spotted you.	5. I spotted you.
6. I dotted you.	6. I dotted you.	6. I dotted you.
7. I hotted hot you.	7. I hotted hot you.	7. I hotted hot you.
8. I wetted you.	8. I wetted you.	8. I wetted you.
9. I rocked you.	9. I rocked you.	9. I rocked you.
10. I blocked you.	10. I blocked you.	10. I blocked you.
11. I shocked you.	11. I shocked you.	11. I shocked you.
12. I locked you.	12. I locked you.	12. I locked you.
13. I robbed you.	13. I robbed you.	13. I robbed you.
14. I dobbed you.	14. I dobbed you.	14. I dobbed you.
15 I mobbed you.	15 I mobbed you.	15 I mobbed you.
16. I grabbed you.	16. I grabbed you.	16. I grabbed you.
17. I godded you.	17. I godded you.	17. I godded you.
18. I prodded you.	18. I prodded you.	18. I prodded you.
19. I added you.	19. I added you.	19. I added you.
20. I speeded you.	20. I speeded you.	20. I speeded you.
21. I logged you.	21. I logged you.	21. I logged you.
22. I begged you.	22. I begged you.	22. I begged you.
23. I hugged you.	23. I hugged you.	23. I hugged you.
24. I drugged you.	24. I drugged you.	24. I drugged you.

Participant 10	**Participant 11**	**Participant 12**
1. I stopped you.	1. I stopped you.	1. I stopped you.
2. I dropped you.	2. I dropped you.	2. I dropped you.
3. I tipped you.	3. I tipped you.	3. I tipped you.
4. I skipped you.	4. I skipped you.	4. I skipped you.
5. I spotted you.	5. I spotted you.	5. I spotted you.
6. I dotted you.	6. I dotted you.	6. I dotted you.
7. I hotted hot you.	7. I hotted hot you.	7. I hotted hot you.
8. I wetted you.	8. I wetted you.	8. I wetted you.
9. I rocked you.	9. I rocked you.	9. I rocked you.
10. I blocked you.	10. I blocked you.	10. I blocked you.
11. I shocked you.	11. I shocked you.	11. I shocked you.
12. I locked you.	12. I locked you.	12. I locked you.
13. I robbed you.	13. I robbed you.	13. I robbed you.
14. I dobbed you.	14. I dobbed you.	14. I dobbed you.
15 I mobbed you.	15 I mobbed you.	15 I mobbed you.
16. I grabbed you.	16. I grabbed you.	16. I grabbed you.
17. I godded you.	17. I godded you.	17. I godded you.
18. I prodded you.	18. I prodded you.	18. I prodded you.
19. I added you.	19. I added you.	19. I added you.
20. I speeded you.	20. I speeded you.	20. I speeded you.
21. I logged you.	21. I logged you.	21. I logged you.
22. I begged you.	22. I begged you.	22. I begged you.
23. I hugged you.	23. I hugged you.	23. I hugged you.
24. I drugged you.	24. I drugged you.	24. I drugged you.

Participant 13	Participant 14	Participant 15
1. I stopped you.	1. I stopped you.	1. I stopped you.
2. I dropped you.	2. I dropped you.	2. I dropped you.
3. I tipped you.	3. I tipped you.	3. I tipped you.
4. I skipped you.	4. I skipped you.	4. I skipped you.
5. I spotted you.	5. I spotted you.	5. I spotted you.
6. I dotted you.	6. I dotted you.	6. I dotted you.
7. I hotted hot you.	7. I hotted hot you.	7. I hotted hot you.
8. I wetted you.	8. I wetted you.	8. I wetted you.
9. I rocked you.	9. I rocked you.	9. I rocked you.
10. I blocked you.	10. I blocked you.	10. I blocked you.
11. I shocked you.	11. I shocked you.	11. I shocked you.
12. I locked you.	12. I locked you.	12. I locked you.
13. I robbed you.	13. I robbed you.	13. I robbed you.
14. I dobbed you.	14. I dobbed you.	14. I dobbed you.
15 I mobbed you.	15 I mobbed you.	15 I mobbed you.
16. I grabbed you.	16. I grabbed you.	16. I grabbed you.
17. I godded you.	17. I godded you.	17. I godded you.
18. I prodded you.	18. I prodded you.	18. I prodded you.
19. I added you.	19. I added you.	19. I added you.
20. I speeded you.	20. I speeded you.	20. I speeded you.
21. I logged you.	21. I logged you.	21. I logged you.
22. I begged you.	22. I begged you.	22. I begged you.
23. I hugged you.	23. I hugged you.	23. I hugged you.
24. I drugged you.	24. I drugged you.	24. I drugged you.

Participant 16	**Participant 17**	**Participant 18**
1. I stopped you.	1. I stopped you.	1. I stopped you.
2. I dropped you.	2. I dropped you.	2. I dropped you.
3. I tipped you.	3. I tipped you.	3. I tipped you.
4. I skipped you.	4. I skipped you.	4. I skipped you.
5. I spotted you.	5. I spotted you.	5. I spotted you.
6. I dotted you.	6. I dotted you.	6. I dotted you.
7. I hotted hot you.	7. I hotted hot you.	7. I hotted hot you.
8. I wetted you.	8. I wetted you.	8. I wetted you.
9. I rocked you.	9. I rocked you.	9. I rocked you.
10. I blocked you.	10. I blocked you.	10. I blocked you.
11. I shocked you.	11. I shocked you.	11. I shocked you.
12. I locked you.	12. I locked you.	12. I locked you.
13. I robbed you.	13. I robbed you.	13. I robbed you.
14. I dobbed you.	14. I dobbed you.	14. I dobbed you.
15 I mobbed you.	15 I mobbed you.	15 I mobbed you.
16. I grabbed you.	16. I grabbed you.	16. I grabbed you.
17. I godded you.	17. I godded you.	17. I godded you.
18. I prodded you.	18. I prodded you.	18. I prodded you.
19. I added you.	19. I added you.	19. I added you.
20. I speeded you.	20. I speeded you.	20. I speeded you.
21. I logged you.	21. I logged you.	21. I logged you.
22. I begged you.	22. I begged you.	22. I begged you.
23. I hugged you.	23. I hugged you.	23. I hugged you.
24. I drugged you.	24. I drugged you.	24. I drugged you.

Participant 19	**Participant 20**	**Participant 21**
1. I stopped you.	1. I stopped you.	1. I stopped you.
2. I dropped you.	2. I dropped you.	2. I dropped you.
3. I tipped you.	3. I tipped you.	3. I tipped you.
4. I skipped you.	4. I skipped you.	4. I skipped you.
5. I spotted you.	5. I spotted you.	5. I spotted you.
6. I dotted you.	6. I dotted you.	6. I dotted you.
7. I hotted hot you.	7. I hotted hot you.	7. I hotted hot you.
8. I wetted you.	8. I wetted you.	8. I wetted you.
9. I rocked you.	9. I rocked you.	9. I rocked you.
10. I blocked you.	10. I blocked you.	10. I blocked you.
11. I shocked you.	11. I shocked you.	11. I shocked you.
12. I locked you.	12. I locked you.	12. I locked you.
13. I robbed you.	13. I robbed you.	13. I robbed you.
14. I dobbed you.	14. I dobbed you.	14. I dobbed you.
15 I mobbed you.	15 I mobbed you.	15 I mobbed you.
16. I grabbed you.	16. I grabbed you.	16. I grabbed you.
17. I godded you.	17. I godded you.	17. I godded you.
18. I prodded you.	18. I prodded you.	18. I prodded you.
19. I added you.	19. I added you.	19. I added you.
20. I speeded you.	20. I speeded you.	20. I speeded you.
21. I logged you.	21. I logged you.	21. I logged you.
22. I begged you.	22. I begged you.	22. I begged you.
23. I hugged you.	23. I hugged you.	23. I hugged you.
24. I drugged you.	24. I drugged you.	24. I drugged you.

Participant 22
1. I stopped you.
2. I dropped you.
3. I tipped you.
4. I skipped you.
5. I spotted you.
6. I dotted you.
7. I hotted hot you.
8. I wetted you.
9. I rocked you.
10. I blocked you.
11. I shocked you.
12. I locked you.
13. I robbed you.
14. I dobbed you.
15 I mobbed you.
16. I grabbed you.
17. I godded you.
18. I prodded you.
19. I added you.
20. I speeded you.
21. I logged you.
22. I begged you.
23. I hugged you.
24. I drugged you.

Participant 23
1. I stopped you.
2. I dropped you.
3. I tipped you.
4. I skipped you.
5. I spotted you.
6. I dotted you.
7. I hotted hot you.
8. I wetted you.
9. I rocked you.
10. I blocked you.
11. I shocked you.
12. I locked you.
13. I robbed you.
14. I dobbed you.
15 I mobbed you.
16. I grabbed you.
17. I godded you.
18. I prodded you.
19. I added you.
20. I speeded you.
21. I logged you.
22. I begged you.
23. I hugged you.
24. I drugged you.

Participant 24
1. I stopped you.
2. I dropped you.
3. I tipped you.
4. I skipped you.
5. I spotted you.
6. I dotted you.
7. I hotted hot you.
8. I wetted you.
9. I rocked you.
10. I blocked you.
11. I shocked you.
12. I locked you.
13. I robbed you.
14. I dobbed you.
15 I mobbed you.
16. I grabbed you.
17. I godded you.
18. I prodded you.
19. I added you.
20. I speeded you.
21. I logged you.
22. I begged you.
23. I hugged you.
24. I drugged you.

Participant 25	Participant 26	Participant 27
1. I stopped you.	1. I stopped you.	1. I stopped you.
2. I dropped you.	2. I dropped you.	2. I dropped you.
3. I tipped you.	3. I tipped you.	3. I tipped you.
4. I skipped you.	4. I skipped you.	4. I skipped you.
5. I spotted you.	5. I spotted you.	5. I spotted you.
6. I dotted you.	6. I dotted you.	6. I dotted you.
7. I hotted hot you.	7. I hotted hot you.	7. I hotted hot you.
8. I wetted you.	8. I wetted you.	8. I wetted you.
9. I rocked you.	9. I rocked you.	9. I rocked you.
10. I blocked you.	10. I blocked you.	10. I blocked you.
11. I shocked you.	11. I shocked you.	11. I shocked you.
12. I locked you.	12. I locked you.	12. I locked you.
13. I robbed you.	13. I robbed you.	13. I robbed you.
14. I dobbed you.	14. I dobbed you.	14. I dobbed you.
15 I mobbed you.	15 I mobbed you.	15 I mobbed you.
16. I grabbed you.	16. I grabbed you.	16. I grabbed you.
17. I godded you.	17. I godded you.	17. I godded you.
18. I prodded you.	18. I prodded you.	18. I prodded you.
19. I added you.	19. I added you.	19. I added you.
20. I speeded you.	20. I speeded you.	20. I speeded you.
21. I logged you.	21. I logged you.	21. I logged you.
22. I begged you.	22. I begged you.	22. I begged you.
23. I hugged you.	23. I hugged you.	23. I hugged you.
24. I drugged you.	24. I drugged you.	24. I drugged you.

| Participant 28	Participant 29	Participant 30
1. I stopped you.	1. I stopped you.	1. I stopped you.
2. I dropped you.	2. I dropped you.	2. I dropped you.
3. I tipped you.	3. I tipped you.	3. I tipped you.
4. I skipped you.	4. I skipped you.	4. I skipped you.
5. I spotted you.	5. I spotted you.	5. I spotted you.
6. I dotted you.	6. I dotted you.	6. I dotted you.
7. I hotted hot you.	7. I hotted hot you.	7. I hotted hot you.
8. I wetted you.	8. I wetted you.	8. I wetted you.
9. I rocked you.	9. I rocked you.	9. I rocked you.
10. I blocked you.	10. I blocked you.	10. I blocked you.
11. I shocked you.	11. I shocked you.	11. I shocked you.
12. I locked you.	12. I locked you.	12. I locked you.
13. I robbed you.	13. I robbed you.	13. I robbed you.
14. I dobbed you.	14. I dobbed you.	14. I dobbed you.
15 I mobbed you.	15 I mobbed you.	15 I mobbed you.
16. I grabbed you.	16. I grabbed you.	16. I grabbed you.
17. I godded you.	17. I godded you.	17. I godded you.
18. I prodded you.	18. I prodded you.	18. I prodded you.
19. I added you.	19. I added you.	19. I added you.
20. I speeded you.	20. I speeded you.	20. I speeded you.
21. I logged you.	21. I logged you.	21. I logged you.
22. I begged you.	22. I begged you.	22. I begged you.
23. I hugged you.	23. I hugged you.	23. I hugged you.
24. I drugged you.	24. I drugged you.	24. I drugged you.

Participant 31
1. I stopped you.
2. I dropped you.
3. I tipped you.
4. I skipped you.
5. I spotted you.
6. I dotted you.
7. I hotted hot you.
8. I wetted you.
9. I rocked you.
10. I blocked you.
11. I shocked you.
12. I locked you.
13. I robbed you.
14. I dobbed you.
15 I mobbed you.
16. I grabbed you.
17. I godded you.
18. I prodded you.
19. I added you.
20. I speeded you.
21. I logged you.
22. I begged you.
23. I hugged you.
24. I drugged you.

Participant 32
1. I stopped you.
2. I dropped you.
3. I tipped you.
4. I skipped you.
5. I spotted you.
6. I dotted you.
7. I hotted hot you.
8. I wetted you.
9. I rocked you.
10. I blocked you.
11. I shocked you.
12. I locked you.
13. I robbed you.
14. I dobbed you.
15 I mobbed you.
16. I grabbed you.
17. I godded you.
18. I prodded you.
19. I added you.
20. I speeded you.
21. I logged you.
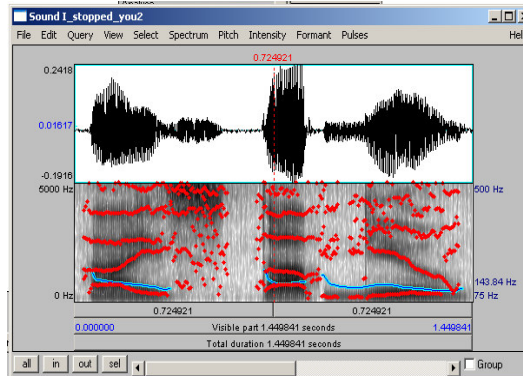22. I begged you.
23. I hugged you.
24. I drugged you.

Appendix M

Praat picture of /aɪˌstɑːpdˌʲuː/ with pause

Praat picture of /aɪˌrɑːkdˌyuː/ with pause
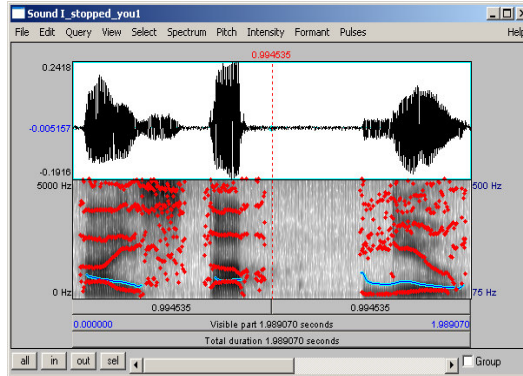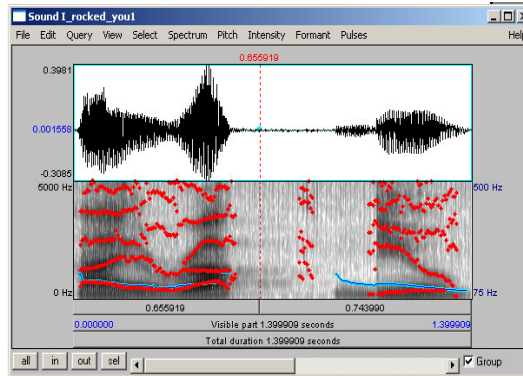
Praat picture of /aɪˌstɑːpdˌyuː/ without pause

Praat picture of /aɪˌrɑːkdˌyuː/ without pause