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RUBENS SOUZA DA CUNHA

The Open Post-Tonic High Front Vowel in Trochaic Bisyllables
A Study of Native Speaker and English Learner Corpora

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PROGRAMA DE PÓS-GRADUAÇÃO EM ESTUDOS LINGUÍSTICOS

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FOLHA DE APROVAÇÃO

The Open Post-Tonic High Front Vowel in Trochaic Bisyllables : A Study of Native Speaker and English Learner Corpora

RUBENS SOUZA DA CUNHA

Dissertação submetida à Banca Examinadora designada pelo Colegiado do Programa de Pós-Graduação em ESTUDOS LINGUÍSTICOS, como requisito para obtenção do grau de Mestre em ESTUDOS LINGUÍSTICOS, área de concentração LINGUÍSTICA TEÓRICA E DESCRITIVA, linha de pesquisa Estudos Linguísticos Baseados em Corpora.

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Belo Horizonte, 12 de maio de 2017.

To C, F and R

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It is my long-standing opinion that English, in its approximant /r/ varieties, is likely the most singer-friendly language that ever was.

Abstract

This is a phonetic study across three oral corpora: one with recordings of naturally spoken American English (the SBCSAE corpus), another with interviews with advanced Brazilian learners of English (the LINDSEI-BR corpus), and a third one, composed by recordings of spontaneous speech in Brazilian Portuguese (the C-ORAL-BRASIL corpus).

The main purpose was to investigate the realization and duration and second formant patterns of the phonologically lax high front vowel in free final position, [ɪ:]#, in English trochaic bisyllables, i.e., *happy* and *study*. The analysis of similar Portuguese [ɪ:]#-WORDS (such as *gente* and *sabe*), was also necessary for comparative purposes, since the project for this thesis originated from the impressionistic contention that native speakers of English consistently produce [ɪ:]#, even in their most casual speech. On the other hand, the English spoken by Brazilians and the Portuguese normally spoken in Brazil both often seem to exhibit [ɪ:]#-WORDS with an overly short or simply unrealized [ɪ:]#.

The results show that native speakers of English do produce [ɪ:]# consistently but that the vowel duration varies considerably (it varied between 33 ms and 124 ms in SBCSAE samples). In LINDSEI-BR the variation was even greater. Brazilian learners of English did not realize the [ɪ:]# in 10 words out of 32 analyzed. In all those cases of unrealized [ɪ:]#, there was phonetic similarity between the intervocalic consonant in the [ɪ:]#-WORD and the sound immediately following it (e.g. [p] and [b] in *happ(y) because*). The two sounds around [ɪ:]# may represent the same phoneme, e.g., (/r/ [ɪ:]# /r/), *ver(y) rich*; (/l/ [ɪ:]# /l/), *reall(y) like.* On the other hand, following pauses seem to have greatly favored the full realization of [ɪ:]# in the LINDSEI-BR, e.g., *She was very...*

The C-ORAL-BRASIL data indicate that, for Brazilian Portuguese, the expectations about [ɪ:]# should be readjusted for a different standard: The common behavior found in the corpus was the non-realization of the free vowel, e.g., the word *gente* was produced as [ʒẽtʃ] more frequently than as [ʒẽ.tʃɪ:]. A further reduction was observed in some other samples analyzed, apparently caused by a considerable distance between two stressed syllables. In a segmentation of the phrase *Sabe que que é?* the canonical sequence of syllables *Sa-be-que-que-é*? was reduced to *Sa-que-q'jé?*

Keywords: *phonetic study, duration, trochaic bisyllables, same phoneme, following pauses.*

Resumo

Este é um estudo fonético baseado em três córpora orais, dois deles em língua inglesa, sendo um de norte-americanos, falantes nativos e outro de aprendizes brasileiros avançados (o SBCSAE e o LINDSEI-BR, respectivamente). O terceiro corpus é de português brasileiro espontâneo (o C-ORAL-BRASIL).

Pesquisa-se, especificamente, a realização ou não e os padrões de duração e segundo formante da vogal alta anterior final, [ɪ:]#, em inglês, em dissílabos trocaicos, como *happy* e *study* e comparam-se os resultados com os de palavras análogas portuguesas, e.g., *gente*, na fala de brasileiros.

O projeto para esta tese teve origem em uma persistente impressão de que falantes nativos da língua inglesa consistentemente produzem [ɪ:]#, mesmo na fala mais espontânea. Essa impressão contrasta com o que aparentemente ocorre na fala de brasileiros em inglês e também no português normalmente falado no Brasil. Em ambos os casos, o [ɪ:]# frequentemente parecia ser muito curto ou simplesmente não realizado.

Os resultados obtidos indicam que o SBCSAE realmente apresenta consistentemente a realização de [ɪ:]#, mas que há grande variação na duração da vogal, tendo esta oscilado entre 33 e 124 ms nas análises feitas (a variação foi ainda maior no LINDSEI-BR). Os falantes do LINDSEI-BR não realizaram [ɪ:]# em 10 palavras entre 32 analisadas. Em todas essas 10 palavras há uma relação articulatória entre a consoante intervocálica que precede o [ɪ:]# e o som que imediatamente segue essa vogal. Quando esses dois sons representam um mesmo fonema, o [ɪ:]# frequentemente é eliminado, e.g., (/r/ [ɪ:]# /r/), em *ver(y) rich*; (/l/ [ɪ:]# /l/), em *reall(y) like.* Por outro lado, pausas seguintes parecem ter grandemente favorecido a realização da vogal livre no LINDSEI-BR. e.g., *She was very…*

Em relação ao português brasileiro, os dados obtidos no C-ORAL-BRASIL sugerem que as expectativas sobre o [ɪ:]# devam ser reajustadas para um padrão específico: O comportamento mais observado no C-ORAL-BRASIL foi a não-realização do [ɪ:]#, e.g., a palavra *gente* foi produzida mais frequentemente como [ʒẽtʃ] do que como [ʒẽ.tʃɪ:]. Uma redução ainda maior nas palavras pesquisadas foi observada em alguns casos, aparentemente provocada por grande distância entre duas sílabas tônicas. Em um dos exemplos (redução silábica), *Sabe que que é?* foi simplificado de *Sa-be-que-que-é?* para *Sa-que-q'jé?*

Palavras-chave: *estudo fonético, duração, dissílabos trocaicos, mesmo fonema, pausas seguintes*

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Symbol/ Name	**Description of use**
Advanced	A general label for the Brazilian learners of English (B-LNR-E) in the LINDSEI-BR corpus, although some subjects are more experienced than others.
Advanced (1)	LINDSEI-BR subjects with more years of English study than the intermediate group and fewer years than the experienced group
av	average
Asterisk (*)	used to indicate that a word was really produced in the way it is transcribed, as e.g., *gente* as [ʒẽ]*
BP	Brazilian Portuguese, with the most examples from Belo Horizonte speakers
B-LNR-E	Brazilian learners of English who have BP as their mother tongue
CCC	in PRAAT file names, indicates that the original file is from the C-ORAL-BRASIL corpus
C-ORAL-BRASIL	Corpus de referência do Português brasileiro falado informal (the Brazilian Portuguese informal speech corpus used in this thesis)
DH	[ð], in PRAAT file names, a voiced labiodental fricative, as in, e.g., *this*
English	basically General American, but some RP examples are also used
Experienced	LINDSEI-BR subjects with the most years of English study among the three groups of students in the corpus
F	Female speaker(s). (used to identify speakers in figures and in Praat file names, e.g., LLL F HAPPY… meaning: LINDSEI-BR corpus; female speaker; research word: *happy*)
FULL-[ɪː]#-WORD	A trochaic bisyllable of this thesis which presents all the canonical phonemes
I	In PRAAT file names, the symbol used for the [ɪː]# to indicate its duration within the research word. In the example below, [ɪː]# measures 36 ms. SSS F REALLY_H HARD SBC001_mono 1008 I = 36, W = 346
INT	The intervocalic consonant in the research words, e.g., [p] in *happy* and [b] in *sabe*
[ɪː]#-phrase	A phrase containing an [ɪː]#-WORD
[ɪː]#-WORD	A research word, such as *happy* or *really*
Intermediate	LINDSEI-BR subjects with the least years of English study in comparison with advanced and experienced ones
LIN	The LINDSEI-BR corpus

LLL	In PRAAT file names, indicates that the original file is from the LINDSEI-BR
M	Male speaker(s)
nr	Number
N-SPK-BP	Native speaker(s) of Brazilian Portuguese
N-SPK-E	Native speaker(s) of English
n/a	Not applicable. This was used to indicate that SYL-1 did not have F2 measured in words other than *happy* and *really* or when measurements were given for more words than just *happy* and *really*
NXT-SGM	The segment that immediately follows an [ɪː]#-WORD, e.g., in *many* parts, NXT-SGM is /p/
NXT-SYL	The first syllable of the NXT-WORD
NXT-WORD	A word immediately following an [ɪː]#-WORD
pct	Percentage
PH	A phrase, which may be a full utterance or just a phonological phrase
Phrase	A whole utterance or, frequently, a shorter unit of speech (many times it was not possible to analyze the whole utterance due to, e.g., a very long pause after the [ɪː]#-WORD)
ppp	In PRAAT file names, this symbol indicates that the NXT-SGM is a pause and not actually a segment
PrP	In PRAAT file names, a pre-pause (i.e., a pause that directly precedes the [ɪː]#-WORD) that lasts more than 200 ms (when the pause is shorter than that, it is indicated by a comma)
PRAAT file names	The names given to PRAAT files, which have limitations on the use of letters and symbols, so that e.g., [θ] (as in 'think') had to be represented by TH
PsP	In PRAAT file names, a post-pause that lasts more than 200 ms
Research vowel	The [ɪː]#
RP	Received Pronunciation
SBC	The SBCSAE
SBCSAE	The Santa Barbara Corpus of spoken American English
sic	In PRAAT file names, due to the fact that it was not possible to use an asterisk (asterisks are used in spectrograms and pitchgrids), I used sic to indicate that the given description was really intended. e.g., MANY_T (*many* things, with /th/ pronounced as /t/)

spk rate	This term is used in relation to the whole phrase in this thesis. The time taken for a speaker to realize one syllable, on average. If, in a phrase, a speaker takes 1500 ms to realize 10 syllables, then spk rate is of 150
SPKR	Speaker
SSS	In PRAAT file names, indicates that the original file is from the SBCSAE
SYL-1	The two first segments of an [ɪ:]#-WORD, e.g. [hæ] in *happy* (exceptions are stu.dy and e.le, in which SYL-1 has three and one segment, respectively). Secondarily, the term is also used to represent the first syllable in the specific phonology of a language.
SYL-2	The two final segments of an [ɪ:]#-WORD, e.g., [pɪ:] in *happy*. Secondarily, the term is also used to represent the second syllable in the specific phonology of a language.
Syllabifica -tion	The tentative combination of morphology and phonetics made for PRAAT file names, in order to better illustrate the way words were really spoken (in a direct relation with morphological form), and to count syllables in phrases and subsequently calculate spk rate. It was not possible to distinguish syllables between light and heavy, or reduced and not reduced, monomoraic and bimoraic
t	In PRAAT file names, a tap (flap) as a NXT-SGM, e.g., *happy* to be doing it, when to was pronounced with a tap for /t/.
TH	[θ], in PRAAT file names, a NXT-SGM which is a voiceless labiodental fricative, e.g. 'think'
Tier	The name used for each line in the PRAAT textgrid, which follows the pitch contour images
Trochaic bisyllable	A bisyllabic word with stress on the first syllable. Differently from a trisyllable, for example, a bisyllable tends to have only one strong syllable (i.e., a trisyllable may have two strong syllables, usually the first and the third one. e.g., 'generate' (Sws) as exemplified by Cutler (ibid.)
tt	Total or totals
UFMG	Universidade Federal de Minas Gerais (The Federal University of Minas Gerais, located in Belo Horizonte)
V	Vowel
W	A woman or women; a research word, mostly used to indicate word duration for comparisons with the [ɪ:]# and the whole phrase
W1	The first word in a word boundary. The elements of interest in this thesis are the two last or the last segment of the word
W2	The second word in a word boundary. The elements of interest in this thesis are the one or two first segments of the word

W1#W2	The boundary of two adjacent words, especially considering the last segment(s) in W1 and the first segment(s) in W2
ZERO-[ɪː]#-WORD	A trochaic bisyllable which lacks the final vowel, [ɪː]# (such cases were found in LINDSEI-BR and C-ORAL-BRASIL)
ZERO-SYL-2 -WORD	A trochaic bisyllable which lacks both the final vowel, [ɪː]# and its preceding consonant, INT (such cases were found only in C-ORAL-BRASIL)

List of Phonetic Symbols for English and BP

Vowel and consonant chart for English (based on Pickett, 1999, p. 6) with analogous sounds in BP (most words are taken from phrases analyzed from SBCSAE and LINDSEI-BR)

Vowels	English examples	BP examples	Consonants	English examples	BP examples
[i]	people	participa	[j]	you	folha [fo.ljɐ]
[ɪ]	did		[w]	were	
[ɪ:]	happy		[m]	many	come
[ɛ] *	very	é; quer	[b]	beautiful	sabe
[e]		ele; cê	[v]	very	vou
[ɑ]	job		[p]	people	procurou
[ɔ]	for (stressed)	pode	[f]	for	fazer
[oʊ]	radio		[ð]	them	
[ʊ]	good		[θ]	things	
[u]	movies		[n]	now	não
[ʌ]	study		[l]	like	levar
[ə]	nerv<u>ous</u>		[d]	do	desses
[ɜɹ]	n<u>er</u>vous		[z]	things	fazer
[aɪ]	hide		[t]	tired	também
[aʊ]	now		[s]	say	sabe
[eɪ]	native		[tʃ]	rich	gente (when pronounced as [ʒẽ.tʃɪ:] or [ʒẽtʃ]
[a]	hard (Boston English)	sabe	[dʒ]	job	pode (when pronounced as [pɔ.dʒɪ:] or [pɔdʒ]
[ɐ] **		casa	[ɹ]	really	only occasionally used in C-ORAL-BRASIL
[ɨ] ***	r<u>ea</u>lly				
[ɪ:]# ****	reall<u>y</u>				

Notes:	
* [ɛ] and [e]	In BP [ɛ] and [e] are often distinctive (in stressed position) in words such as sede [se.dʒɪ:] (thirst) vs sede [sɛ.dʒɪ:](headquarters)
* * [ɐ] vs [ə]	Some researchers consider that the final sound of BP words such as casa [ɐ], is the same as the schwa [ə]. But it seems that the possible segments represented, in BP, by [ɐ] can frequently be quite long and very alike [a:]. It should be noted that, while [ə] can replace any morphological vowel in English, in BP, [ɐ] can only represent /a/, and this might favor a strong phonological identity between the phoneme /a/ and its possible physical manifestations in BP
*** [ɨ]	The symbol for IPA 'barred /i/'. It was used when the F2 of the phonologically tense vowel /i/ averaged under 1700 Hz in the [ɪ:]#-WORD *really* (i.e., it was actually realized as a centralized vowel). Such an occurrence was registered nine times in the SBCSAE (i.e., the vowel in the initial, stressed syllable of the word and not the final vowel, [ɪ:]#)
**** [ɪ:]#	This is a barred [ɪ:], or a centralized high front vowel in a weak syllable. It was used once for a final vowel in the word *really* by an SBC speaker who realized a very low (centralized) F2 vowel in the final, post-tonic position.
Comment:	From the point of view of a N-SPK-BP, for the stressed vowel in words such as happy it would make more sense to use a symbol like [aɛ] than the IPA symbol [æ], since [e] (the second part of the symbol in [æ]) is used, in isolation, to represent a much higher vowel than [a]

List of oral and nasal vowels in BP	
Oral and nasal vowel contrasts in Brazilian Portuguese	Examples with translations
a/ã	lá/lã (there/wool)
aɪ/ãɪ	cais/cães (wharf/dogs)
aʊ/ãʊ	nau/não (ship/no)
e/ẽ	leda/lenda (merry/legend)
ei/ẽɪ	sei/sem (I know/without)
i/ĩ	se/sim (if/yes)
o/õ	ode/onde (ode/where)
u/ũ	o/um (the/one)

Chapter 1 - Introduction

This is a phonetic study on vowel duration, which investigates patterns of realization of the phonologically lax high front vowel in final position of trochaic bisyllables, e.g., English *happy* and *study* and Brazilian Portuguese (BP) *gente.* All the data for the analysis originate from three oral corpora, two in English and one in BP. The first corpus contains recordings of American native speakers of English (N-SPK-E) and the second one, of advanced [1] Brazilian learners of English (B-LNR-E). The third one is a BP corpus containing spontaneous speech. The subjects recorded in this last corpus are native speakers of BP (N-SPK-BP) and live in the same area as the B-LNR-E (i.e., in and around the city of Belo Horizonte, State of Minas Gerais)**.**

The chosen corpora are the *Santa Barbara Corpus of Spoken American English*, SBCSAE (SBC); the LINDSEI-BR (LIN); and the *Corpus de referência do português falado informal,* C-ORAL-BRASIL. While the two first corpora are directly comparable for realizations of words in English, the third one serves as a data bank for study of possible influences of BP on the B-LNR-E realizations of the high front vowel of interest and the words and phrases containing them.

The vowel analyzed is represented phonetically in this thesis as [ɪː]#, following Harrington, 2005 (p. 441). The author uses the representation [ɪː],[2] for words such as *happy;* [ɪ], for *kit;* and [i], for *fleece*. The symbol **(#)** is used, in the present thesis, to indicate word end (i.e., right word boundary). The English *y*-ending bisyllables containing the vowel of interest, as well as similar Poruguese words will, henceforth, be referred to as *[ɪː]#-WORDS* or *research words*. Examples of similar English trochaic bisyllables (i.e., ending in the same phonological vowel) which do not end in *y* are *coffee* and *posse.*

Most of the reasoning in the proposal for this thesis and in the research questions was based

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[1] The term 'advanced' has two meanings in this thesis: it refers both to all the LIN speakers in general and also to the middle group within it, as the subjects in LIN were classified as *experienced, advanced* and *intermediate.*

[2] The actual IPA symbol for an elongated sound is not exactly the colon (:), but a more complicated symbol, difficult to reproduce in a normal text (ː).

on personal experiences as an English teacher and as a dilettante in a couple foreign languages rather than on actual experience with phonetic data analysis.[3]

To the ear of this Brazilian observer, one distinguishing feature of spoken English has long appeared to be the 'remarkable stability' with which N-SPK-E consistently seem to realize, even in very informal speech, the final high front vowel of words such as the above-mentioned *happy* and *study.*

The impression of '[ɪː]#-stability' in N-SPK-E speech sharply contrasts with the one I have always had, as a teacher, from beginning learners of English, N-SPK-BP, because they frequently seem to realize English [ɪː]#-WORDS with very short or faint [ɪː]#s or simply with complete 'skipping' of the research vowel.

The [ɪː]# is phonologically distinctive in English, mainly because it normally represents one additional syllable in otherwise monosyllabic words. It distinguishes many English words, a fact observable in the following noun - adjective pairs: *ease* > *easy* [iz], [iz.ɪː]; *sleep* > *sleepy* [slip], [slip.ɪː]; *sun* > *sunny* [sʌn], [sʌn.ɪː], as well as in other similar pairs, such as *red / ready* [ɹɛd], [ɹɛd.ɪː] and *store /* story [stɔɹ], [stɔɹ.ɪː], or even *earl / early* [ɜɹl], [ɜɹl.ɪː] and *stud* / *study* [stʌd], [stʌd.ɪː] - [stʌɾ.ɪː][4].

The apparent [ɪː]#-keeping characteristic of English seems noticeably different from BP speech, probably due to the fact that similar Portuguese words do not seem to require consistent realizations of [ɪː]# for prompt understanding by N-SPK-BP. In BP, the final vowel sound in [ɪː]#-trochaic bisyllables seems to be in free variation with zero realization. Words such as *gente* do not have similar pairs in Portuguese (i.e., they have no other words contrasting with them for presence/absence of final high front vowel). Apparently because of this lack of 'word-boundary competition', [ɪː]#-WORDS in BP do not seem to present,

[3]The author of this thesis is a native speaker of Brazilian Portuguese and is graduated in English and French, besides having basic knowledge of German and Latin.

[4] The intention behind this study was not to simply indicate differences in the pronunciation of [I:]# by Brazilians and Americans but, hopefully, to tap into broader aspects of the phonologies involved.

phonetically, a 'standard' pronunciation for the final vowel, and very often that vowel appears to be left out. This notion that Brazilians, while speaking in Portuguese, tend not to regularly pronounce [ɪ:]# was supported in initial analyses of a few words from the C-ORAL-BRASIL which are analogous to English [ɪ:]#-WORDS: in some cases, the [ɪ:]# was realized and in others it was not, even in samples by single speakers.

Considering also that the reduction or deletion of English [ɪ:]# by B-LNR-E is generally observed to become less frequent after the initial stages of learning of the language, it would appear reasonable to deduce that the Brazilian '[ɪ:]#-instability' is probably an influence of BP-phonology. It seems to be a fact that those B-LNR-E who have studied English beyond the basic levels usually do realize a perceptible English [ɪ:]#. Still, their production does not always seem fully regular or smooth. During preliminary auditions of parts of the LINDSEI-BR, it sounded like many speakers resorted to pauses before saying [ɪ:]#-WORDS and when they did not pause, they frequently would fail to produce the research vowel. LIN subjects who spoke more slowly seemed to be able to realize the [ɪ:]# every time.

In BP, the word *gente* may be variously pronounced by different speakers, and influenced by context, as [ʒẽ.tʃɪ:], [ʒẽ.tɪ:], [ʒẽtʃ], [ʒẽt] or even [ʒẽ], without causing any confusion or hesitation in the listener. It is a contention of this thesis, however, that, at the level of lexical representation, i.e., the association that speakers of a language make between the written and the spoken word (Mohanan, 1982, p. 29)**,** N-SPK-BP would consider that Portuguese words such as *gente, pode*, etc., are, by all means, bisyllabic and should, when 'correctly pronounced', be realized as [ʒẽt.t(ʃ)ɪ:], [pɔ.d(ʒ)ɪ:] etc. In this sense, N-SPK-BP would not be fully conscious of when exactly they produce the research vowel and when they do not.

> There are several interesting properties that converge on the level of lexical representation. The judgments of the native speakers of a language on the sameness and distinctness of sounds appear to be based on this level, not on the underlying or the phonetic. Thus, speakers of English judge the /p/ in *pin* and *spin* to be the same sound, in spite of the phonetic difference in aspiration: ([phin] vs [spin]). (ibid.)

In order to start an objective investigation of the [ɪː]#-WORDS, then, it was concluded that the basic comparison to be made between the SBC and the LIN had to be through measurements of [ɪː]# duration. Those measurements should be compared with similar words taken from the C-ORAL-BRASIL. One of the first conclusions that could be taken from this would be to which corpus the LINDSEI-BR is closer in terms of [ɪː]# realization patterns, whether the Brazilian or the American. For the analysis of those patterns, other measurements were also needed, such as of fundamental frequency (F0) variations, degrees of emphasis and, as an apparently favoring factor for [ɪː]# realization in the LINDSEI-BR, the use of pre- and post-pauses. The impressionistic notion of a reduced or unclear [ɪː]# in the speech of Brazilians might also be related with articulatory and acoustic features of the vowel. For this reason, measurements of the second formant, F2, should be systematically made for each research vowel analyzed in the comparative investigation among different speakers from SBC, LIN and C-ORAL-BRASIL.

"The average locations of F1 and F2 for an individual are also affected somewhat by language environment and training." Pickett (1999, p. 40).

Research questions

It was necessary to phonetically segment the [ɪː]#-WORDS for the obtention of comparative measurements. For this purpose, the PRAAT software package was chosen (PRAAT. Doing Phonetics by Computer, by Paul Boersma and David Weenink). URL = http://www.fon.hum.uva.nl/praat/. The measurements obtained should indicate answers to the following questions:

1) What are the proportions of the LINDSEI-BR, the SBCSAE and C-ORAL-BRASIL [ɪː]#-WORDS with full, reduced and null realizations of [ɪː]#?;

2) What contextual elements, such as pre- and post-pauses, emphases, as well as features of voicing, place of articulation etc., of the segment immediately following the [ɪː]#, (NXT-SGM), would favor or disfavor the full realization of the research word?;

3) How are sounds distributed in duration, e.g., in an occurrence of the word *very,* how long are, on average, [v], [ɛ], [ɹ] and [ɪː]?;

3.1) When the [ɪː]# is not produced, how are durations of sounds rearranged in relation to 'normal' realizations ? e.g., the word *very* realized with only the three initial segments ([v], [ɛ] and [ɹ]) in relation to a normally pronounced, four-segment word?;

4) What are the effects of pauses and emphases on the durations of [ɪ:]# samples studied in each corpus?;

5) How recurrent are pauses in LIN in comparison with the N-SPK-E corpus?

5.1) Are pauses and emphases also used purposefully in the C-ORAL-BRASIL?;

6) What are the average measurements of the second formant in the research vowel?

6.1) Is the [ɪ:]# F2 by B-LNR-E and N-SPK-BP similar to that of N-SPK-E? Does the Brazilian [ɪ:]# seem 'unclear ' because it is actually a different articulation?

7) Do the three corpora differ in the reasons why they exhibit suprasegmental features of pauses and emphases? How so?

8) How does the C-ORAL-BRASIL relate with the LINDSEI-BR in the production of [ɪ:]#-WORDS in English?

Hypothesis

In English, the types of words proposed for investigation are very often distinguishable from similar, monosyllabic ones, by the presence of [ɪ:]#, as in the comparison, *store / story*. Advanced B-LNR-E are expected to know the phonological differences. Considering, however, that the final vowels of similar BP trochaic bisyllables do not need to be distinctive in the same way (i.e., presence vs absence of a high front vowel after the intervocalic consonant), LINDSEI-BR speakers could be expected to frequently hesitate or pause before the English [ɪ:]#-WORDS, for considering them somehow 'marked'. Thus, B-LNR-E would tend to overemphasize the pronunciation of the [ɪ:]#-WORDS, but when they did not pay special attention or spoke fast, they would tend to produce BP-like, short [ɪ:]#s or no vowel at all. Therefore, very different [ɪ:]# realizations should be expected for the LINDSEI-BR [ɪ:]#, duration-like: sometimes overlong, sometimes unsuitably short or null.

In relation to the SBCSAE, since 'remarkable stability' is supposed to be the norm, contextual influences on the duration and second formant of the research vowel should be comparatively immaterial.

Chapter 2 - The syllable and word boundaries in English and in BP; the high front vowel [ɪ:]# and the difficulties inherent in speech segmentation

This chapter initially considers several aspects that differentiate English from BP in what concerns variety in phoneme inventories (especially word-final) and syllabification rules, besides some other particularities of each language. Next, there is a brief analysis of other works related with this thesis and, finally, some conclusions and advice from experienced linguists on the difficulties of speech segmentation and on the best ways to cope with the task.

2.1 - Phoneme distribution in syllable and word boundaries in English and in BP; boundary sounds restrictions and preferences; stressed, strong and weak syllables; the bigger picture of morphology, syntax and etymology

This section examines the differences in phoneme inventories of syllable and word boundaries in English and in BP, especially right word boundaries. Syllabification rules and the loss of final vs initial sounds are focused. Syllables are classified as stressed, strong and weak and their typical positions in the two languages are studied. Possible influences of syntax on word order and semantic content are related with phonetic realizations. Etymological influences on syllabification are suggested. The questions of why English seems to always preserve post-tonic sounds while BP does not, and why BP tends to preserve pre-tonic sounds while English sometimes does not, are approached.

"Lexicon, morphology, and syntax are not abstractions; they are knowledge which speakers of the language possess, a knowledge which is largely unconscious for native speakers, who acquired the language in the earliest years of life". (Kreidler, 2004, p. 9).

For the sake of clarity, I start this subsection with a couple etymological and syntactic comparisons. Then follow analyses of stress position, phoneme restrictions in syllable codas, syllable length, vowel and syllable loss and, finally, an illustrative set of examples of how some foreign words get modified when they are adapted to English and BP phonologies.

2.1.1 - Do etymology and syntax differently influence syllabification and the realization of final sounds in English and in BP?

The random choice of the word *Atlanta* for a comparative illustrative syllabification in English and in Portuguese and the (also random) choice of the phrase *as meninas pequenas* (the small girls) for a comparative syntactic analysis in this section, led me to consider etymology and the way syntax differently organizes semantic information in the two languages as possible strong influences on today's Brazilian and English ordinary speech.

There are considerable syntactic differences between English and Portuguese at the level of the sentence and, apparently, different weights given to etymology at the level of the syllable. Portuguese tends to give essential information in the beginning of the sentence and to use a 'linking' consonant between morphemes to, supposedly, make pronunciation easier, which is also typical of French (*liaison*).

In what concerns syntactic ordering of information, let us compare the phrase *the small girls* with its Portuguese equivalent, *as meninas pequenas.* Several semantic differences promptly become apparent. In *the small girls*, there is no indication, in the two first words, of what is being talked about, except that it is *small*. Only in the final word of the phrase do we realize what is being described and only in the last phoneme do we get to know whether it is singular or plural. In *as meninas pequenas*, on the other hand, the initial word already tells that the subject of discussion is feminine and plural. When one gets to the last stressed syllable in the phrase, /que/ (*as me<u>ni</u>nas pe<u>que</u>nas*), and hears the onset of SYL-3, ([n]), all the essential information has already been given. This could be a contributor to the weakening or elimination of final sounds in Portuguese or to the resyllabification of words, with syllable reduction. But if syllable reduction does occur in Portuguese (or in BP), the ensuing resyllabification may create unpredicted, closed syllables: (pe.que.nas) → (pe.quen*). According to Câmara Jr., 1977 (pp. 47-48), BP final post-tonic syllables are considerably weak, having *"atonicidade máxima"* (maximal stresslessness).

At the level of the single word, English seems to preserve the original pronunciation of several morphemes while Portuguese loses them to simplify syllabification (as, typically, the

CV syllable prevails). Example words are *Atlanta* and *attract*, syllabified below. English does not reduce the initial vowel in *Atlanta* ([æt.læn.tə]) nor separates it from the following consonant, probably because of the word's relation with *atlas* and *atlantis.* Portuguese, for its part, reaffirms its typical preference by simply subdividing the word into open syllables, ([a.tlã.tɐ]), thus giving no indication as to the word's etymology at the syllabic level. It has appeared, during the present study, that a word root in English words has more of a tendency to be preserved in beginnings of words than have prefixes (e.g., *At.lan.ta* vs (*re)mem.ber*). If it ever was someone's intention to preserve morphemes as transparent as possible in words borrowed from other languages, that would necessarily require the permission, within the language's phonological system, for syllables to end in several different sounds. English seems very apt at that, considering its remarkable syllable-final reality, as partly illustrated in Table 2.2). The *the small girls* example seems also to be a good way of training the ear to listen carefully for the very last sound of a word or phrase.

For such reasons, it seems that, also for phonetic analysis, it may sometimes be necesary to think beyond purely phonetic terms. The official Portuguese grammar is often redundant. Portuguese has masculine and feminine nouns, usually ending in /o/ and /a/, respectively. Most adjectives follow the same rule. *The pear*, for example, is feminine in Portuguese (*a pera*), but *the strawberry* is masculine (*o morango*). The phrase *as meninas pequenas* has three markers of feminine and three markers of plural (*as*), so that, in informal conversation, the speaker might be excused for not abiding by traditional grammar rules and repeating all those redundancies. In the example, the second and/or the third plural markers, (*s*), may be deleted: i.e., *as menina(s) pequena(s)*. Portuguese has an echoing gender / number agreement system which English does not. Incidentally, English has the qualifying word first and the real content word coming only in the end of adjective-noun type phrases. That difference of content-word position between English and Portuguese may cause speakers of the two languages to have different attitudes in their speech. In English, the 'more concrete' word often comes in the end.

2.1.2 - The English preference for strong initial syllables and the apparent BP tendency for word-final stress

"The most fundamental unit of speech seems to be the syllable. On the articulatory side, the syllable is produced by the alternation between open and constricted phases of the upper vocal tract". (Pickett, op. cit., p. 146).

This thesis uses Kreidler's identification of syllables by means of capital and small letters. An English stressed syllable is represented by *S*, a strong but not stressed syllable is represented by *s* and a reduced syllable (with schwa vowel) is represented by *w*. "Numerous English words contain one strong syllable (containing the stressed vowel) and one or more weak syllables." (Kreidler, op. cit., p. 74). e.g., *salad* (*Sw*). "In long words, there may be two strong syllables. Of course, only one of the strong syllables is the stressed syllable." (ibid.). e.g., *engineer* (*swS*). [5.] This has been adapted to BP in the present thesis, by means of always attributing the strong, *s*, status to pre-tonic syllables and the status of weak, *w*, syllables to post-tonic ones. [6]

According to Cutler (apud Tohkura et al., op. cit., pp. 419-422), laboratory tests have repeatedly shown that native English speaking listeners treat any strong syllable as if it were highly likely to be word-initial. The researcher adds that it is not fundamental whether an initial full vowel is the main stress of the word or not. As shown in the following examples, *generous* (*Sww*), *generate* (*Sws*) and *generation* (*swSw*) all have clearly strong initial syllables while e.g., *generic* has a weak initial syllable. "Weak syllables are those which contain central, or 'reduced' vowels" (ibid.). She relates that in tests when speakers had to produce words beginning with weak syllables, they frequently paused before those syllables, apparently to indicate to the listener that the following syllable, although weak, was word-

[5] It seems that, while English tends to have a stressed syllable in the beginnings of bisyllables (e.g, *salad*) it usually has a weak syllable in the middle of trisyllables (e.g., *engineer*). Because of that, this thesis considers a usually non-reduced syllable as a strong syllable in both English and BP. The word *happy*, for example, is considered to have *Ss* syllables (stressed - strong), while the word *restaurant* is considered to be *Sws*. In the case of words in BP, pre-tonic syllables are considered strong and post-tonic syllables are considered weak. e.g., *gente* (Sw), *menino* (sSw).

[6] It does not seem simple, though, to make accurate and all-embracing generalizations in phonetics. It is fairly common, in BP (notably in Paulista Portuguese), for people to eliminate one or two phonemes of a pre-tonic syllable, in some apparently very frequent words. Ex: *precisa* ([you/he/it] need[s]; it is necessary) spoken as *p'siza* (phonetically [p.<u>si</u>.zɐ] instead of canonical [pɾi.<u>si.</u>zɐ] or [pɾe.<u>si</u>.zɐ]). But there is not vowel reduction (schwa) in this example. There is either full vowel elision or not.

initial.

2.1.2.1 - A phoneme distribution test between a small excerpt in Portuguese and its adaptation into English

This thesis presupposes that, due to the fact that English has a lot more words with distinctive right-boundary sounds than BP, English has more of a practical need to preserve those sounds. According to Ball & Rahilly, 1999 (p. 133), "speech economy" must be balanced with the need to maintain contrastivity for the listener. As an example given by the authors, the exact articulation of /s/ in Spanish may vary, in different contexts, much more than English /s/. They claim that it is probably because English needs the /s/ vs /ʃ/ distinction, which Spanish does not. Because of this, Spanish /s/ can become quite [ʃ]-like without risk of misinterpretation.

The above example corroborates the supposition that the frequent omission of an [ɪ:]# in BP trochaic bisyllables may be related with a lack of contrasting, similar words in the language (minimal pairs ending in a slightly different vowel or words contrasting with the [ɪ:]#-WORDS for presence/absence of the [ɪ:]# itself).

Following is an illustrative test of word-boundary phoneme distribution in English and in BP. Two small texts are transcribed. The first one, in Portuguese, is an excerpt from the introduction to the project for the present thesis; the second one is its adaptation into English.

Original text:

> Para este trabalho, propõe-se a investigação das realizações orais do segmento (1) frouxo [ɪ] em finais de palavras dissílabas paroxítonas em língua inglesa (aqui, LI), em corpus de estudantes brasileiros da LI em comparação a falantes nativos da mesma. O segmento pesquisado, que aqui terá a representação formal [ɪ:]# em dissílabo paroxítono, é representado, ortograficamente, pela letra *Y*, na grande maioria dos casos, e.g., *city, happy, story, coffee*.

English version:

> This is a project for the investigation of the phonetic realizations of the post-tonic segment [ɪ], (henceforth, [ɪ:]#) (Ns. 1 & 2) , in trochaic disyllables ending morphologically in *y*, e.g., *city*, *happy* and *story*, from an oral corpus of native speakers of the English language (EL) to be compared with a corpus with speech records of Brazilian learners of English. (Examples of [ɪ:]# WORDS which do not take a final *y* are *coffee* and *posse*) (N. 3).

Table 2.1 - Distribution of word-boundary sounds and positions of stressed syllable in excerpt from thesis project introduction (Portuguese and English versions)

	Types of words	BP vs English (total words)	Portuguese version words	English version words
A	With stress on final syllable (excepting monosyllables)	**11 - 1**	propõe, investigação, realizações, orais, finais, aqui, comparação, aqui, terá, representação, formal	compared
B	Ending in plosives	**0 - 7**	–	project, phonetic, post-tonic, segment, trochaic, not, take
C	Ending in nasal vowels	**9 - 0**	propõe, investigação, realizações, em, em, em, comparação, representação, em	–
D	Ending in nasal consonants	**0 - 5**	–	investigation, from, an, ending, Brazilian
E	Ending in oral vowels (excepting monosyllables)	**21 - 0**	para, este, trabalho, segmento, frouxo, língua, inglesa, aqui, mesma, segmento, pesquisado, aqui, terá, dissílabo, paroxítono, representado, ortograficamente, pela, letra, grande, maioria,	–
F	Beginning with vowels (excepting monosyllables)	**8 - 5**	este, investigação, orais, inglesa, aqui, estudantes, aqui, ortograficamente	ending, oral, English, English, examples
G	Ending in fricatives (excepting /s/)	**0 - 15**	–	of, of, henceforth, native, of, English, language, with, with, speech, of, of, English, of, which

2.1.2.1.1 - A brief analysis of Table 2.1

While the first comparison proposed (A) refers to word stress position in the two languages analyzed, all the other comparisons (B through G) refer to word-boundary phoneme distribution, which are a result of language-specific syllabification restrictions.

A: Perhaps the most striking difference observable in Table 2.1 is that the Portuguese excerpt reveals 11 (non-monosyllabic) words with stress on the last syllable while the text in English has only one such word (*compared*).

According to Kreidler (op. cit., p. 208), English has frequently shown a preference for non-final word stress: "Ever since the eleventh century, English has been borrowing words from other languages, chiefly French, with stress on the last syllable. Often the stress has been moved forward." Examples given by the author include *beauty* < *beauté* [bo.te]; *element* < *élément* [e.le.mã]; and *ticket* < *ticket* (ti.kɛ]). [7]

From the data in **A**, it is possible to suppose that English frequently seems to avoid word-final stress and that BP, on the other hand, may have a strong penchant for it, what would suggest that, when the final syllable of a word in BP is post-tonic, that final syllable may be reduced or fully deleted in several contexts. That 'penchant', if real, may be strongly influenced by the presence of 'redundant' information in the right boundaries of Portuguese words because of particularities of Portuguese syntax.

B: The fact that English very commonly has words ending in plosive codas differentiates it from BP;

C and **D**: (distribution of words ending in nasal vowels vs nasal consonants) The results found are exactly what is expected according to each language's phonology, as discussed in the nasalization analysis below, in subsection 2.1.4.

E: (in the studied excerpts, the Portuguese version had 21 non-monosyllabic words ending in

[7] French words and phonetic symbols given by the author of the present thesis.

vowel sounds while English had none) These data tell a lot: BP has a massive amount of words ending in vowel sounds. English, for its part, has many words that end in a silent /e/, e.g. *take* (many English words ending in a silent /e/ once had that final vowel pronounced). English also has a lot of words which end in diphthongs and in [ɪː]# (not present in the brief adaptation above).

F: (words beginning with vowels) The data here indicate that English also has quite a few words that begin with vowels. But the difference is that BP has a majority of words that end in vowels, which often encounter the considerable amount of words that begin with vowels, as in an example taken from the Portuguese excerpt: *propõe-se a investigação*. The word *investigação*, as can be seen, also ends in vowels [ãʊ].

G: the final /s/ was ignored in this analysis because plurals in Portuguese are indicated by an /s/. Incidentally, the only Portuguese word ending in /s/ in the excerpt above which is not a plural form is *corpus*. Similarly to the case of final plosives in **B**, English has many words that end in fricative consonants, while BP has none. [8]

2.1.3 - Some phonological particularities of word boundaries in English and BP

There is an observable difference in the number of possible phonological contrasts in right boundaries of words in English and in BP. English has multiple distinctive final phonemes, which most likely act as efficient inhibitory instruments against the loss of canonical word-final sounds.[9] BP, on the other hand, has relatively few distinctive sounds (i.e., minimal pairs) in right word-boundaries. BP speakers often fail to realize several canonical post-tonic phonemes (but somehow intelligibility is preserved) and frequently – as shown in studies on BP haplology, referred to by Leal (2006), Pavezi (2006) and Mendes (2009) [10]– omit whole

[8] i.e., canonical word endings. In this thesis, the word *gente*, for example, was often found, in connected speech, to end phonetically in a fricative sound [ʒẽtʃ].

[9] This thesis studies the differences between English and BP in what concerns syllable- and word-boundary phonemes, especially word-final phonemes.

[10]All studies found on haplology in BP refer to the term as the loss of a whole final post-tonic syllable in favor of a following one with the same onset consonant, either /t/ or /d/. e.g., in *Cidade de Belo Horizonte* (Mendes, 2009), the final syllable of *Cidade* is lost in favor of the following word, *de*. For loss of final syllables or segments in boundaries which do not have, exclusively, /t/ or /d/ as onsets, other terms are used (Leal, 2006). In this thesis, the term *BP haplology* will refer to contexts in which only those two consonants are onsets of the syllables involved; *haplology*, on the other hand, will have a broader, actually, original, meaning: "Haplology is a term used in phonology to refer to the omission of sounds occurring in a sequence of similar articulation, e.g., *library – libry*" (Crystal, 1985, p. 224).

final post-tonic syllables, especially when the initial syllable in W2 has onset similar to the one in the final syllable of W1 and when that first W2 syllable is not stressed (subsection 2.2.3, below).

2.1.3.1 - Right-boundary phonemes in English and Portuguese words (in BP pronunciation)

Below, the densely populated syllable- and word-boundary space of English is briefly compared with its counterpart in BP.

2.1.3.1.1 - English right-boundary phonemes

Table 2.2 shows some phonologically distinctive final sounds in English.

Table 2.2 - Some word-final consonantal phonemes in English

Words with voiceless codas	Words with voiced codas	Phonetic symbols
lap	lab	**[p], [b]**
duff	dove	**[f], [v]**
breath	breathe	**[θ], [ð]**
hat	had	[t]*, [d] *
bus	buzz	**[s], [z]**
–	boar - ball	**[ɹ], [l]**
–	whim - win - wing	**[m], [n], [ŋ]**
watch	lodge	**[tʃ], [dʒ]**
bush	beige	**[ʃ], [ʒ]**
back	bag	**[k], [g]**

(*) /t/ and /d/ are typically realized as taps in General American English before a vowel sound in a following weak syllable. e.g., *mad hatter* [mæd hæɾəɹ]. (They can also be partly assimilated according to manner of articulation of the next sound. e.g., when followed by /w/, /t/ and /d/ tend to become bilabial). English /t/ and /d/ taps show a remarkable relation with BP haplology, because the sounds in BP found to be the onsets of the most easily eliminated W2 syllables are precisely the same alveolar (or coronal) sounds. e.g., *faculda(de) de letras*; *lei(te) de coco.* Pavezi (2006), subsection 2.2.3.

It could be argued, for example, that it is very difficult to say *we will* and there would be a strong tendency for people to normally say *we'll.*

2.1.3.1.2 - BP right-boundary phonemes

It seems generally agreed among phonologists that syllable- and word-final phonemes in BP should only be vowels (with and without nasalization) and the consonants phonologically represented as /s/, /l/ and /r/. That consonantal inventory seems quite small and, according to Callou et al. (apud Abaurre et al., 2014, pp. 167-194), the codas in /s/, /l/ and /r/ can become highly variable in their phonetic realizations, depending on the following segment and/or on boundary prosodic features. i.e., they vary, but they usually do not have minimal pairs.

2.1.4 - Nasalization in English and in Portuguese

This subsection has analyses of the different ways in which English and Portuguese create nasal distinctions. Basically, the English nasalization is made with consonants, depending on place of articulation. In Portuguese, by contrast, nasal phonemes are all vowels, but allophonic nasalization caused by (onset) nasal consonants is fairly common (See Cristófaro-Silva below).

2.1.4.1 - Nasalization in English

Phonological nasalization in English is made with the consonantal phonemes /m/, /n/ and /ŋ/, as in *Kim, kin* and *king.* /m/, /n/ and /ŋ/ are distinctive, so that, e.g., a bilabial or alveolar closure will differentiate words such as *team* and *teen*, i.e., [tim] vs [tin].

2.1.4.2 - Nasalization in Portuguese (phonemic and allophonic)

According to Abaurre et al. (op. cit, p. 85), among Indo-European languages, only French, Portuguese and Polish have phonological nasalization with the vowels (rather than with coda consonants, as is the case with English).

In Portuguese, a nasal vowel sound is contrasted only with its oral counterpart and not with consonant sounds. e.g.,

tato [<u>ta</u>.tʊ], (tact) vs *tanto* [<u>tã</u>.tʊ] (so much)

se [si], (if) vs *sim* [sĩ] (yes)

During a vowel, "there is no contact or near contact between the articulators." (Ball & Rahilly, op. cit., p. 91).

According to Kreidler (op. cit., p. 48), a vowel has, among its characteristics, the following ones:

1) [+ syllabic], capable of carrying stress and pitch;
2) [– consonantal], made without impeding the air flow;
3) [+ continuant], articulated with air going continuously out.

Cristófaro-Silva, 2014 (pp. 91-94) classifies nasalization in Portuguese in two types: phonological nasalization (with 'nasal' vowels) and allophonic nasalization (with 'nasalized' vowels).

A nasal vowel distinguishes a nasal phoneme from an oral one, e.g., [u] vs [ũ]: *o livro,* [u <u>li</u>.vɾʊ:], (the book) vs *um livro,* [ũ <u>li</u>.vɾʊ:], (a book, one book).

Nasal consonants in Portuguese do not occur (phonetically) in syllable codas, but only in syllable onsets.[11] As such, they often cause the allophonic nasalization of preceding or following vowels. The following example brings an analysis of optional nasalization in the pre-tonic vowel in the word *canela* (shin; cinnamon), which is pronounced either as [a] or [ã] ([ka.<u>nɛ</u>.lɐ] vs [kã.<u>nɛ</u>.lɐ]), depending, usually, on regional differences.

According to Pickett (op. cit., p. 115), for the production of a nasal consonant, the movement downward of the velum to open the nasal passages happens well before the nasal consonant actually begins. Besides, the velopharyngeal port remains open for some time after the release of the nasal consonant. There is, therefore, a 'lead and lag' of nasal passages openings and closings in relation to the timing of the phonemes of the word being spoken (ibid.).

Notwithstanding Pickett's description, some BP speakers nasalize the phonologically oral pre-tonic /a/ of *canela* while others do not. The difference in pronunciation suggests that individual speakers are able to maximize or minimize anticipatory nasalization effects and it

[11]For example, the Portuguese equivalent for the English word *consonantal*, syllabified as [kɑn.sə.<u>næn</u>.tl], is written the same, but syllabified as [kõ.so.nã.<u>taw</u>]. In these examples, the English word exhibits two coda nasal consonants while the Portuguese word exhibits four open vowels, being two oral and two nasal.

also suggests that the nasalized vowel in BP may be more the result of diachronic dialectal choice than purely the effect of articulatory constraints.

2.1.5 - Free and checked vowels and open and closed syllables in English

English vowels can be classified as 'free' and 'checked' (Kreidler, op. cit., p. 258), a system reflected in syllabifications given in dictionaries. Checked vowels (also known as 'short' vowels), e.g., æ, ɛ, ʌ are vowels which require a coda consonant, if they are in strong syllables (in weak syllables, any vowel [or vowels] becomes a schwa). Checked vowels can only occur, phonologically, in closed syllables [Kreidler, op. cit., p. 103], e.g., *ad, bed, bud*). On the other hand, free vowels (also known as 'long' vowels), among which diphthongs are included, e.g., i, a, u, aɪ, oʊ, can occur both in closed (VC or CVC) as well as in open (CV or V) syllables (e.g., *bead, bee*, *spa, bar, show, shown*).

Here follow examples of syllabification of vowels in some words, based on transcriptions from *The American Heritage Dictionary* (https://www.ahdictionary.com/word/search.html?q=mayday&submit.x=35&submit.y=20) [12]

Table 2.3 - Some words with checked and free vowels in English

Checked vowels (closed syllables)	Free vowels (open syllables) *
[ɛ] as in *second* [sɛk.ənd]	[eɪ] as in *nasal* [neɪ.zəl]
[æ] as in *classified* [klæs.ə.faɪd]	[oʊ] as in *coda* [koʊ.də]
ɑ as in follow [fɑl.oʊ]	u as in durations [dju.ɹeɪ.ʃənz]

* as mentioned above, free or long vowels also occur in closed syllables (e.g., *claim* [kleɪm]; *own* [oʊn], *classified* [klæs.ə.faɪd]). The schwa happens in weak syllables, both open and closed. e.g., *production* [prə.dʌk.ʃən].

According to Stetson, 1945 (apud Pickett, op. cit., pp. 149-150), only languages with strongly marked syllable stresses, such as English, seem to make extensive use of syllable-final consonants and ample use of CVC syllables, as opposed to most other languages, e.g., French,

[12] The actual symbols used in dictionaries to represent vowel sounds are often different from the IPA ones used in this thesis (e.g., in several dictionaries, *nasal* is represented as [nā.zəl], rather than IPA [neɪ.zəl]).

which have less variation in syllable duration and a preference for CV syllables. In weak syllables, all vowels become short (and the syllables themselves are also characteristically short), like the first and last syllables in the word *production* [prə.dʌk.ʃən].

The table above and Stetson's observations corroborate that, in English, a non-reduced (strong or stressed) syllable is usually a long one. Interpreting Cutler (subsection 2.1.1), when there is a 'short' vowel (e.g., æ, ɛ, ʌ) within a strong syllable, that syllable gets elongated by means of a coda consonant. e.g., the short vowel [ɛ], in the word *second*, cannot stand alone (a short vowel within a strong syllable is not allowed), so it is followed by [k] in the same syllable, [sɛk.ənd]. A strong open syllable is long due to the presence of a 'long' vowel, but there are *long* and *longer* strong syllables, i.e., depending on whether the long vowel is followed by a coda consonant or not , e.g., *clay* [kleɪ] and *claim* [kleɪm]. [13]

As an example of the syllabification of checked vowels in English, let us look at the word *Atlanta*, which has a dictionary syllabification as [æt.læn.tə], with the unstressed initial vowel in the same syllable as the consonant that follows: [æt]. Nothwithstanding if the consonant /t/ is glottalized or silent, the initial vowel remains as [æ], i.e., it is not reduced to schwa. Note that English does not have syllables with onsets in /tl/ (Paradis & Prunet, op. cit., p. 53). If /tl/ onsets were permissible in English, the word-initial vowel /a/ in *Atlanta* would probably become an isolated schwa, as in *about* [ə.baʊt]. The similar word *attract* is pronounced as [ə.trækt], because /tr/ is a permissible, high-frequency syllable onset in English. This seems strongly related with etymological choices, as commented above, since the initial letters (*at*) in *attract* are just a prefix. *Atlanta* in English has, therefore, three syllables, being two closed and one open, [æt.læn.tə], i.e., VC-CVC-CV.

In accordance with BP phonology, *Atlanta* is syllabified as *a.tlan.ta*, phonetically [a.tlã.tɐ] or V-CCV-CV, i.e., three open syllables (in sharp contrast with English's two closed and one

[13] Some examples found with not too much difficulty, however, seem to mock or at least challenge some phonological rules. e.g., the song *I Got You*, by B. R., a female singer, has the word *got* clearly pronounced, several times, without a final /t/ (i.e., [gɑ]) (although, in the example, *got* is followed by a glide-vowel sequence, *you*). The American English sound [ɑ] is generally considered to be a short vowel, as in, e.g., *top* [tɑp].

open syllables).

2.1.6 - The pre- and post-tonic syllable in BP and in English; confirmation of the strength of final and initial stressless vowels in the two languages

Examples of minimal and maximal stresslessness in BP can be seen in the word *menino* (boy), with the pre-tonic SYL-1 /me/ being a lot stronger than the post-tonic SYL-3 /no/ (sSw). In this word, SYL-1 is usually quite longer and louder than SYL-3.

2.1.6.1 - BP final vowel loss: external vocalic sandhi and the BP preference to preserve word-initial vowels

Bisol, apud Abaurre et al. (op. cit., pp. 53-64), explains and exemplifies BP *external vocalic sandhi* and subdivides the process of BP final vowel loss or simplification as *elision*, *degemination* and *diphthongization*. Here I examine two of her examples of *elision* and *degemination*.

a) *Elision* is defined by Bisol to be the process by which a post-tonic, final, W1 vowel is lost in favor of a phonologically different vowel in the beginning of W2 (the first phoneme of W2). e.g., *Eu estav**a ho**spitalizado* (*I was hospitalized*), (/a/#/o/).
[eʊ estavɐ ospitalizadʊ] → [eʊ estav**o**spitalizadʊ].

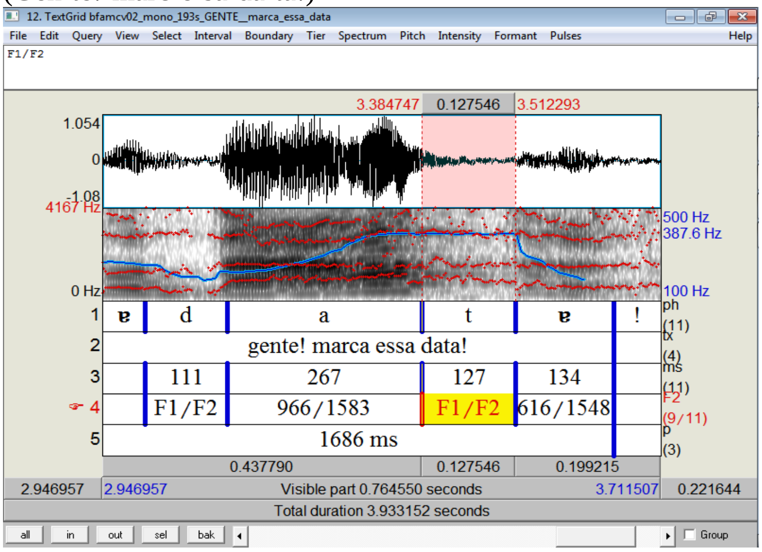
In the above example, the final vowel of *estava*, /a/, is lost in favor of the first vowel of *hospitalizado /o/*. The consonant (*h*) is silent in the beginnings of Portuguese words.

b) *Degemination* is defined by Bisol as a process similar to *elision*, but the vowels involved are phonologically the same (geminate vowels).
e.g., *Camis**a a**marela* (*shirt / yellow*, i.e. *yellow shirt*), (/a/#/a/).

Phonetically, though, example b) is similar to example a). In both cases, there is the loss of a final vowel (W1#) in favor of an initial vowel (#W2). In both cases, the initial vowel in W2 is not stressed. And, in each case, the vowels involved are actually different phonetically. In the second example, a fairly accurate phonetic transcription is [kamizɐ amarɛlɐ] →

[kamizamaɾɛlɐ]. i.e., the V#V encounter is one of different vowels. The final phoneme /a/ in *camisa* is normally a centralized sound, [ɐ], and the initial /a/ in *amarela* is normally a positively low central vowel, [a]. In the phrase *camisa amarela*, the spoken vowel is normally the first [a] of *amarela* and not the centralized final sound of *camisa*. This idea was supported by measurements made from a C-ORAL-BRASIL file with the word *data*, spoken utterance-finally. In Spectrogram 2.1 below, are registered the measurements of F1 and F2 for the two vowels in the word. The first, stressed vowel (in *da*), is longer, has a lot of energy, and its F1 is high, indicating a widely open mouth, typical of [a]. The second vowel (in *ta*) has lower F1, i.e., less widely open mouth, with a lot less energy as well. In this example, the formant measurements of the first and second vowels were quite different: the post-tonic vowel in (*ta*) was centralized. Even though the final vowel is phonologically the same open vowel as in the stressed syllable, /a/, it was shown to be clearly different from the stressed vowel. The whole utterance was spoken emphatically but, apparently, the emphasis did not reach that final vowel. It is also observable that F0 slopes steeply downward.

Spectrogram 2.1 - LIN - *Gente*! Mark'essa data! with focus on the word *data*
CCC F GENTE_M_MARCA bfamcv02_mono 193 I = 34, W= 460
(Gen-te!-marc-e-sa-da-ta!)



A possible realization of *camisa amarela* as *camisa 'marela* [kamizɐ maɾɛlɐ], i.e., with preservation of the phonetic features of the final vowel of W1 and elimination of the first vowel in W2 might sound substandard or over-informal for many Brazilians or may be understood as clearly non-formal speech. This kind of judgment seems to be due to the BP speakers' strong tendency to preserve pre-tonic sounds (e.g., the SYL-1 vowel in the word *menino* is normally raised from /e/ to /i/ but it is never simplified into a schwa and it is rarely deleted, as may happen in European Portuguese (*m' nino*).

2.1.6.2 - BP final syllable loss

The strength of pre-tonic syllables as opposed to post-tonic ones in BP is repeatedly confirmed in BP haplology studies**.** According to Mendes (op. cit., p. 20), whole post-tonic, word-final syllables are commonly eliminated before a similar syllable in the onset of a following word. e.g., in *Cidade de Belo Horizonte* (*City of Belo Horizonte*), the words *cidade* and *de* are repeatedly found to be realized with only one (*de*) syllable. From the same phrase, also the toponym *Belo Horizonte* exhibits almost systematic loss of the final sound in W1, as the vowel in *Belo* is canceled in favor of the first vowel in *Horizonte*: [bɛ**lʊ: o**ɾizõtʃ(ɪ:)] → [bɛl**o**ɾizõtʃ(ɪ:)]. *Syllable elision* is a term alternative to haplology used in BP phonology when the loss of a W1 syllable in favor of a W2 syllable does not involve, exclusively, the consonants /t/ and/or /d/. (See subsection 2.2.3).

2.1.6.3 - The English preference to preserve word-final vowels

When it comes to the apparent 'competition' between word-final and word-initial vowels, English, for its part, seems to 'like better' the reduction or exclusion of initial pre-tonic sounds. For example, English tends to include an 'intrusive /r/' after a final schwa in phrases like *America **r** and Canada.* This preserves both the final vowel in *America* as well as the initial vowel in *and*. Brazilians would easily tend to say *A.me.ric' and Ca.na.da*. In Brazil, *American Airlines* is usually pronounced as *A.me.ric' Air.li.nes*. While the first example is a result of weak post-tonic syllables in BP (or of the lack of possible ambiguity with the word *America*), the second one is related with Portuguese nasalization rules (no nasal coda consonants).

As commented on by Kreidler (op. cit. p. 235), the elimination of word-initial, unstressed vowels is a common process of rapid, casual speech in English. A word-initial unstressed vowel may be deleted, especially after a word-final vowel, as in:
Go (a)way; I (e)xpect so.

According to Cutler's analyses, referred to in subsection 2.1.2, English speaking listeners usually expect a strong word-initial syllable.

It seems that in cases when intelligibily can be easily preserved, English speakers also eliminate whole initial syllables or the vowel following the consonant in a weak initial syllable. e.g.,
I 'member (I remember); *I b' lieve yes* (I believe yes).

2.1.6.4 - The English 'problem' with word-final consonants

Not to be overlooked is the analogous situation of final consonants in English in relation to final vowels in Portuguese. English has an uncountable number of words that end and also that begin with consonants. Therefore, encounters of those consonants in the end of W1 and the beginning of W2 is predictable. But differently from the case in BP, when a final vowel tends to be eliminated in favor of an initial one and when whole final syllables are lost in favor of initial ones, English tends to lose final consonants in favor of initial ones. And, interestingly, the consonants most likely to be canceled (or glottalized) are /t/ and /d/. e.g., *tha**t th**ing; You di**d th**at?* When those plosive consonants cannot become taps (as before a vowel sound), they are frequently elided.

2.1.7 - The Anglicization of foreign words; the adaptation of English and French words to BP phonology

"Perception of nonnative speech often occurs through the filter of our native language phonological system." Gass & Selinker (2008, cit., Introduction).

The following is just an illustration of how several words are interestingly adapted to the English and BP phonologies.

2.1.7.1 - Anglicization

One remarkable characteristic of English syllable endings is the systematic way by which the original pronunciations of words with open syllables, borrowed from foreign languages, often get substantially changed, because of the restrictions of English syllabification rules (which are based on the checked vs free vowel differences analyzed above). It seems that English regularly 'shuns' [– high] or [– round] vowels in the ends of syllables as well as [– high] vowels in the ends of words. [14]

a) From Portuguese, the acronym *EMBRAER*, pronounced, in Brazil, as [ẽ.bɾa.ɛh] , with two low vowels in sequential syllable boundaries [a - ɛ], becomes [em.**bɹaɪ**.ɛɹ];
b) Another example is French *m'aidez!*, (help me! [in simplified language, since the norm would be *aidez-moi!*]) is transformed from standard French pronunciation [me.de] into [meɪ.deɪ] (with shift of stress position and diphthongization of vowels);
c) Similarly to *m'aidez!* there is also the expression *No way, Jose!* [noʊ weɪ hou.seɪ]. The original Spanish vowels [o] and [e] in *Jose* are diphthongized to [oʊ] and [eɪ], respectively.

Diphthongs in English end only in high vowel sounds (falling diphthongs), Ball & Rahilly (op. cit., pp. 98-99). e.g., *baby* / *try*, [beɪ.bɪ] / [tɹaɪ]. The French word *Détroit* [de.tʁʊa] is anglicized to [dɪ.tɹɔɪt]. [15]

English sometimes changes the position of stressed syllables in trisyllables when the stress falls on the middle syllable. e.g. Spanish *vaquero* [ba.ke.ɾo], (cowboy), is anglicized in the word *buckaroo*, pronounced [bʌk.ə.ɹu] (with secondary stress on the first syllable and main stress on the last syllable, i.e., *swS*).

2.1.7.2 - The adaptation of foreign words to the BP syllable- and word-final sound inventory and Brazilians' suppositions about word stress in foreign languages

On the Brazilian side, foreign words often get substantially changed as well, in their adaptation to BP phonology. English words with meanings as diverse as *team/teem, teen, tin,*

[14] There are some English words which end in [ɔ] or similar sounds. e.g., *law, saw, thaw.*
[15] It seems that the checked vs free vowel syllabification rules in English do not fit perfectly in what concerns the short vowel [ɪ]. As seen in the example of *Detroit*, that short vowel stands in a codaless syllable [dɪ.tɹɔɪt]. A similar example is *begin* [bɪ.gɪn]. This seems to be related with the environments in which [i] and [ɪ] are neutralized, as noted by Harrington (op. cit.). But it should also be observed that English pre-tonic vowels in words similar to the ones exemplified above tend to be interchangeable with schwa ([ɪ]/[ə]), even though the alternative, schwa-pronunciation, is often not registered in dictionaries. Importantly, as mentioned above, a pre-tonic syllable may also fully lose its vowel, (e.g., *b' lieve*, for *believe*).

Tim, and even *thin*, are all likely to be homophonously pronounced as [tʃĩ].

Brazilians generally seem to suppose that English words should have their stress put on the first syllable and that French words should always have stress on the last syllable. Apparently for those reasons, *Tycoon Studios*, in Rio de Janeiro, rented by *Rede Globo* in the 1990s, are commonly known, by Brazilians, as [taɪ.kũ], with a clear trochaic pronunciation. In English, the word, which means *magnate*, is supposed to be pronounced as [taɪ.kun], with a long stressed high back vowel in the final syllable. The French word *misère* [mi.zɛʁ], *considered a bisyllable*, meaning *misery*, is jokingly pronounced by Brazilians as if it were written *miséré*, with three syllables and stress on the final one. Those Brazilian speakers do not realize that when a final /e/ in French does not carry a diacritic, that vowel is usually not pronounced. Compare: *élève* [e.lɛv], (student) vs *élevé* [el.ve], (elevated). Other examples of generalizations with English words by BP speakers are, e.g., *control* [kən.tɾoʊl] > (BP) [kõ.tɾoʊ]; *Monroe* [mən.ɹoʊ] > (BP) [mõ.hɔɪ] (not specifically because of the word form, but because of the reference to the famous American actress); *glamour* [glæm.əɹ] > (BP) [gla.muh]. This last word is widely considered, in Brazil, to have French origins, due to its morphological ending (*mour*).

2.2 - Related works

For this thesis, a long research was made for studies about post-tonic vowels in bisyllables, and several scientific articles and graduate studies on phonology and a few ones on phonetics have been read. Some studies related with word-boundaries in BP and with the use of high front vowels by N-SPK-E and B-LNR-E are analyzed below.

2.2.1 - On high front vowels

Harrington (op. cit.), in a longitudinal study based on recordings of Christmas broadcasts by Queen Elizabeth II, over a period of 50 years, analyzes community influences on the speech of adults, by comparing the quality of [ɪ:]# by the Queen in relation to more popular varieties of speech. The researcher also draws attention to the unique position of [ɪ:]# in English and points out that [ɪ:]# is the only full English lax vowel that can occur in final open syllables. According to him, (p. 441), tense [i] and lax [ɪ] can show phonetic overlap in "word-final context, because this is an environment in which they are neutralized, i.e., in which the phonological contrast is suspended."

Silva, F (2004), with *O caso das vogais altas frontais e do glide /j/ no Inglês e no português brasileiro* (High front vowels and the front glide /j/ in English and in BP) is a thesis on phonetic analysis. It is a synchronic work with test and control groups of Brazilian teenage learners of English, with the purpose to test and improve their knowledge about differences in English /i/,/ɪ/, [ɪ:]# and /j/, as in words such as *beat, bit, happy* and *yes,* respectively. Groups were given a pre-test in the use of the distinction between those different phoneme sounds, intervocalically and word-finally, in monosyllables and polysyllables (p. 140). Portuguese words were also used and phonological differences were made explicit. The control group was given traditional instruction while the test group received clear information on the importance of the vowel distinctions in English and how the sounds are similar and dissimilar from BP (p. 60) . The control group's final test showed generally the same result as initially: a lot of phonetic overlap among the realizations of vowel phonemes (p. 119). While the test group showed general progress, the most marked improvements were observed in the beginning learners of that group, which suggests that instruction in phonetics should be given early rather than late to language learners. (pp. 71-72).

2.2.2 - On English /l/ and /r/ (and /h/) transitions into vowels

Coarticulatory Influences of Liquids on Vowels in English (Tunley, 1999) is a doctoral dissertation that analyzes the use of synthetic speech in listening experiments, with focus on the influences of /l/ and /r/ on adjacent vowels in standard Southern British English. Tunley shows how measurements may be made between C (consonant) and V (vowel) in the contexts of /(C)hV/, /(C)lV/ and /(C)[ɹ]V/ and reports that the approximant /r/ was, by far, the most difficult consonant to segment.

Tunley's study is useful for the understanding and segmentation of important words in the present thesis (i.e., *happy* and *really*), even though Tunley worked with syllable-onset [ɹ], which is acoustically quite different from intervocalic [ɹ] (as in *very*). Thus, it was a help in confirming how to segment the first two sounds of *really* (it was necessary, in the present thesis, to subdivide SYL-1 (*r-ea)* in *really*, because large differences were observed between

SBC and LIN speakers in relation to F1 and F2 values of the stressed vowel /i/ in that word [Table 4.3]). However, for the segmentation of the originally number-one choice word for the present thesis, *very,* Tunley's research served only as an indication that it is especially hard to segment intervocalic [ɹ] (in most cases), since, even word-initially, when there is a lot of contrast with the following vowel, [ɹ] was not found to be satisfactorily segmentable by the researcher. In his words, "Definition of vowel onset is difficult after this consonant. For /rV/ syllables, there are only gradual changes in the waveform between consonant and vowel." (Tunley, op. cit., p. 23). Ladefoged, 2003, (pp. 149-151), confirms the different degrees of acoustic complexity between the two /r/s (section 3.4, below).

2.2.3 - On vowels in word boundaries in BP

In a thesis entitled *A haplologia na variedade paulista* (Haplology in the São Paulo variety*)*, Pavezi (op. cit.) revisits haplology, or, in the Brazilian tradition, the elimination of a whole syllable before a similar one in the specific contexts with /t/ and /d/ onsets. Pavezi relates that haplology is considered to commonly occur with post-tonic word-final syllables with high vowels [ɪ:, ʊ:]. The researcher depicts the process with some typical examples. Pavezi also notes that the trochee (e.g., <u>*lei*</u>*.te*) is a type of word that very frequently undergoes haplology (p. 58).

Results similar to Pavezi's were also found for Mineiro Portuguese, by Mendes (op. cit.), with a thesis entitled *A haplologia no português de Belo Horizonte* (Haplology in Belo Horizonte Portuguese).

A third study on BP haplology is Leal (op. cit.)*, Elisão silábica e haplologia: Aspectos fonológicos da cidade paulista de Capivari* (Syllable elision and haplology: Phonological aspects in the São Paulo town of Capivari). Leal uses the definition of *haplology* in BP as the word-boundary encounter of two similar syllables (with /t/ or /d/ as onsets), the first of which must be necessarily unstressed (Tenani, 2002), resulting in the full elimination of the first syllable involved in the process. Two processes of omission of sounds outside of the /t/ and /d/ onset syllables are given specific names: *"Elisão silábica"* (Syllable elision) is what is defined as the loss of other onset consonant types of syllables in W1. e.g., *Por cau**sa d**o quê?* (for what reason?) realized as *Por ca(usa) do quê?* (P. 15). A third kind of occurrence is what is called *"Alongamento da consoante"* (Consonant elongation) (p. 46). Citing Alkmin & Gomes (1982), Leal writes that the loss of a final vowel in word boundary can cause two phonologically equal consonants to become a single, elongated one. e.g., *sab(e) beijar* (knows how to kiss), described as being realized with a long /b/ connecting the two words.

Another graduate study analyzed was Costa (2008), *Influências prosódicas nos encontros vocálicos em fronteira de palavras* (Prosodic influences in V#V sequences in word boundaries), which concludes that the typical BP external sandhi of unstressed V#V does not always occur when pauses, lengthenings or emphases intervene.

In the research for works related to the object of this thesis, besides some works on BP haplology and external sandhi, several studies on post-tonic vowel loss in BP were found, but always in trisyllables, not in bisyllables. In the case of trisyllables in Portuguese with the stress on the first syllable, a tendency was repeatedly attested for the reduction or elimination of the middle vowel (which seems to be sometimes the case in English as well, e.g. *aspirin, camera, restaurant,* [æs.pɹɪn], [kæm..ɹɐ], [rɛs5.tɹɑnt]).

"In most cases of vowel loss the following consonant is /l/ or /r/." (Kreidler, op. cit, p. 241).

One difficulty in the search for studies related with this thesis was that essentially phonetic theses and dissertations (preferably with use of learner corpora, and with utilizing of extensive analyses of spectrograms and waveforms) were not found.

2.3 - The Literature: on the 'paradox' of speech segmentation, on how to best segment words, and on some articulatory and acoustic characteristics of speech sounds

Speech segmentation is generally referred to in the literature as being complex and somehow controversial.

2.3.1 - The 'paradox'

According to Perkell & Klatt, 1986 (apud Barbosa & Madureira (2015, p. 167), segmenting into discrete units what is continuous variation (speech) is a complex task, which exposes the paradox between invariance and variability of phonic material.

According to Odden (2005, pp. 14-15), what came to be considered as discrete phonemes in phonology is equivalent, in phonetics, to parts of the continuously changing sound patterns in the speech signal. That is, segmentation is arbitrary because one has to segment what does not exactly have boundaries, or has only partial boundaries.

Ladefoged, 2003 (op. cit., p. 103) points out that "many segments do not have clear beginnings and ends" and that "There are hard decisions to be made whatever the form of the acoustic analysis. All that one can do is to choose consistent measurement points", he teaches.

Ball & Rahilly (op. cit., pp. 128-129) corroborate Ladefoged's point by explaining that the various phonetic features that go to make up segments do not always have co-terminous boundaries.

All of the comments above seem to be apt to describe the difficulties in segmenting speech, especially approximant sounds in intervocalic position, such as [l] and [ɹ] in *really* and *very*, due to their gradual, gliding nature. As suggested in Table 3.7, the fewer the contrasts between sounds, the fewer the clues for segmentation.

Besides the inherent difficulty in speech itself, technical challenges may further complicate segmentation, as commented by Ball & Rahilly (op. cit., p. 162) "Acoustic phonetics is not an exact science". For example, the recorded material may be of less than ideal quality (due, e.g., to background noise) or the chosen acoustic program may fail to analyze the data in the best way (ibid).

2.3.1.1 - Phoneme vs segment

Kreidler (op. cit., p. 7) describes *segment* in opposition to *phoneme*. There has been doubt, in the present thesis, as whether NXT-SGM (next segment) or NXT-PHON (next phoneme) should be used to indicate the sound following the [ɪ:]#-WORD. [16]

Here I use Kreidler's description of segment (italics mine):

> If you get ready to pronounce – but don't pronounce – *meet, moot, beet, boot,* you will find that all four words begin with lips closed. You should also find that with *meet* and *beet* the lips are stretched but with *moot* and *boot* they are slightly pursed or rounded. We think of *meet* and *moot* as beginning the same way, and likewise *beet* and *boot*. That is true, but not true. *Meet* and *moot* begin with the same phoneme, /m/, but they begin with different segments; the two segments have some articulatory features in common and they differ in another feature, the shape of the lips. (Kreidler, op. cit., p. 7)

2.3.2 - On manners to segment speech sounds

Consistency seems to be the most used word by speech researchers as the one remedy for the difficulties of segmentation.

2.3.2.1 - Spectrograms, formants and waveforms

In this subsection, the hard task of describing formants and how they are represented in waveforms and spectrograms is taken up.

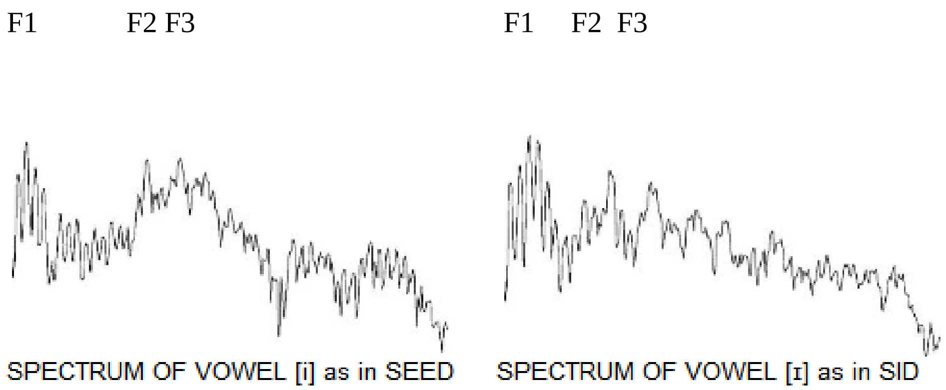
2.3.2.1.1 - Spectrograms

According to Odden (op. cit., pp. 7 and 11), a *spectrogram* is a reasonably informative and accurate display of properties of sound. It is less accurate than the spectrum (See Figure 2.1) at a single point, because a spectrogram is nothing more than a series of spectra where the

[16] In this thesis, what is interpreted as phonemes is put within forward slashes; what is understood as the physical representations of the sounds of speech, or segments, is put inside square brackets.

detailed amplitude information represented on the vertical axis (as in a spectrum) is simplified to a less detailed and less reliable visual difference in degrees of darkness. While the spectrum is "the defining frequency and amplitude components of a complex waveform, over a fixed period of time." (Odden, op. cit., p. 8), a spectrogram is a display of the spectral changes of sound through time.

Figure 2.1 - Spectra of vowels in the words *seed* and *sid*



The three highest peaks from left to right in the two parts of the figure represent F1, F2 and F3 in each word. Note that, in the *seed* part, F1 is farther to the left and F2 is farther to the right in comparison with the *sid* spectrum. This is because, in *seed*, F1 is lower and F2 is higher than in *sid* (See Table 4.4). The descending contours of the two spectra in Figure 2.1 are due to the fact that lower formants (especially F1) have more energy than higher formants.

2.3.2.1.2 - Formants

"The resonances in sound transmission through the vocal tract are called *formants*" (Pickett, op. cit., p. 37).

According to Ball & Rahilly (op. cit., p. 162), vocal tract filters produce peaks of amplitude at certain frequencies, and we refer to these peaks as *formants*.

2.3.2.1.3 - Waveforms

A speech waveform is a complex wave made up of the interaction of different frequency formants. The source wave is created by the vibration of the vocal folds, and is called fundamental frequency, or F0. Once the airstream passes into the vocal tract it is modified or 'filtered' according to particular shapes made by the speaker in the mouth for particular sounds intended. The filtering causes the exaggeration of sounds in some frequencies and its deletion in others. (Ball & Rahilly, op. cit., p. 157).

According to Ladefoged, 2003 (p. 103), when measuring the durations of segments, it is a good idea to use spectrograms in conjunction with waveforms. Spectrograms are good to identify segments (top down visualization) and waveforms are best to make actual measurements, because they "readily permit measurements in milliseconds" (bottom up visualization).

2.3.2.2 - Segmenting speech sounds

According to Barbosa & Madureira (op. cit., p. 168), to make proper speech segmentation, it is necessary to have knowledge about articulatory phonetics and about its acoustic consequences manifested in the waveform and spectrogram.

Likewise, Ball & Rahilly (op. cit., p. 162) state that "We must acquire a firm grasp of basic procedures in acoustics, and of how acoustic representations relate to articulatory characteristics of speech".

Barbosa & Madureira (op. cit., p. 171) give an initial guide for segmentation by drawing attention to several acoustic features of different speech sounds, which is useful for the segmentation of several words in this thesis:

- **vowels**: periodicity in waveform and formant structure;
- **stop plosives** (e.g. [p] as in *happy;* [b] as in *sabe*): Consider silence, plosion and first vowel pulses;
- **fricatives** (e.g. [h] as in *happy;* [s] as in *sabe*): Consider continuous frication noise;
- **laterals** (e.g. [l] as in *really* and *ele*): Consider periodic wave with lower amplitude than vowels;
- **nasals** (e.g. [m] and [n] as in *many*): Periodic wave, lower amplitude than vowel,

predominance of lower formants;

- **taps** (e.g., [ɾ] as in American English *study*): Consider momentary interruptions caused by touch of articulators.

Table 2.4, below, gives articulatory, rather than acoustic, descriptions of different types of sounds, with focus on the intervocalic consonants segmented in this thesis (intervocalic sounds tend to be harder to segment because of coarticulation and, in this thesis, they have to be consistently separated from vowels for proper measurements as, e.g., [p], [n] and [l] in 'ha/p/y', 'ma/n/y' and 'rea/ll/y).

Table 2.4 - Articulatory descriptions of speech sounds according to the literature
(the sound of interest is the INT consonant of [ɪː]#-WORDS)

1	Affricates e.g., tʃ in *gente*: [ʒẽ.tʃɪː]	According to Barbosa & Madureira 2015 (op. cit., pp. 176-177) affricates are sounds that begin as stops and end as fricatives: there is first a stop-like silence, followed by transient noise (plosion) and then continuous noise. According to Pickett (op. cit., p. 121) affricates are produced like fricatives that are preceded by an occlusion instead of a more open articulation.
2	Approximants	Approximants can be divided into the non-prolongable semi-vowels ([w] and [j]) and the prolongable central and lateral approximants ([ɹ] and [l]). (Ball & Rahilly, op. cit., p. 87)
2.1	Glides	According to the description given in Pickett, (op. cit., p. 108-109), a glide can be exemplified by the first phoneme in *yes* [jɛs] and in *why* [waɪ], but not by the final sound in *say* [seɪ], as the second vowel here is considered a short vowel, not a glide. The difference is that a glide has greater constriction and faster transitions than vowels.
2.2	Lateral and retroflex approximants example words: *really* [ɹilɪː] and *very* [vɛɹɪː]	Pickett (ibid.) defines English /l/ and /r/ as *glides*, based on their transition speeds, considered as medium-fast (as compared with those of stops [plosives and nasals], which are abrupt, i.e., momentary, and with those of vowels, which are slower). "For [l] the tongue tip makes contact with the alveolar ridge, but is shaped to leave lateral openings, one on each side of the contact area. For [ɹ], the tongue is flexed back and curled upward (retroflexed), so that the tip makes a moderate constriction (without touch) at the palate."

3	Nasals example word: *many* [menɪ:]	According to Barbosa & Madureira (op .cit., pp. 177-178), nasal consonants are produced with full obstruction of the oral tract and lowering of the velum, with full passage of air through the nose. The nasal cavity favors the lowering of energy at certain frequencies. The waveform shows less amplitude than in vowels and concentration of energy in F1. The first formant has strong intensity but higher formants have weak intensity. During the nasal closure, the sound produced with the passage of air through the nostrils is called *nasal murmur*. It is an intense but very low frequency noise, limited to the region below around 300 Hz. Pickett (op. cit., pp. 113-115)
4	Plosives vs nasals example word with plosive: *happy* [hæpɪ:]	According to Ball & Rahilly (op. cit., pp. 48-49), stops are divided into two types: oral stops, or 'plosives' and nasal stops, or 'nasals'. Plosives are formed by creating a complete closure somewhere in the upper vocal tract. This stoppage of the airflow usually lasts from 40-150 ms. This short period is enough for air pressure to build up behind the closure and, for plosives, there is usually a characteristic popping sound when they are released. This does not occur with nasals, because air is allowed to escape freely through the nasal cavity, so there is no build-up of air pressure in the oral cavity. Oral stops or plosives (e.g., /p/ and /b/), have three stages in their production. First, articulators move together, then are held closed for 40-150 ms. During the closure, there is silence if the sound is voiceless (e.g. /p/ in *happy*) or buzzing if it is voiced (e.g., /b/ in *sabe*). Finally, articulators move apart with a plosive (popping) sound. Ball & Rahilly (op. cit., p. 62).
5	Taps example word: *study* [stʌɾɪ:]	The tap cannot be prolonged, as it requires a very swift contact between the tip of the tongue and the roof of the mouth. If the tongue is held more than a few milliseconds at this position, the sound would change and be heard as a [d]. (Ball & Rahilly, op. cit., p. 47).

Chapter 3 - Methodology: the choice of words for segmentation in PRAAT, the measurements made and the symbols used

This chapter brings explanations of what word types and word sequences were given preference for segmentation, what was actually segmented and how it was represented. Examples are given of what needed to be adjusted and adapted in PRAAT and of how sounds were segmented according to spectrograms and waveforms.

3.1 - The basic measurements made with [ɪ:]#, [ɪ:]#-WORDS and [ɪ:]#-phrases

The objective measurements considered to be the most important in this thesis are the duration (absolute and percentual) and the F2 height of the [ɪ:]# in the words investigated. There has been an endeavor to find segmentable [ɪ:]#-WORDS for analysis in different contexts. This had the aim to test the hypothesis of '[ɪ:]#-stability' in words by N-SPK-E and to obtain details of the identifiable difficulties of B-LNR-E in as many phonetic contexts as possible and also to respond to the question of how similarly or differently from the LINDSEI-BR are [ɪ:]#-WORDS actually realized in Portuguese by N-SPK-BP, with use of the C-ORAL-BRASIL. Following is a summary of the main measurements made in the present thesis: [17]

a) The realization and duration of [ɪ:]# in 82 research words measured (59 of those words had the [ɪ:]# identified and segmented).
b) The average F2 of [ɪ:]# in all the FULL-[ɪ:]#-WORDS;
c) The F1 and F2 and the difference between them in the stressed vowel (SYL-1) in the words *happy* and *really* (i.e., the phonemes /æ/ and /i/, respectively) in SBC and in LIN. This was done in *happy* because BP does not have a phonological /æ/ vowel, but does have /a/ and /ɛ/; and it was also done in *really* because some SBC speakers were observed to realize that word with a markedly low (centralized) F2 in the first syllable;
d) The durations of the [ɪ:]#-WORDS;

[17] A research word with an [ɪ:]# is called a FULL-[ɪ:]#-WORD, e.g., *sabe* [sa.bɪ:]; A research word missing [ɪ:]# is called a ZERO-[ɪ:]#-WORD, e.g., *sabe* [sab]; A research word with neither [ɪ:]# nor the preceding consonant (INT) is called a ZERO-SYL-2-WORD, e.g., *sabe* [sa];

e) The percent proportions of SYL-1, INT and [ɪ:]# in those respective [ɪ:]#-WORDS;

f) The speaking rates (spk rates) in each corpus, measured by dividing the total duration of each phrase by the number of syllables counted in it (example in section 3.6);

g) The durations of pauses occurring just before or just following the [ɪ:]# (pre- and post-pauses (PrPs and PsPs);

h) The relation between duration and [ɪ:]# F2 height and NXT-SGM (the possible rises or falls of [ɪ:]# measurements depending on whether the following sound is, e.g., a voiceless or voiced sound, a plosive or fricative, or a pause) (See subsection 4.1.5);

i) Differences in spk rates between corpora, levels of experience with English (in the case of LIN speakers), or depending on the research word analyzed (Table 4.3);

j) Differences in spk rates and distribution of word parts (SYL-1, INT and [ɪ:]#) depending on FULL, ZERO-[ɪ:]# (LIN and C-ORAL-BRASIL) or ZERO-SYL-2 (C-ORAL-BRASIL) reazlizations of the [ɪ:]#-WORDS. Generally, in C-ORAL-BRASIL the incomplete words were spoken in phrases with faster spk rates than the full ones, i.e., they were shorter words. [18]

Table 3.1 - The three subdivisions of the [ɪ:]#-WORDS in SBC, LIN and C-ORAL-BRASIL

SBC/LIN	SYL-1	INT	[ɪ:]#	C-ORAL-BRASIL	SYL-1	INT	[ɪ:]#
happy	hæ	p	ɪ:	**desse**	de	s	ɪ:
many	me	n	ɪ:	**ele**	e	l	ɪ:
really	ri	l	ɪ:	**gente**	ʒẽ	t/tʃ	ɪ:
study	stʌ	d/ɾ	ɪ:	**pode**	pɔ	d/dʒ	ɪ:
very	vɛ	ɹ	ɪ:	**sabe**	sa	b	ɪ:

3.2 - The PRAAT software and other useful tools

PRAAT was the software used for the segmentations in this thesis. It is a free software package for phonetic analysis. It is a flexible program that allows for several adjustments to be made for the attainment of specific goals. The program can be downloaded freely at

[18] When a research word was incomplete, it was counted as having only one syllable. e.g., *sabe* realized as [sa.bɪ:], (two syllables); *sabe* realized as [sab], (one syllable).

<http://www.fon.hum.uva.nl/praat/>. To locate and organizing words and phrases from the three corpora, Antconc, "a freeware corpus analysis toolkit", was used. <ANTCONC. URL = http://antconc.joydownload.com/>. For the checking of spellings and meanings of words and phrases, the main dictionary consulted was the American Heritage Dictionary available at <https://www.ahdictionary.com/word/search.html?q=mayday&submit.x=35&submit.y=20> The phonetic symbols used in the segmented files are the Lenz, "the IPA keyboard remapper", by Scott Sadowsky, from the Catholic University of Chile. The keyboard can be downloaded freely at <http://sadowsky.cl/lenz.html>

3.2.1 - Standard vs adjusted settings in PRAAT

In order to improve the quality of segmentations in this thesis and to enhance visualization of segment boundaries in waveforms and spectrograms, some adjustments were made to PRAAT standard settings. Below, I give a brief description of each function used and modified in the acoustic analysis tool, with standard and adjusted values, and the reasons for the choices made.

In the large image below (Spectrogram 3.1), it is possible to see the menu titles with names of several PRAAT analysis options, but all of the modifications needed for the present thesis were done only in *spectrum* and *formant* values. Also, *Pitch settings* are shifted between two specific ranges of measurement according to speaker gender, following PRAAT instructions. (explanations about the naming of PRAAT files are in subsection 3.2.3).

Under the heading *spectrum*, several modifications can be made for the display of spectrograms; *pitch* can be adjusted to accommodate the chosen range of the visual field of F0 movement considered ideal for the investigation being carried out. Under the heading *formant*, the researcher can choose how many formants should be shown, if any, and how big or small or detailed their trackings should look.

Spectrogram 3.1 - PRAAT menu options in SBC word segmentation
SSS F MANY_P PARTS SBC055_mono 1228 I = 71, W = 340
(I-got-man-y-parts, of-fered-me)

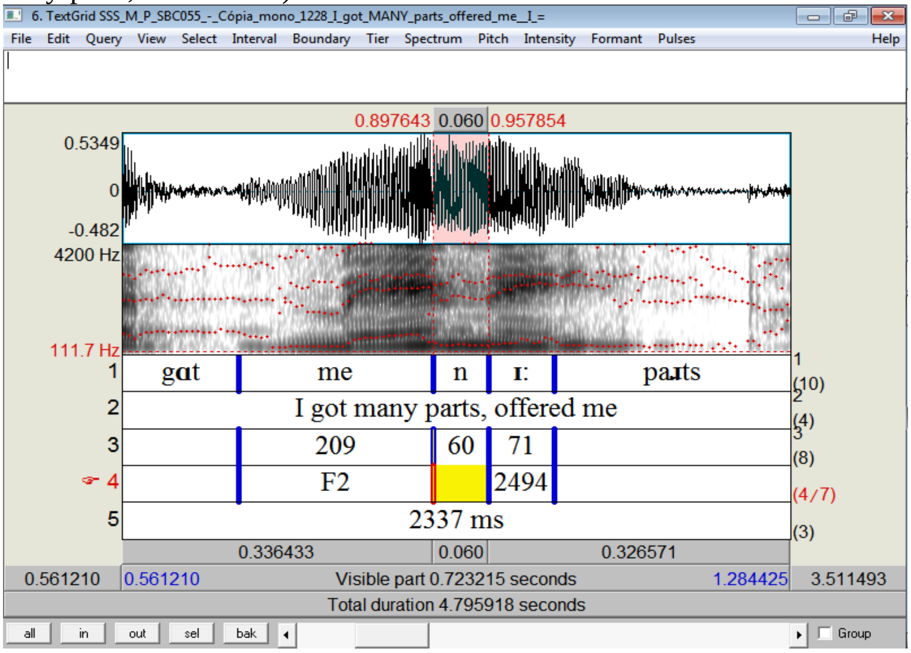


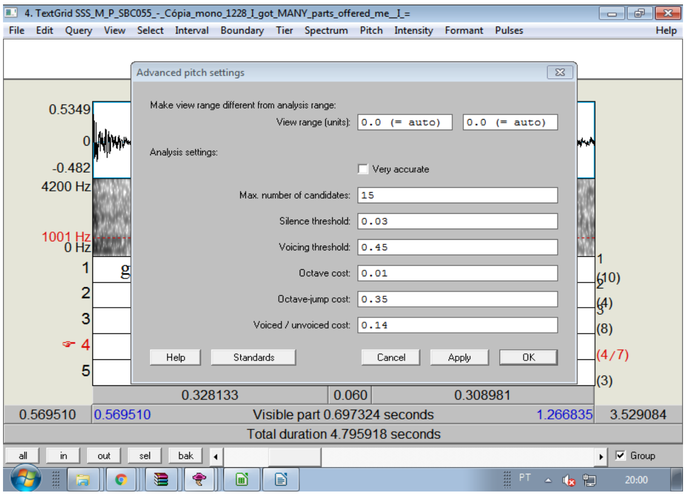
Table 3.2 - PRAAT adjustments

MENU	PRAAT STANDARD VALUES	ADJUSTMENTS USED IN THIS THESIS
A PITCH		
PITCH SETTINGS (measures F0 contours along the spectrogram)	(75-500 Hz)	PITCH RANGE was used only between two ranges of values: (100-500 Hz) for women and (75-300 Hz) for men, according to PRAAT instructions
B SPECTRUM -SPECTROGRAM SETTINGS		
VIEW RANGE (delimits the scope of frequencies desired)	0 – 5,000 Hz	0 – 4,200 Hz (note below)
DYNAMIC RANGE (describes the ratio between maximal and minimal light intensities)	70 dB	56 dB (note below)
ADVANCED SPECTROGRAM SETTINGS		
DYNAMIC COMPRESSION	0	0 – 2 (note below)
C FORMANT - FORMANT SETTINGS		
NUMBER OF FORMANTS	5	5 (note below)
WINDOW LENGTH	0.025	0.025 – 0.010 (note below)
DOT SIZE	1 mm	0.5 – 1 mm (note below)
D SOUND VOLUME		
(PRAAT objects – sound – modify -scale intensity)	70 (new average intensity - dB SPL)	75 (new average intensity - dB SPL) (note below)

3.2.2 - The PRAAT adjustments briefly explained

A - (Pitch - pitch settings) **Pitch range** is the function with which one can establish the frequency range within which PRAAT will track F0 movement. It was not manipulated in this thesis, except for adjustments prescribed for speaker gender.

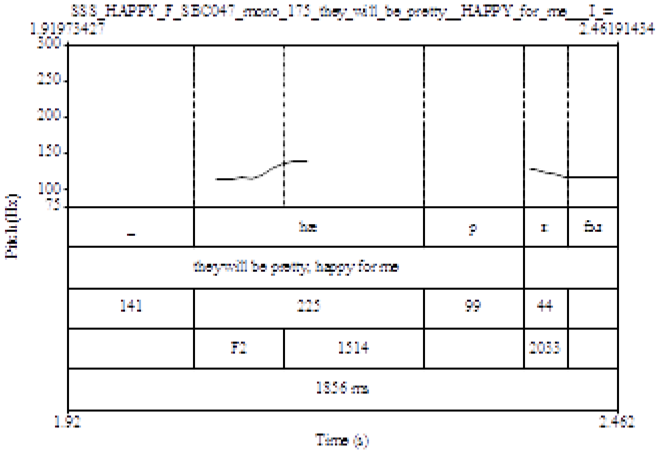
Figure 3.1 - Advanced pitch settings options



(Pitch) In **Advanced Pitch Settings**, as shown in Figure 3.1, there are multiple ways to change the pitch contour (See Pitch contour and Textgrid 3.1 below). It is useful, sometimes, to manipulate the pitch contour, which is the acoustic rendering of F0 movement. But each pitch contour image presented in this thesis (there are several *pitch contour and textgrid* images in the present work), is exactly what it looked like using PRAAT standard pitch settings, i.e., they were all kept at standard values. Because of this, if a stretch of phonologically voiced speech is shown without the predicted pitch contour in an image in this thesis (e.g., Pitch contour and Textgrid 3.1 - Devoiced vowel in the word *happy*), this means either that probably there was some variation to normal voicing. It is common for voiced sounds to be sometimes pronounced without complete voicing and it is also common for voiceless sounds to be pronounced with voicing (C-ORAL-BRASIL has several examples). Adjustments can be made in PRAAT, e.g., by lowering *voicing threshold* in order to visualize pitch contours non-apparent by standard pitch values.

Pitch contour and textgrid 3.1 shows part of the vowel [æ] in *happy* without any voicing contour. By not adjusting pitch settings, therefore, I present the potential researcher with the original acoustic 'problem', without any touch-ups. In the example, the 'problem' is to solve the mystery of why [ae] is not voiced in the specific stretch of recording.

Pitch contour and textgrid 3.1 - Devoiced vowel in the word *happy*
SSS M HAPPY_F FOR SBC047_mono 175 PrP = 141, I = 44, W = 368
(They-will-be-pret-ty, hap-py-for-me)



B - (Spectrum – spectrogram settings) **View range:** For the analysis and segmentation of the phrases, a *view range* between zero and 4200 Hz and the *dynamic range* (See definition below) at 56 dB were used. According to Ladefoged (1993, p. 195), a view range from zero to 4,000 Hz is sufficient to analyze vowels and so this range was used, as it appears adequate to enhance the high F2, so characteristic of /i/ vowels.

(Spectrum – spectrogram settings) **Dynamic range** is a ratio of values of lightness and darkness in the spectrogram. PRAAT's standard dynamic range, of 70 dB, has generally seemed too dark for the acoustic data in this thesis, so I adopted 56 dB for all files.

(Spectrum – advanced spectrogram settings) **Dynamic compression**. This is an option to make the spectrogram image lighter or darker. In some cases, several contrasts between segments, i.e., where they should be segmented, can be spotted by darkening the spectrogram. In *Advanced spectrogram settings*, I frequently doubled the standard *pre-emphasis* value of 6 dB/oct and many times darkened the spectrogram by increasing the *Dynamic compression* from standard zero up to 2.0. Dynamic compression can be used to emphasize the visualization of quiet sounds, or, in practice, the higher formant frequencies in relation to lower frequencies.

> While the spectrogram visualizes the main acoustic landmarks as a function of time and frequency fairly well, it is not especially strong at visualizing the strengths of these landmarks. This is because these strengths are visualized as grey values, and the capability of the human eye to interpret more than a few different grey values at the same time is moderate.
> (Boersma, 2013, apud Podesva & Sharma, Chapter 17, p. 18).

C - (Formant – formant settings) **Number of formants:**

According to Boersma (op. cit., p. 20):

> Asking for five formants is necessary even if you are interested only in F1 and F2, because if you ask for only two formants the algorithm will distribute those two formants over the whole range from 0 to 5500 or 5000 Hz. Asking for two formants between 0 and 2200 or 2000 Hz does not work either, because F2 tends to fluctuate heavily with articulation; that is why you want to measure F2 in the first place.

(Formant – formant settings) **Window length:** This option can be used to analyze the measurements of formants in sequential intervals. If, e.g., in the segmentation of the research vowel, one needs to know what are the F2 measurements of the very first part of [ɪː]# after a consonant, by using a standards window length of 0.025 s, values will be given for roughly every 5 ms. If window length is changed to, e.g., 0.01 s, that calculation will be proportionally reduced, giving more precise information. Figure 3.2 shows [ɪː]# formant measurements in the word *happy* (i.e., between INT and NXT-SGM) in the phrase SSS F HAPPY_T TO SBC055_mono 1371 I = 76, W = 370 (I'm-ver-y-hap-py-to-be, say…).

Figure 3.2 - Example of formant measurements given by PRAAT with a 0.025 s window length for [ɪ:]# in an SBC file

Time_s	F1_Hz	F2_Hz	F3_Hz	F4_Hz
1.224902	445.428109	1994.135068	2361.216097	3746.802564
1.231152	419.905225	1994.400605	2402.728424	3746.460815
1.237402	399.347263	2006.038122	2459.109062	3722.850251
1.243652	386.731944	2048.492932	2548.971623	3807.210305
1.249902	379.517353	2038.289729	2567.604085	3965.486974
1.256152	370.763554	2024.631999	2547.679674	4006.055749
1.262402	372.769664	2036.879997	2522.001896	3943.177129
1.268652	369.720591	2118.478370	2657.122178	4173.139879
1.274902	349.879625	2139.555625	2578.791099	4168.371885
1.281152	323.291308	1948.595197	2552.591199	4115.505987
1.287402	304.874267	1980.635464	2587.796401	4094.476513
1.293652	308.017798	2087.193736	2615.099650	4028.782534

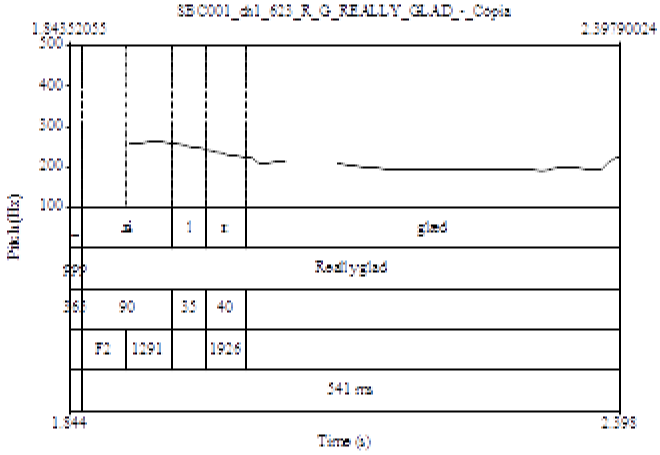
(Formant – formant settings) **Dot size:** The red dots of the formant tracks (as seen in Spectrogram 3.1, above) have standard size of 1 mm, but it is often necessary to reduce that size so that the dots do not cover important details of the spectrogram under analysis. In the image of Spectrogram 3.1, the dots are reduced from standard size.

D - Sound volume adjustments: In this study, it was many times necessary to raise the volume of sound in order to better hear the speech samples.

3.2.3 - The naming of the PRAAT files segmented

In the segmentation of the 82 [ɪ:]#-WORDS in this thesis, there was a concern to give each phrase a title as descriptive as possible. This is exemplified below with an SBC pitch contour and textgrid.

Pitch contour and textgrid 3.2 - SBC - *Really* glad
SSS F REALLY_G GLAD SBC001_mono 623 PrP = 365, I = 40, W = 165
(real-ly-glad)



The file name above contains the following information:

SSS: the corpus of origin (i.e., SBC);

F: the gender of the speaker (female);

REALLY: the [ɪ:]#-WORD analyzed;

G: the segment following the [ɪ:]#-WORD (NXT-SGM, i.e., next segment);

GLAD: the following word or NXT-WORD (GLAD);

SBC001: the name of the original file within the given corpus;

623: the approximate moment (in seconds) in the sound file where the segmented phrase started;

I = 40: the measured duration for [ɪ:]# (40 ms);

W = 165: the total duration of the research word.

In the naming of PRAAT files, adaptations needed to be made to normal orthography in some cases for which phonetic symbols could not be used. Because the file names should indicate which is the NXT-SGM, in the cases when this segment was a linguodental fricative or when it was a tap, it became necessary to adapt the IPA phonetic symbols [θ], [ð] and [ɾ], to *TH*, *DH* and *t*, respectively. e.g.,

a) SSS F REALLY_TH THINKING SBC028_mono 214 I = 83, W = 275

(Like-I-was-real-ly-**th**in-king-a-bout-it-now);

b) SSS M STUDY_DH THE SBC021_mono 1087 I = 64, W = 293
(And-to-study-**th**e-Bi-ble);

c) SSS F HAPPY_t TO SBC006 166 I = 33, W = 266
(They-were-real-ly-hap-py-**t**o-be-do-ing-it).

In c) an SBC subject in file SBC006 (ALIN) produced the word *to* with an initial tap instead of the plosive [t], i.e., [hæpɪ: ɾə bi duiŋ ɪt].

For a 'normal' [t] sound and any other NXT-SGM, capital letters were used for the naming of the segmented files.
e.g., SSS M REALLY_T TEACHES SBC027_mono 950 I = 38, W = 153
(This-real-ly-teach's-us-a-lot)

3.3 - The corpora

According to Sardinha (2000), the use of corpora provides empirical evidence for linguistic data analysis.

Three oral corpora were selected for the data analysis in this thesis. Two of them are in English, i.e., the SBCSAE and the LINDSEI-BR. The third corpus, the C-ORAL-BRASIL, of N-SPK-BP speech, is used to make measurements for influences of BP in the speech of B-LNR-E compared with influences from N-SPK-E.

The LINDSEI-BR is an oral English language learner corpus that integrates the international project named LINDSEI or Louvain International Database of Spoken English Interlanguage, <http://www.uclouvain.be/en-cecl-lindsei.html>, from the Catholic University of Louvain, in Belgium. It consists of learner interviews with a specific format, which comprises three parts: the first one prompts the description of a personal experience or a remarkable movie; the second proposes a brief reflection about future plans and the final one is the narration of a story based on a sequence of drawings (apparently, a woman goes to a painter's atelier and asks for a portrait). The Brazilian version of LINDSEI, in conformity with the original project, consists of 50 interviews with advanced learners of English. The corpus was organized by Heliana Mello, professor and researcher at UFMG. It was deemed convenient to separate the LIN subjects in three different groups: *experienced, advanced* and *intermediate*, according to years of exposition and experience with the English language. At the time of the interviews, the LINDSEI-BR subjects, who were undergraduate students, were to conclude their courses within one or two years. Some of them, here labeled as *intermediate*, had only studied English in the university (besides regular school); others had also studied for several years in private English courses (*advanced*), and a third group had also lived in English speaking countries (*experienced*).

The C-ORAL-BRASIL corpus, <http://c-oral-brasil.org/> – organized by Heliana Mello and Tommaso Raso, another researching professor at UFMG – is a spontaneous corpus of spoken BP, which follows the methodology of the C-ORAL-ROM project (acronim for 'oral corpora of Romance languages') <http://lablita.dit.unifi.it/coralrom/>. The project also includes corpora of Italian, Spanish, French and European Portuguese. The C-ORAL-BRASIL registers varied forms of oral interaction: monologues, dialogues and conversations (i.e., interactions among three or more people).

The SBCSAE corpus, freely accessible at <http://www.linguistics.ucsb.edu/research/santa-barbara-corpus>, is an oral corpus of American English that was created at the University of California in Santa Barbara, under the supervision of John W. Du Bois. It comprises monologues, dialogues and conversations with people of several age groups and different occupations, hailing from various parts of the USA. Such speaker variability seems most welcome for the study of [ɪː] in trochaic bisyllabes. It would be perhaps like 'putting to the test' numerous possibilities of different realizations of the research vowel, so that its impressionistically perceived stability in N-SPK-E speech should be demonstrated by the SBCSAE data, and the LINDSEI-BR and C-ORAL-BRASIL supposed instability in [ɪː]#-WORDS may be directly related to the N-SPK-E results.

3.4 - The choice of the research words

Initially, there was a reading of the transcriptions from the corpora, which were run through Antconc, and then several interesting contexts were chosen. But when those stretches of speech were first actually listened to, I realized that many were not adequate for acoustic analysis and a laborious selection was started for the actually segmentable parts.

3.4.1 - Some challenges in collecting phonetic data for analysis and the '*very*' limitations

It is not easy to select and segment a lot of words from natural speech, especially when one is inexperienced with phonetic analysis. Very often, interesting contexts registered in the transcriptions have actual recordings not good enough for acoustic study and demonstration. Other times, a recorded file has excellent acoustic quality but none of the contexts in it is of interest to a particular investigation. An acoustically good file can also have overlapped speech during the production of the actual words of interest or there may be a noise at the very moment those words are being spoken. In order to partly reduce such problems, a preference was given, in the present thesis, to analyze recordings with no more than three participants.

In addition, the word *very* was found not to be normally segmentable. If we think of a 'well-rounded' intervocalic [ɹ] or [l], we can imagine a continuous, gradual articulation, which needs some time to transition into the next vowel. Considering formant values, a well-produced [ɹ] reaches very low F2 and F3 values, due to lip rounding. A well-produced [l], in turn, has a very low F2 in comparison with a high front vowel. [ɹ] and [l] do not have recourse to abrupt release movements like stop consonants do. When pronounced quickly between vowels, the approximants [ɹ] and [l] tend to be simplified in their articulation, as exemplified by an [ɹ] analysis in Ladefoged, 2003 (op. cit., pp. 149-151) in section 3.5. In the initial attempts to segment the word *very*, the waveforms and spectrograms usually showed [ɹ] visually and auditorily overlapped with the surrounding vowels. Because of these limitations in *very*, only on a few occasions was it possible to segment it adequately. The initial, unpredicted problem with *very* set me thinking about the likelihood of other difficulties with some [ɪ:]# – NXT-SGM transitions, as, e.g., the [ɪ:]# into another vowel in the following word, as in, e.g., *really interesting*. For those reasons, [ɪ:]# followed by vowel sounds were sequences generally avoided in the present thesis. It is not just a question of locating a segment, but also to decide where exactly to segment it on and off, and exactly by which criteria.

There is mention in the literature (e.g., Ladefoged, 2003, pp. 149-151) that word-initially, [ɹ] is less complicated to segment than intervocalically. This has been repeatedly seen in the present thesis with segmentations of the word *really*. Word-initially, [ɹ] shows weaker energy than intervocalically, which is a good visual aid for segmentation, because of the contrast with the vowel formants (See Spectrogram 4.4, below), even though Tunley (op. cit., p. 23) has concluded that the SYL-1 /[ɹ]V/ is less satisfactorily segmentable than /hV/ or /lV/. Ladefoged (ibid) relates an example in which word-initial and intervocalic [ɹ] are compared. In a test recording with the phrase *a red berry*, it was observed how the F3 of [ɹ] was very low (because of a lot of lip rounding) in the onset for the word *red* (F3 around 1,240 Hz) and how high it was intervocalically in *berry* (F3 around 2100 Hz). In the first word, the tongue made a considerable movement in the stressed [ɹ] (after a weak initial schwa: [ə ɹəd]); but we can conclude that the intervocalic [ɹ] had only a small tongue movement, and is, acoustically, very 'vowel-like'.

3.4.2 - Initial segmentation plans and results

Three words were initially considered as obvious choices for analysis in this thesis: *very*, *really* and *gente*, because of their high occurrence rates in the corpora. *Very* seemed, initially, the most interesting word to be studied from the LIN, since it is by far the most common [ɪ:]#-WORD in the B-LNR-E corpus. In SBC, *really* is ranked first and *very* is third (Table 3.3). As soon as segmentations were started, though, it became clear that it would not be possible to segment the word *very* serially with any satisfactory level of accuracy. The General American /r/ is an approximant sound, [ɹ], which, differently from other rhotics, like the trill [r] and the tap [ɾ] or the alveolar approximant [l], does not have any contact between articulators. Segmenting a trill and a tap is rather simple, as observed in examples in Barbosa & Madureira (op. cit., pp. 178-179), due, basically, to the touch of articulators, whose contact is usually clearly visible in spectrograms.

The initial intention had been to segment, besides *very* and *really,* several other English words (all English words in Table 3.3, below). However, it soon became clear that it would be better to concentratre on more phrases with fewer word types, so that comparisons among realizations were more consistent.

For C-ORAL-BRASIL, on the other hand, the initial plan was simpler. The idea was to segment only the word *gente*. But after analyzing the results found for that word, I saw the need to analyze other word types, to test whether the data obtained with *gente* were word-specific or general for BP. The phonetically very different word *sabe* was then segmented a few times, but the results were very similar to those obtained with *gente*.

3.4.3 - The importance of the INT consonant and NXT-SGM in the choices of phrases

Because of acoustic problems with intervocalic [ɹ], several stretches of recording in LIN, which indicated a clear absence of the vowel [ɪ:]# in samples of the word *very* were not analyzed. The words *happy, many* and *really* were chosen as the main ones for segmentation in the English corpora alongside the word *gente* and, later on, *sabe,* in C-ORAL-BRASIL. *Happy, many and really* have the analytical convenience of being articulatorily quite different from each other, be it in terms of word onset, stressed vowel or intervocalic consonants (i.e., approximant, plosive and nasal: [l], [p] and [n]). Based on word frequencies shown in Table 3.3, *Really* was initially chosen over *only,* and *many* was chosen over *funny,* on grounds of higher recurrence rates within the corpora. But the results of those choices, based mainly on word frequency and INT variability, turned out surprising in the measurements of the different word types, as shown below, in section 4.1. Those results are commented in subsection 4.1.3.

Table 3.3 - Most Frequent [ɪː]#-WORDS in the SBCSAE, LINDSEI-BR and C-ORAL-BRASIL files analyzed

Most frequent [ɪː]#WORDS in the SBCSAE	Most frequent [ɪː]#WORDS in the LINDSEI-BR	Most frequent [ɪː]#WORDS in the C-ORAL-BRASIL (only files analyzed)
675 really	**583 very**	98 esse
376 many	**369 really**	**89 gente**
353 very	**123 study**	**59 ele**
209 only	71 only	**23 pode**
70 happy	**66 many**	17 dele
52 funny	**46 happy**	**13 desse**
22 easy	36 pretty	**10 sabe**
15 study	22 funny	9 deve

words chosen for analysis are shown in bold

From Table 3.3, it is easily observable that most frequent [ɪː]#-WORDS coincide in SBC and in LIN. On the other hand, the INT consonants in English, according to the lists above ([l] for *really*, [n] for *many*, [ɹ] for *very*, [ɾ] for *city* and *study*, and [p] for *happy*) are very differently distributed from those in the Portuguese words ([s] for *esse*, [tʃ] for *gente*, [l] for *ele* and *dele*, [dʒ] for *pode*, [b] for *sabe* and [v] for *deve*).

3.4.4 - Seeking 'really intercomparable' words for segmentation

I call 'normalization' the permanent attempt, in this thesis, to make the data selected for analysis from SBC, LIN and C-ORAL-BRASIL as comparable as possible inter- and intra-corpora. Some criteria were established to approach that goal. The initial one was to look for exact morphological sequences for the phrases to be analysed, which was achieved for eight sequences in 20 files, as shown in Table 3.4.

Table 3.4 - Exact morphological sequences within [ɪː]#-phrases in SBC and LIN (Word sequence matches in SBC and LIN phrases)
happy because (BR019*, BR019**, BR039)
really beautiful (SBC028, BR029)
really don't know (SBC055, BR028)
really hard (SBC001, BR042)
really like (SBC030, SBC040, BR011, BR025*, BR035*)
really love (SBC020, BR009*)
study the Bible (SBC021, BR025*)
very happy (SBC055, BR044)
(asterisks indicate ZERO-[ɪː]#s)

3.4.4.1 - Other normalization criteria

Besides the selection of exact word sequences from the English corpora, the following normalizing criteria were also targeted:

a) Preference for frequent word types: There has been an attempt to select words with high recurrence, so that several comparisons with the same word type could be made between the corpora, within the same corpus and, when possible, by single speakers;

b) Analyses of more than one word per speaker, especially when that speaker realized a ZERO-[ɪː]#, so that phonetic-phonological context influences could be more directly and realistically hypothesized;

c) A balance between genders, i.e., if three phrases with *many* were segmented for male speakers from LIN, three other *many* phrases by females should also be segmented, and the same should be done with SBC; if that gender matching was not possible, I would try to, at least, segment the same numbers of the same words from each corpus;

d) To give a preference for phrases in which the NXT-WORD had, as onset, the same phoneme as that of the INT consonant in the research word. As an example, due to the fact that it was not possible to find any (segmentable) *many people* sequence in SBC to be compared with LIN BR028 (We-knew-man-y-peo-ple-from-U-tah), the sequence *many parts,* located in SBC055 (I-got-man-y-parts, of-fered-me) was considered interesting enough for comparisons because of the coincidence of [n]-[ɪː]#-[p] sounds. In the end, this choice proved very important in analyses of duration and F2 patterns and, especially, for the ZERO-[ɪː]# realizations in LIN;

e) To choose words with the same INT consonants in the English and Brazilian corpora, so that better comparisons could be made between English and BP. e.g., if I chose *happy* from the Engish corpora, I should look for an [ɪː]#-WORD in C-ORAL-BRASIL which also had [p] as intervocalic consonant.

3.4.4.2 - The impossibilities of some normalization objectives

The balance between genders for each word type searched, mentioned in the previous subsection, proved an elusive goal. It was not possible to segment same numbers of same words in SBC and LIN, either. One of the causes of those practical impossibilities is that, as mentioned above, several prospective examples of segmentable phrases in the corpora were not acoustically viable. Besides, 10 [ɪː]#-WORDS analyzed from LIN were incomplete (ZERO-[ɪː]#-WORDS), as compared with no such words in SBC. It soon became apparent that FULL-[ɪː]#-WORDS should not, in most cases, be measured alongside incomplete ones. Those two kinds of realizations of [ɪː]#-WORDS in LIN (22 FULL-[ɪː]#-WORDS and 10 ZERO-[ɪː]#-WORDS) are measured separately (top and middle of Table 3.5, lines 1 through 7 and 8 through 14) and also as one single group (bottom of Table 3.5, lines 15 through 21). The separate averages show interesting results. At the top part of the table, the actual average F2 for LIN FULL-[ɪː]#-WORDS is shown to be of 2042,77 Hz (line-column 4G). That is the F2 value worth comparing with SBC and with C-ORAL-BRASIL FULL-[ɪː]#-WORDS, because in that calculation, all words involved have realization of an [ɪː]#. But at the bottom of the table, the division of all measurements by 32 shows a very low average [ɪː]# F2 (1404,41 Hz) (18G), because 10 of those 32 words did not 'contribute' for the total F2 value (44941 Hz) (3G and 17G), so that it is not realistic to make the division by 32 for real proportions, but only to illustrate how often LIN speakers fail to produce the research vowel. And the same applies to all the other measurements: SYL-1, INT and [ɪː]# durations, percentages and speaking rates (Compare line-columns 4 and 11B for INT consonant durations within LIN). For such reasons, the measurements of the ZERO-[ɪː]#s in LIN and C-ORAL-BRASIL were analyzed separately from FULL-[ɪː]#-WORDS, and yet a third kind of list was created for the ZERO-SYL-2-WORDS from C-ORAL-BRASIL, as opposed to the

FULL-[ɪ:]#-WORDS and ZERO-[ɪ:]#-WORDS in that corpus.

Another thwarted comparison attempt concerned the proposition in 3.4.4.1 (e), due to the fact that the C-ORAL-BRASIL has very different intervocalic consonants than both the English corpora in [ɪ:]# trochaic bisyllables, as is observable in Table 3.3. Words such as *many, very* and *study* had no paralell INTs among the BP corpus' most frequent [ɪ:]#-WORDS. Alternatively, and because the words *gente* and *pode* were selected for analyses in the C-ORAL-BRASIL, I looked for words such as *twenty* in the LIN, to try a comparison with *gente* [ʒẽ.tʃɪ:],[19] but the search proved futile for two reasons: LIN subjects normally used a tap before [ɪ:]#, i.e., [twenɾɪ:] rather than an affricate consonant, i.e., [twentʃɪ:]. Besides this, *twenty* and similar words (*thirty* etc) are quite rare in the corpora to allow for any consistent investigation. Similarly, the word *study* was discovered to be realized almost always, in the LIN, with an intervocalic tap as well, i.e., [stʌɾ.ɪ:], rather than as [s.tʌdʒ.ɪ:] or [ɪs.tʌdʒ.ɪ:] (to compare with BP *pode* [pɔ.dʒɪ:].

Table 3.5, below, has the same layout as Tables 4.1, 4.2 and 4.11. They are an attempt to show several important SBC and LIN data at the same time. The data measured are identified in line 2 (SYL-1, INT, etc). Line 3 brings the sum total of those data and their averages are in line 4; line 5 gives the percentages of those averages within the word (columns A, B, C and E). Column G gives F2 averages, and column H gives spk rates within the phrases analyzed.

Different colors in the tables identify SYL-1, INT, [ɪ:]# and W (orange, yellow, blue and pink, respectively). F2 and spk rates are also in blue. Due to the need to show numerous measurements in the same images, colors were chosen as a means to aid quicker and easier visualisation.

[19] Realizations like [twentʃ.ɪ:] or [twentʃ] are typical of beginning learners of English in Brazil, but, apparently, no longer of those more experienced B-LNR-E. It seems that the use of an intervocalic tap soon becomes popular among learners, probably influenced by American English [twenɾɪ:] . The word *study,* similarly, is commonly produced by beginning B-LNR-E as [ɪs.tʌdʒ.ɪ:] or [ɪs.tʌdʒ], but in LIN, I only found intervocalic taps, when [ɪ:]# was realized. With ZERO-[ɪ:]#, one example of [is.tʌd] was found (BR025) and contrastively analyzed here with SBC021 (spectrograms 4.8 and 4.9).

Table 3.5 - LIN - 22 FULL-[ɪ:]#-WORDS, 10 ZERO-[ɪ:]-WORDS and all 32 [ɪ:]#-WORDS

1		LIN DATA: 22 FULL-[ɪ:]#-WORDS MEASUREMENTS and PHRASE SPEAKING RATES							
2	data	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	F2 SYL-1	[ɪ:]# F2	SPK RATE
3	tt	4960	1352	1820	8132		n/a	44941	5207
4	av	225,45	61,45	82,73	369,64	23%	n/a	2042,77	236,68
5	pct	60,99%	16,63%	22,38%					
6		ALL LIN [ɪ:]#-PHRASES 12W/10M							
		A	B	C	D	E	F	G	H
7		FULL-[ɪ:]#-WORDS in LIN: 14 really, 3 many, 2 happy, 2 very and 1 study							
8		LIN DATA: 10 ZERO-[ɪ:]#-WORDS MEASUREMENTS and PHRASE SPEAKING RATES							
9	data	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	F2 SYL-1	[ɪ:]# F2	SPK RATE
10	tt	1779	1003	0	2782		n/a	0	2900
11	av	177,9	100,3	0	278,2	0%	n/a	0	290
12	pct	63,95%	36,05%	0,00%		0		0	
13		LIN ZERO [ɪ:]#s							
		A	B	C	D	E	F	G	H
14		ZERO-[ɪ:]#-WORDS in LIN: 3 really, 2 happy, 2 many, 2 very and 1 study							
15		LIN DATA: 32 WORDS (22 FULL-[ɪ:]#-WORDS AND 10 ZERO-[ɪ:]#-WORDS)							
16	data	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	F2 SYL-1	[ɪ:]# F2	SPK RATE
17	tt	6739	2355	1820	10914		n/a	44941	8107
18	av	210,59	73,59	56,88	341,06	17%	n/a	1404,41	253,34
19	pct	61,75%	21,58%	16,68%					
20		LIN ALL ([ɪ:]#-PHRASES: 22); (ZERO-[ɪ:]#-PHRASES: 10)						20W/12M	
		A	B	C	D	E	F	G	H
21		All FULL-[ɪ:]# and ZERO-[ɪ:]#-WORDS in LIN: really (14-3); many (3-2); happy (2-2); very (2-2) and study (1-1)							

3.5 - The distribution of the analyzed words in the corpora

There are a total of 82 [ɪ:]#-WORDS analyzed in this thesis, as shown in Table 3.6. For SBC and LIN, 32 words were segmented from each, while 18 others were taken from C-ORAL-BRASIL. On a couple of occasions, more than one word were analyzed within a single stretch of speech. e.g., from C-ORAL-BRASIL file bfamcv01, the word gente was measured three times in the following sequence: *Gente, a gente perdeu no campo; a gente não perdeu por causa disso não.*[20]

[20] *Gente (!)* is a vocative which means, *Folks (!); Hey, everybody (!). A gente,* on the other hand, has the function of a pronoun meaning *we* or *us, and*, occasionally, *I* or *me*. e.g., *A gente faz o que pode* (*We/I do what we/I can*).

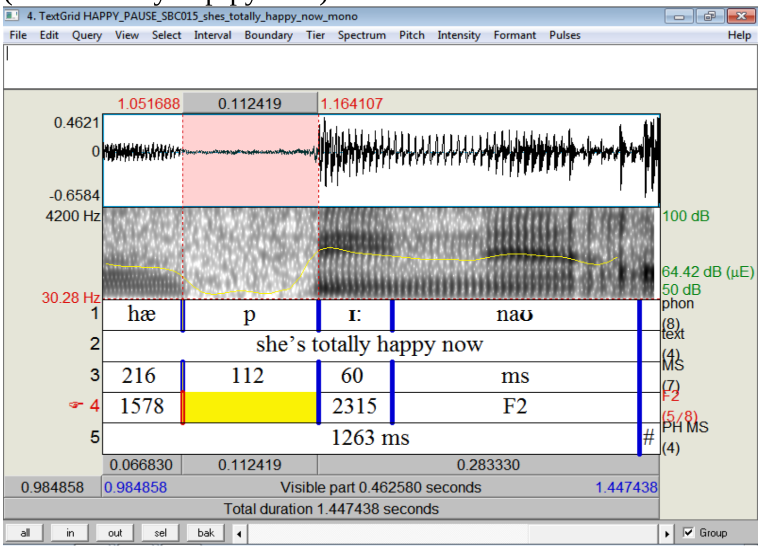
Table 3.6 - Distribution of [ɪ:]#-WORDS analyzed from SBCSAE, LINDSEI-BR and C-ORAL-BRASIL

Corpus / Gender Word	SBC women	SBC men	LIN women ([ɪ:]#)	LIN men ([ɪ:]#)	LIN women (ZERO [ɪ:]#)	LIN men (ZERO [ɪ:]#)	C-ORAL women (all)	C-ORAL men (all)
happy	5	2	1	1	2	0	–	–
many	2	4	1	2	1	1	–	–
really	12	5	7	7	2	1	–	–
study	0	1	1	0	1	0	–	–
very	1	0	2	0	2	0	–	–
desse	–	–	–	–	–	–	1	0
ele	–	–	–	–	–	–	1	1
gente	–	–	–	–	–	–	6	4
pode	–	–	–	–	–	–	1	0
sabe	–	–	–	–	–	–	4	0
tt	**20**	**12**	**12**	**10**	**8**	**2**	**13**	**5**

3.6 - The segmentation of the chosen words

Spectrogram 3.2 exemplifies how segmentations were made in this thesis:

Spectrogram 3.2 - SBC - Some vowels and consonants in *happy* phrase
SSS F HAPPY_N NOW SBC015_mono 862 I = 60, W = 388
(She's-toud-ly-hap-py-now)



- **Tier # 1** gives the phonetic transcriptions of the three subdivisions of the research word (SYL-1, INT and [ɪː]#, i.e., hæ.p.ɪː). The word immediately preceding and the word immediatelly following the [ɪː]#-WORD are also delimited and transcribed phonetically. If a pause over 200 ms precedes or succedes the research word, that pause will be demarcated instead of the preceding or following word;

- **Tier # 2** gives an orthographic rendition of the analyzed phrase;

- **Tier # 3** informs the durations of the three word parts analyzed;

- **Tier # 4** gives the average F2 for the SYL-1 vowel (only for *happy* and *really,* as explained above) and for [ɪː]#. In the example above, 2315 Hz was the average F2 found for the 60 ms [ɪː]#;

- **Tier # 5** shows the total duration of the phrase. This is important for the measurement of speaking rates. In the example, 1263 ms should be divided by the number of syllables counted in the phrase, which is as an attempt at an approximation between morphology and phonetic transcription (She's-toud-ly-hap-py-now). i.e., six syllables. Therefore, 1263/6 = 211. Thus, each syllable in the phrase was spoken, on average, in 211 ms.

There has been a constant concern, throughout the segmentations in this thesis, to cut onsets of the research words with precision, so that word size was properly determined, indicating also the correct proportions of the [ɪː]# in the word. e.g., if a W measures 300 ms and the [ɪː]# measures 60 ms, this means that [ɪː]# represents 20% of that word. The descriptions following will focus mostly on the transitions between INT and [ɪː]#, since phrase and word onsets were generally not a problem in this study, due to a stronger contrast between the initial consonants and the vowels in the beginnings of words (differently from intervocalic consonants), because, word-initially, consonants tend to be less influenced by vowel articulation.

3.6.1 - The segmentation of the onset and offset of [ɪː]#

For the segmentation and proper measurements of duration of the [ɪː]# it is very important, first of all, to use consistent ways to segment both the onset and the offset of the research vowel.

3.6.1.1 - The onset of [ɪː]#

The identification of where [ɪː]# starts depends on knowledge about the articulatory and acoustic characteristics not only of vowels but also of the INT consonant which precedes [ɪː]#. After different INT consonants [ɪː]# has shown to have different initial formant values and characteristic acoustic configurations (See Table 4.3).

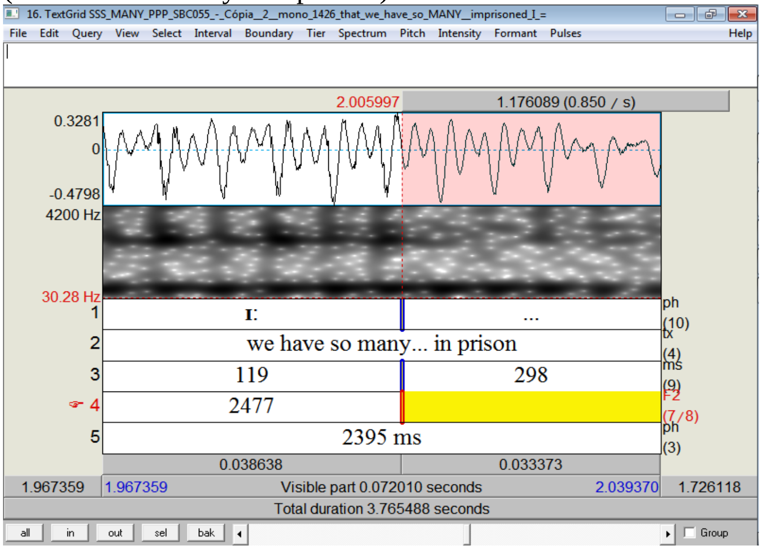
3.6.1.2 - The offset of [ɪː]#

The offset of [ɪː]# was marked according to Ladefoged, 2003 (pp. 141-142). There are two common situations: a vowel followed by a consonant and a vowel followed by a pause. When there is a consonant following, Ladefoged suggests that the cut should be made where there is loss of energy in F2 and higher formants, a fact that indicates the forming of the following constriction, even if part of a glottal vibration is still "visible at the beginning of the consonant closure." When the vowel is followed by a pause, loss of energy in F2 is also to be observed, but there may be some additional difficulties. This is because, while following consonants may have very specific acoustic characteristics, a following pause may involve a continued exhaling of air and the production of some vowel-like sound. Below, I give two illustrative spectrograms of [ɪː]# followed by pauses: one with a noisier and another with a quieter transition into a pause (Spectrograms 3.3 and 3.4, respectively). In the first and noisier example, the speaker makes a pause of approximately 300 ms just after [ɪː]#. A faint but vowel-like sound continues being produced into the pause for some time.

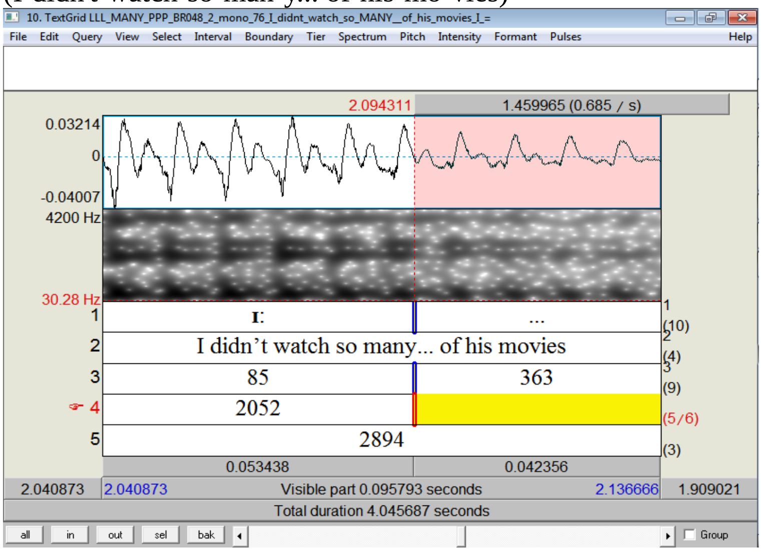
One of the main segmenting criteria for the offset of [ɪː]# in the present thesis is to decide when the waveform becomes simpler and the spectrogram shows a clear weakening of F2. There is also usually a lowering in intensity (before a consonant or pause), indicating reduction of lip opening. Sounds that "fade away" (which actually are very common) are a problem for segmentation, according to Ladefoged, 2003 (pp. 141-142). [21]

[21] In the PRAAT spectrogram images, waveforms are shown at the top and the actual spectrograms are at the bottom.

Spectrogram 3.3 - Offset of [ɪː]# before pause in SBC word (*many*)
SSS F MANY_PPP SBC055_mono 1426 I = 119, W = 376, PsP = 298
(We-have-so-man-y... in-pris-on)



Spectrogram 3.4 - Offset of [ɪː]# before pause in LIN word (*many*)
LLL M MANY_PPP BR048_2_mono 76 I = 85, W = 360, PsP = 363
(I-didn't-watch-so-man-y... of-his-mo-vies)



Of the two above spectrograms, the one with the more complex offset (Spectrogram 3.3) will be analyzed here. It is possible to see that, in Spectrogram 3.4, there is almost silence just after the offset of [ɪː]#.

In Spectrogram 3.3, although the waveform apparently does not change much after where [ɪː]# was segmented off, it is observable that the second formant fades into the pause. The first formant stays on, both in the waveform and in the spectrogram. The second formant is much more flexible than the first formant, because while F1 is related with degrees of mouth opening, F2 is related with position of active articulator (here, the tongue). Because of this, F2 can change instantly while F1 is very slow in comparison. According to Ladefoged, 2003 (p. 131), "F1 largely represents vowel height." The configuration seen in the waveform of Spectrogram 3.3, after the segmentation of the offset of [ɪː]#, is a simpler one, dominated by F1.

Considering, e.g., an [ɪː] with an F1 of 300 Hz and and F2 of 1800 Hz, then for each F1 cycle there would be six F2 cycles. That is, around the F1 there would be six 'small F2s', making the waveform quite complex-looking. Higher formants, like the F3, have even more cycles. Weaker formants above F1 are also a cause of simpler waveforms in [n] and other nasals, because their higher formants have very little energy. The alveolar approximant [l] has more complex waveforms than [n] because the strong low-frequency portion of nasals is limited to about 300 Hz (Pickett, op. cit., p. 114), while [l] has stronger energy in higher frequencies, notieceably a strong F3.

3.6.2 - Degrees of acoustic contrast between vowels and consonants

The segmentations of INT and [ɪː]# pose varying degrees of complexity due to minor or major contrasts between the two sequential segments. The clearer the acoustic contrasts between two sequential sounds, the easier the segmentation. In Table 3.7, below, I propose four ways by which articulatory contrasts between vowels and consonants may correspond to bigger or smaller acoustic differences, predicting more or less complexity in the task of segmenting the INT consonants and the vowels around it.

Table 3.7 - Proposed vowel and consonant contrasts for voice, sonority, transition speed and touch of articulators in [ɪː]#-WORDS analyzed: the **INT** consonants

Phonetic features Y = yes; N = no.		voiced (pitch)	sonorant (intensity)	slow transitions	no touch of articulators	contrasts with vowel
Vowel	**e.g., [ɪː]**	**Y**	**Y**	**Y**	**Y**	**-**
Word	**Segment**					
happy	**[p]**	**N**	**N**	**N**	**N**	**4**
sabe	**[b]**	**Y**	**N**	**N**	**N**	**3**
gente	**[tʃ]**	**N**	**N**	**N**	**N/Y**	**4 and 3**
pode	**[dʒ]**	**Y**	**N**	**N**	**N/Y**	**3 and 2**
desse	**[s]**	**N**	**N**	**N**	**Y**	**3**
study	**[ɾ]**	**Y**	**N**	**N**	**N**	**3**
many	**[n]**	**Y**	**Y**	**N**	**N**	**2**
really, ele	**[l]**	**Y**	**Y**	**Y**	**N**	**1**
very	**[ɹ]**	**Y**	**Y**	**Y**	**Y**	**0**

Considering the 'segmentation difficulty ranking' in Table 3.7, it can be concluded that the C-ORAL-BRASIL words selected are, generally, easier to segment than the ones from the English corpora (i.e., with the exception of *happy*, the Portuguese words in this study have more vowel vs INT contrasts than the English words).

[tʃ] and [dz]: The words *gente* and *pode* were marked with N/Y in relation to the vowel because, in the affricate pronunciation of C-ORAL-BRASIL, those words start with a plosive closure followed by a fricative constriction, with close approximation (with friction) but not touch between articulators.

Intensity: According to Ladefoged, 2003 (p. 91), "For vowels, the intensity is largely proportional to the degree of opening of the lips". Sounds like [a] and [o] tend to have higher intensities than [i] and [u], for example. A sonorant consonant has high intensity, similarly to a vowel and opposed to non-sonorants. In Spectrogram 3.2, above, [p] has no intensity while [n] has close to vowel-like intensity. This is related with the expelling of air during the consonant constriction; [n] has oral closure but air escapes continually through the nostrils; [l]

has central closure but lateral openings and [ɹ] has only an approximation between articulators (i.e., high intensity). For plosives, like [p] and [b], there is total obstruction of the passage of air, so that there is normally a sharp drop in intensity during their constriction.

Formant transitions: The slow transitions of formants, typical of sounds such as vowels and glides, make the articulatory and acoustic separation between them into a gradual process. However, to segment, it is obviously necessary to choose one specific point for division. In the case of the /l-V/ transition, as in *really*, despite difficulties, according to Ladefoged, 2003 (p. 98), there is normally "a clear increase in amplitude when the vowel begins". For the case of intervocalic [ɹ], the 'zero-contrast' with vowel in Table 3.7 suggests considerable difficulty for segmentation. The articulation for an approximant demands gradual or 'gliding' oral tract movements, and, in rapid speech, the actual duration of the approximant may not be enough for its full articulation. The formant values themselves indicate that: an [l] can have a low F2, around 1200 Hz. If [l] F2 drops that low before a high front vowel, it will need some time to rise enough to become an /i/, since the typical F2 for /i/ is well above 1700 Hz. A big acoustic difference between [l] and [ɹ] is caused by the palatal closure for [l], which is sustained during the full duration of the lateral sound (Ball & Rahilly, op. cit., p. 46). In this sense, [l] can be considered partly a stop consonant.

Manner of articulation: Although the consonant [n] has only two contrasts with the vowel in Table 3.7, its segmentation is made easier by the concentration of energy in F1, as can be seen in Spectrogram 3.6. During oral closure for a nasal, the nasal spectrum is "dominated by low frequency sound, determined mostly by the main resonance of the large volume of the nasal passages constricted by the small nose openings." (Pickett, op. cit., p.113).

3.6.3 - Articulatory and acoustic differences in the segmentation of [p], [n], and [l], as in *happy, many* and *really*; the segmentation of *gente*

This was an instructive part of the present study and is directly related with the different measurements found for *happy, many* and *really* durations and formant heights (See Chapter 4, section 1).

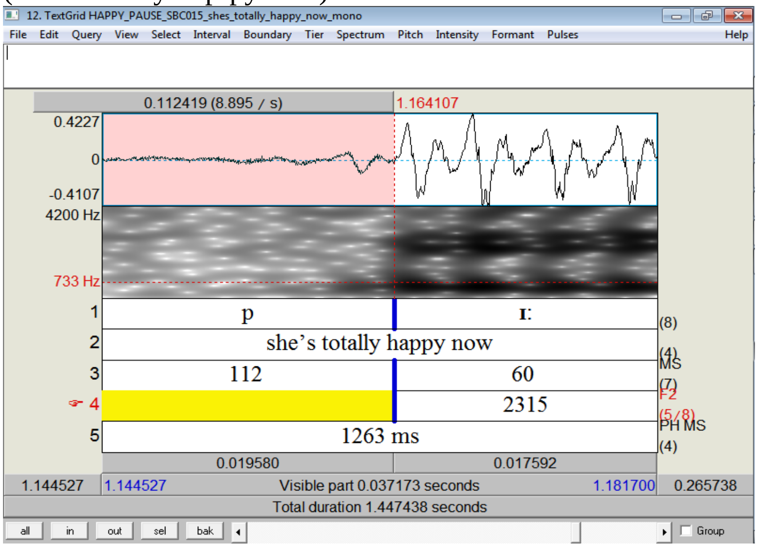
3.6.3.1 - The segmentation of [p] - [ɪː]# in *happy*

In the segmentation of INT into [ɪː]# in *happy*, the model followed in this thesis is taken from Barbosa & Madureira (op. cit., p. 174). The vowel onset after a voiceless plosive was marked on an upslope at zero crossing in the waveform, going into the first large vocal pulse.

Spectrogram 3.5 - Onset of [ɪː]# after plosive sound in SBC word - She's totally *happy* now

SSS F HAPPY_N NOW SBC015_mono 862 I = 60, W = 388

(She's-toud-ly-hap-py-now)

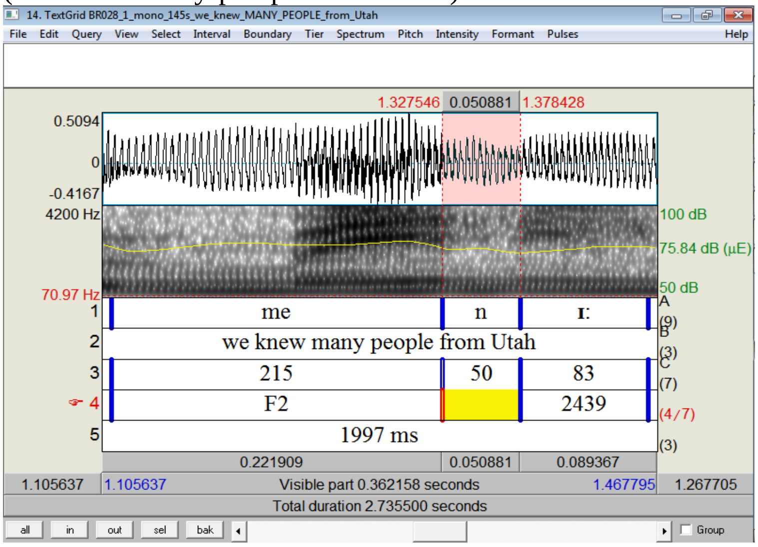


The voiceless plosive [p] is characterized by full obstruction of air passage with the closing of lips and by momentary burst at their reopening. Formant transitions are abrupt. As mentioned above, intensity (the yellow line in Spectrogram 3.2) characteristically drops during the plosive.

3.6.3.2 - The segmentation of [n]-[ɪː]# in *many*

For the separation of [n] from [ɪː]#, two basic criteria were followed: a sudden complexity in the waveform and the stronger energy of F2 in the beginning of the vowel (See Spectrograms 3.1 and 3.6).

Spectrogram 3.6 - LIN - We knew *many* people from Utah
LLL F MANY_P PEOPLE BR028_1_mono 145 I = 83, W = 348
(We-knew-man-y-peo-ple-from-U-tah)



Although the intensity (yellow line in Spectrogram 3.6) in the nasal sounds is about the same as in the vowels, the spectrogram is much fainter above F1 and the waveform is less complex than in vowels.

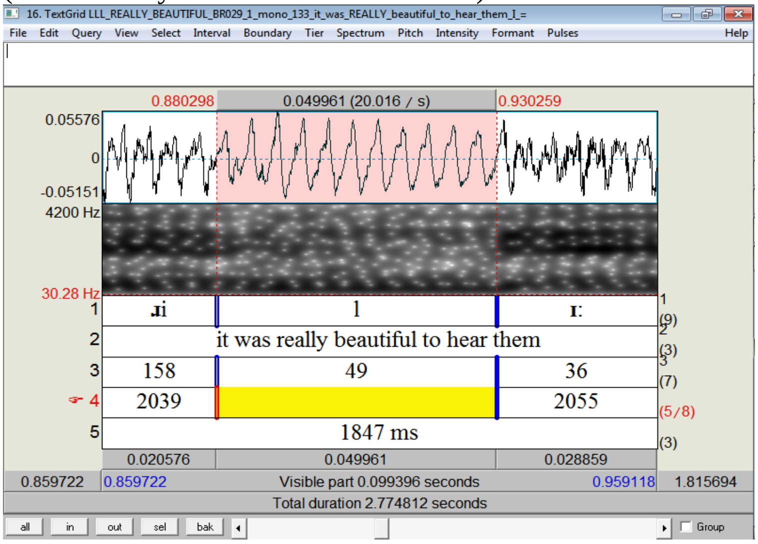
Ladefoged, 2003 (op. cit., p. 143), informs that nasals are usually clearly observable on spectrograms. "Nasals are usually easy to spot on specrtrograms." They have lower amplitude than vowels and their formants are often not fully visible.

3.6.3.3 - The segmentation of [l]-[ɪː]# in *really*

The cut for the onset of [ɪː]# in *really* was made when the strong energy of F2 into the vowel and the complexity of the waveform began, normally over 1700 Hz.

According to Ladefoged, 2003 (op. cit., p. 145), from the acoustic (visual) point of view, laterals have formants with lower amplitudes and with distinct locations from those in neighboring vowels, usually producing a break in the pattern.

Spectrogram 3.7 - LIN - It was *really* beautiful to hear them
LLL F REALLY_B BEAUTIFUL BR029_1_mono 133 I = 36, W = 243
(It-was-real-ly-beau-ti-ful-to-he-ar-them)

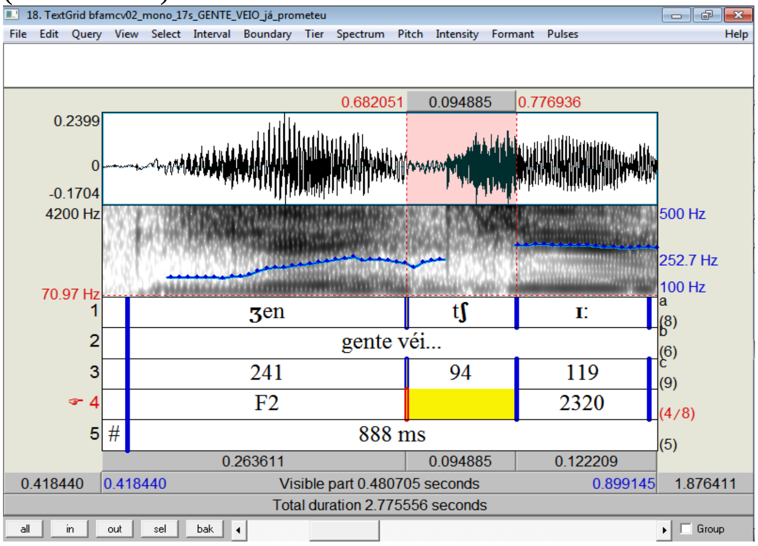


The waveform of *really*, above, becomes less complex during the [l] (i.e., between [i] and [ɪː]#) and in the spectrogram it is possible to see a weaker F2 during the approximant sound [l], with lighter F1 and F2 formants than in the the surrounding vowels.

3.6.3.4 - The segmentation of [tʃ]-[ɪː]# in *gente*

The alveolar plosive [t], when in onset position before a high front vowel, is usually pronounced as a post-alveolar affricate [tʃ] in Belo Horizonte as well as in most of Brazil.

Spectrogram 3.8 - C-ORAL-BRASIL - *Gente* véi...
CCC F GENTE_V VELHO bfamcv02_mono 17 I = 119, W = 454
(Gen-te-véi...)



Chapter 4 - The data analysis: SBCSAE vs LINDSEI-BR; C-ORAL-BRASIL; the research questions

This chapter begins with several comparisons between the two English language corpora, followed by specific measurements within the C-ORAL-BRASIL. Finally, the initial research questions are discussed, with some conclusions that take into consideration all the data obtained from the three corpora studied.

4.1 - The measurements of SBC and LIN [ɪː]#-WORDS and phrases

This section presents analyses of measurements of all the 64 [ɪː]#-WORDS studied in SBC and LIN. First, with the aid of Table 4.1, there is an analysis of measurements of all 54 FULL-[ɪː]#-WORDS (32 from SBC and 22 from LIN). Table 4.2 exhibits measurements of male and female speakers in SBC and LIN, which are the same data as in Table 4.1, subdivided by speaker gender. Next, there are specific analyses of the words *happy*, *many* and *really*, starting with Table 4.3. It was observed that different [ɪː]#-WORD types repeatedly revealed different measurements from other word types (e.g., the word *happy* shows a typically longer INT consonant and shorter [ɪː]# than *many* and *really*). Tables 4.4 through 4.9 show differences between the words *happy* and *really* in the two English corpora, concerning how the formants vary in the [ɪː]# and also in the SYL-1 vowels /æ/ in *happy* and /i/ in *really*. Then there is an analysis of the ZERO-[ɪː]#-WORDS in LIN, with aid of Table 4.10, followed by a comparative analysis of *really* phrases by the three categories of LIN speakers, considering their years of English learning: the experienced, advanced and intermediate groups, with Table 4.11. The final part of section 4.1 gives measurements of [ɪː]# in *really* in relation to NXT-SGM type (e.g., voiced vs voiceless), with Tables 4.12 through 4.15, and Table 4.16 shows all [ɪː]# F2 measurements in *really* in relation to place of articulation of NXT-SGM (e.g., bilabial, alveolar or velar), indicating also the specific words those NXT-SGMs are parts of.

4.1.1 - The 32 FULL-[ɪː]#-WORDS from SBC and the 22 FULL-[ɪː]#-WORDS from LIN

This subsection shows analyses of all the measured durations and F2 averages in FULL-[ɪː]#-phrases from SBC and LIN. Different proportions of samples of *happy, many, really*, *study* and *very* were segmented from each corpus. The quantities of each FULL-[ɪː]#-WORD type analyzed in the two corpora are indicated at the bottoms of the upper and lower halves of Table 4.1 (lines 7 and 14). Putting all 32 SBC and 22 LIN measurements together in single lists requires the knowledge that the averages found may be influenced by the different proportions of word types and tokens measured: 17 *really*, 7 *happy*, 6 *many*, 1 *study* and 1 *very* tokens from SBC and 14 *really*, 3 *many*, 2 *happy*, 2 *very* and 1 *study* tokens from LIN. The results of the measurements of all those words is what is shown in Table 4.1.

Table 4.1 - SBC 32 and LIN 22 FULL-[ɪ:]# phrases

1		SBC DATA: 32 FULL-[ɪ:]#-WORDS MEASUREMENTS and PHRASE SPEAKING RATES							
2	data	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	F2 SYL-1	F2 [ɪ:]#	SPK RATE
3	tt	5009	2055	2145	9357		n/a	67771	6457
4	av	156,53	69,52	67,03	293,08	23%	n/a	2117,84	201,78
5	pct	53,41%	23,72%	22,87%					
6		[ɪ:]#-PHRASES SBC 20W/12M							
		A	B	C	D	E	F	G	H
7		FULL-[ɪ:]#-WORDS in SBC: 17 really, 7 happy, 6 many, 1 very and 1 study							
8		LIN DATA: 22 FULL-[ɪ:]#-WORDS MEASUREMENTS and PHRASE SPEAKING RATES							
9	data	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	F2 SYL-1	F2 [ɪ:]#	SPK RATE
10	tt	4960	1352	1820	8132		n/a	44941	5207
11	av	225,45	61,45	82,73	369,64	23%	n/a	2042,77	236,68
12	pct	60,99%	16,63%	22,38%					
13		ALL LIN [ɪ:]#-PHRASES 12W/10M							
		A	B	C	D	E	F	G	H
14		FULL-[ɪ:]#-WORDS in LIN: 14 really, 3 many, 2 happy, 2 very and 1 study							

The SBC data are composed by 20 [ɪ:]#-WORDS in phrases by women and 12 [ɪ:]#-WORDS in phrases by men (20 W / 12 M) and the LIN FULL-[ɪ:]#-WORDS are made up of measurements of 12 words in phrases by women and 10 by men. Considering all the 54 English FULL-[ɪ:]#-WORDS measured, the following can be concluded (results are rounded to the nearest whole number):

- The [ɪ:]#-WORD (columns 4 and 11D, in pink) is considerably shorter in SBC than in LIN (293 ms vs 370 ms), but most of that difference can be attributed to SYL-1 measurements (4 and 11A);

- LIN has longer [ɪ:]#s (83 ms vs 67 ms) (column 4 and 11C, in blue) but virtually the same percent proportions for the vowel as SBC (5 and 12C and 4 and 11E), at 23%;

- INT (columns 4 and 5B and 11 and 12B, in yellow) is longer in SBC than in LIN in absolute durations (70 ms vs 61 ms [rounded values]) and much more so in percent proportions of the word (24% vs 17%). (As seen in Table 3.5 above, at line-columns 4B and 11B, there is a considerable difference between the duration of the average intervocalic consonant in LIN in complete words [61,45 ms], as shown again here, and its measurements in ZERO-[ɪ:]#-WORDS [100,3 ms]. That ZERO-[ɪ:]# INT duration, of over 100 ms, is much longer than in the C-ORAL-BRASIL ZERO-[ɪ:]#-WORDS [66,67 ms], shown in Tables 4.20 and 4.22);

- F2 values for [ɪ:]#, (4 and 11G), are higher in SBC than in LIN (2118 Hz vs 2043 Hz);
- Spk rate (4 and 11H, in blue) is appreciably faster in SBC than in LIN (202 vs 237), i.e., considering only measured phrases with FULL-[ɪ:]#-WORDS, one syllable was spoken, on the average, in 202 ms by SBC subjects and in 237 ms by LIN subjects.

The F2 measurements for the stressed vowels in SYL-1 (column F) are not given in Table 4.1 (n/a), because it was measured only for the words *happy* and *really,* as mentioned above and shown in the following subsection. F2 measurements are supposed to vary depending on each different stressed vowel, i.e., [æ] in *happy*, [ʌ] in *study* and [ɛ] in *very,* so that, put together for all words, the total F2 divided by 32 in SBC and by 22 in LIN would give no clear indication about each individual stressed vowel, since the SBC and LIN phrases have different distributions of word types segmented. On the other hand, the [ɪ:]# was expected to have similar durations and F2 in every case. However, as the data in subsection 4.1.3 demonstrate, there are consistent duration and formant differences in [ɪ:]#, most likely attributable to the INT consonant preceding it in each different [ɪ:]#-WORD type.

4.1.2 - Male and female speakers' measurements of all FULL-[ɪ:]#-phrases taken from SBC and LIN

Some of the data analyzed in the present study are far from robust enough to allow for very solid conclusions. This seems to be especially the case in this subsection. Because the samples are few and the proportions of [ɪ:]#-WORD types in each of the four subdivisions is variegated, Table 4.2 should hardly serve as an indication of typical differences in the productions of words and phrases by male and female speakers.

Table 4.2 - Measurements of 54 FULL-[ɪ:]# phrases by male and female speakers in SBC and LIN

1		SBC DATA: 20 FULL-[ɪ:]#-WORDS BY FEMALE SPEAKERS							
2	data	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	F2 SYL-1	[ɪ:]# F2	SPK RATE
3	tt	3083	1383	1374	5840		n/a	41905	4039
4	av	154,15	69,15	68,7	292	24%	n/a	2095,25	201,95
5	pct	52,79%	23,68%	23,53%					
6		FULL-[ɪ:]#-PHRASES SBC 20W							
		A	B	C	D	E	F	G	H
7		FULL-[ɪ:]#-WORDS BY SBC FEMALE SPEAKERS: 12 really, 5 happy, 2 many and 1 very							
8		SBC DATA: 12 FULL-[ɪ:]#-WORDS BY MALE SPEAKERS							
9	data	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	F2 SYL-1	[ɪ:]# F2	SPK RATE
10	tt	1926	772	771	3469		n/a	25866	2418
11	av	160,5	64,33	64,25	289,08	22%	n/a	2155,5	201,5
12	pct	55,52%	22,25%	22,23%					
13		FULL-[ɪ:]#-PHRASES SBC 12M							
		A	B	C	D	E	F	G	H
14		FULL-[ɪ:]#-WORDS BY SBC MALE SPEAKERS: 5 really, 4 many, 2 happy and 1 study							
15		LIN DATA: 12 FULL-[ɪ:]#-WORDS BY FEMALE SPEAKERS							
16	data	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	F2 SYL-1	[ɪ:]# F2	SPK RATE
17	tt	2408	801	993	4202		n/a	25671	2650
18	av	200,67	66,75	82,75	350,17	24%	n/a	2139,25	220,83
19	pct	57,31%	19,06%	23,63%					
20		FULL-[ɪ:]#-PHRASES LIN 12W							
		A	B	C	D	E	F	G	H
21		FULL-[ɪ:]#-WORDS BY LIN FEMALE SPEAKERS: 7 really, 2 very, 1 happy, 1 many and 1 study							
22		6 phrases by experienced speakers, 3 phrases by advanced speakers and 3 phrases by intermediate speakers							
23		LIN DATA: 10 FULL-[ɪ:]#-WORDS BY MALE SPEAKERS							
24	data	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	F2 SYL-1	[ɪ:]# F2	SPK RATE
25	tt	2552	551	827	3930		n/a	19270	2557
26	av	255,2	55,1	82,7	393	21%	n/a	1927	255,7
27	pct	64,94%	14,02%	21,04%					
28		FULL-[ɪ:]#-PHRASES LIN 10M							
		A	B	C	D	E	F	G	H
29		FULL-[ɪ:]#-WORDS BY LIN MALE SPEAKERS: 7 really, 2 many and 1 happy							
30		3 phrases by experienced speakers, 4 phrases by advanced speakers and 3 phrases by intermediate speakers							

As predictable from Table 4.1, both genders of SBC speakers realized the [ɪ:]#-WORDS as shorter than the LIN subjects (column D, in pink). Actually, the two groups of SBC speakers produced words of very similar size (4 and 11D), while LIN men produced very long words (393 ms). SYL-1 was also very similar with SBC speakers(4 and 11A). In LIN, line-columns 26 and 27A show that the long duration of the word for LIN male speakers should actually be credited to a very long SYL-1 (255 ms), rather than to INT or [ɪ:]# durations, which were actually shorter by LIN men than by LIN women (18 and 19B and C and 26 and 27B and C).

Phrase spk rate was slowest for LIN men (26H) and, coincidentally, the same for SBC speakers (202 ms for both men and women).

F2 height was higher for men in SBC (4 and 11G). In LIN, women had higher [ɪː]# F2 values (18 and 26G).

Male speakers are expected to normally have lower formants than women speakers. According to Pickett (op. cit., p. 38), women have higher formant averages than men, basically because their vocal tracts are about 15% shorter than men's. The LIN data in Table 4.2 correspond to that prediction (while women speakers had [ɪː]# F2 average of 2139 Hz, men had [ɪː]# F2 average of 1927 Hz. The SBC reveals [ɪː]# F2 averages of 2095 Hz for women and 2156 for men.

Some things should be considered concerning these [ɪː]# F2 data: the samples are very few, being highly susceptible to specific pronunciations in specific contexts; only the F2 of [ɪː]#-WORD vowels is being considered, rather than the average F2 of the word or of the entire phrase; specific men and women may have bigger or smaller vocal tract sizes and, importantly, the distribution of [ɪː]#-WORDS in the four groups of speakers is, as mentioned above and shown in Table 4.2, diversified. As will be shown in the next subsection, the word *really* tends to have a low average value of [ɪː]# F2 and, in SBC, there were 12 *really* tokens by the women's group and only five *really* tokens by the men's group (lines 7 and 14).

4.1.3 - The measurements of *happy, many* and *really*

Of the eight word types analyzed in the three corpora which had realization of [ɪː]#, as shown in Table 3.6 (*happy, many, really, study* and *very; ele, gente* and *sabe*), *really* was the word that exhibited the lowest average [ɪː]# F2 of all.

This subsection deals with the three most segmented words in SBC and LIN, and initially had the purpose of testing the stability or instability of measurements in the research vowel in the two English corpora. But the results obtained were actually surprising and led me to review my readings about formant transitions and consonant loci, and gave me some more knowledge on articulatory phonetics.

Table 4.3, below, has a format slightly different from Tables 3.5, 4.1, 4.2 and 4.11 (below), because it shows, at the same time, the average measurements of three specific [ɪː]#-WORDS, in both SBC and LIN. Besides, The F1 and F2 averages and (F2 – F1) differences in the stressed vowels in the words *happy* and *really* are also given. This was done because it became clear, rather early in the present study, that several SBC speakers centralized the phonologically tense vowel /i/ in the word *really*. The word *happy* is also compared between the English corpora because, since the phoneme /æ/ does not exist in BP phonology, LIN speakers were expected to realize [ɛ] instead of it (when influenced by British RP, B-LNR-E are expected to realize [a] in place of [æ]).

According to Pickett (op. cit., p. 194), when two sounds of a foreign language "fall into a single phonemic class in the listener's native language", "they are less likely to be distinguished from each other" than when they are markedly different sounds.

The words *happy, many* and *really* were found to exhibit consistent differences in SYL-1, INT and [ɪː]# durations and [ɪː]# F2 heights, both in SBC and in LIN.

Table 4.3 - Summarized measurements of *happy*, *many* and *really* in SBC and LIN

1	HAPPY in SBC					
2	7 PHRASES					
3		DUR.	PERCENT	F1	F2	F2 – F1
4	SYL-1 [æ]	178	55%	820	1659	839
5	INT [p]	95	29%			
6	[ɪ:]#	52	16%	443	2234	1791
7	W SIZE	325				
	A	B	C	D	E	F

1	HAPPY in LIN					
2	2 PHRASES					
3		DUR.	PERCENT	F1	F2	F2 – F1
4	SYL-1 [æ]	225	55%	631	1868	1237
5	INT [p]	131	32%			
6	[ɪ:]#	54	13%	378	2074	1696
7	W SIZE	410				
	A	B	C	D	E	F

1	MANY in SBC					
2	6 PHRASES					
3		DUR.	PERCENT	F1	F2	F2 – F1
4	SYL-1 [e]	151	56%	n/a	n/a	n/a
5	INT [n]	47	17%			
6	[ɪ:]#	74	27%	n/a	2343	n/a
7	W SIZE	272				
	A	B	C	D	E	F

1	MANY in LIN					
2	3 PHRASES					
3		DUR.	PERCENT	F1	F2	F2 – F1
4	SYL-1 [e]	221	65%	n/a	n/a	n/a
5	INT [n]	39	11%			
6	[ɪ:]#	80	24%	n/a	2087	n/a
7	W SIZE	340				
	A	B	C	D	E	F

1	REALLY in SBC					
2	17 PHRASES					
3		DUR.	PERCENT	F1	F2	F2 – F1
4	SYL-1 [i]	143	51%	534	1615	1081
5	INT [l]	70	25%			
6	[ɪ:]#	69	24%	513	1991	1478
7	W SIZE	282				
	A	B	C	D	E	F

1	REALLY in LIN					
2	14 PHRASES					
3		DUR.	PERCENT	F1	F2	F2 – F1
4	SYL-1 [i]	220	64%	446	1948	1502
5	INT [l]	53	15%			
6	[ɪ:]#	70	21%	454	1988	1534
7	W SIZE	343				
	A	B	C	D	E	F

4.1.3.1 - A brief analysis of Table 4.3

In Table 4.3, SYL-1 measurements are all given in line 4, INT in line 5, [ɪ:]# in line 6 and W in line 7. The identifying colors are the same as in the preceding tables.

4.1.3.2 - SYL-1, INT and [ɪ:]# measurements of *happy, many* and *really*

The durations and percent proportions of the three subdivided W parts (4B and C, 5B and C and 6B and C) show *happy* with SYL-1 longer than INT and INT longer than [ɪ:]#, i.e., SYL-1 > INT > [ɪ:]#; *many* presents SYL-1 > [ɪ:]# > INT and *really* has a longer SYL-1 and INT and [ɪ:]# about the same size in SBC, but in LIN [ɪ:]# is longer than INT.

In *happy,* the [ɪ:]# had the shortest durations in both English corpora, and in *many* it had the largest proportions. Conversely, in *happy,* the INT [p] had the longest durations and largest percent proportions in both corpora, while in *many*, the INT [n] had the smallest proportions.

SYL-1 was longer in LIN than in SBC for all three words, with differences between 47 and 77 ms. Note that INT was longer in SBC *many* and *really.*

Line-column 6E is very important, because it shows the average [ɪ:]# F2 and indicates that in *really* the second formant is lowest in both corpora. The highest average [ɪ:]# F2 was registered for *many* in SBC (2343 Hz) and the second highest F2 was also found in SBC, for *happy* (2234 Hz).

Line-columns 4D, E and F show the (stressed) SYL-1 vowels of *happy* and *really*, and reveals large differences between the results of the subtraction (F2 – F1) for SBC and LIN, with LIN showing longer distances between F1 and F2 for both words. In the SYL-1 vowel of *happy*, the F2 – F1 difference was of 839 Hz in SBC and 1237 Hz in LIN, indicating a fronter, higher vowel in LIN. (See Table 4.4 below).

Specifically in relation to the research vowel, the most relevant fact from Table 4.3 seems to be that there is a lot of similarity between the two English corpora in the comparative durations and F2 height measurements of [ɪ:]# in each of the three words, whereas the initial expectations were that the SBC research vowel would show some kind of consistency in relation to LIN, some kind of immutability, in its measurements in each different word type. However, while the measurements of the research vowel are very similar in SBC and LIN, the measurements of SYL-1 in *happy* and *really* are strikingly different between the two corpora, with LIN speakers considerably fronting the /æ/ of *happy* and several SBC speakers fully centralizing the /i/ of *really*. It can be observed that, while in 4D, E and F, the F1 and F2 differences for the stressed vowels in *happy* and *really* is shown to be very large between the two corpora, in 6D, E and F, the two main formants are very similar for both *happy* and *really* [ɪ:]#.

Given the measurements above, several questions are worth posing:

a) Why is [ɪ:]# shortest in *happy*?

b) Why is [ɪ:]# F2 so high in *many*? (considering especially the results from SBC rather than from LIN, since SBC has 6 samples of *many* analyzed while LIN has only 3).

c) Why is *really* [ɪ:]# F2 the lowest?;

d) Why is INT so very long in *happy* and so noticeably short in *many*?

After some pondering, some re-reading of the literature and the taking of some additional measurements, the best answers that could be found within the present study are given next.

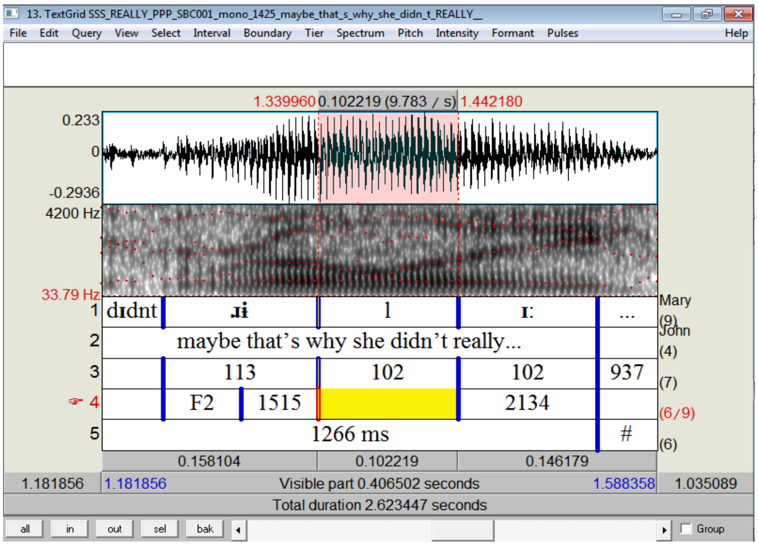
Question a) This is the unanswered one. Umeda, 1975 (apud Pickett, op. cit., pp. 86-88), after having made extensive analyses of durations of vowels and consonants, starts by confirming that that a vowel preceding a voiceless consonant is shorter than a vowel preceding a voiced consonant. This was seen in C-ORAL-BRASIL (Section 4.2, next).

Questions b) and c) are related. The measurements shown for F2 in this thesis are, as mentioned, average values. In the word *really*, there is a transition from a very low F2 in /l/ into the high F2 of [ɪː]# (Spectrogram 4.1). The second formant may begin to rise from as low as 1200 Hz, in the middle of /l/ until it transitions into a high front vowel formant, usually around 1700 Hz. Spectrogram 4.1, from SBC001, shows very low F2 in the central constriction in /l/ and a slow rise into [ɪː]#. This F2 trajectory of [l] is not comparable with the abrupt transitions from a plosive or a nasal consonant and it is also different from when a high front vowel begins a word after a silence, in which case F2 usually starts already with canonical values, as seen in the word *in*, occurring after a pause, shown in Spectrogram 4.2 (We have so *many*… in...).

Spectrogram 4.1 - SBC - Rise of F2 from [l] into [ɪː]# in the phrase Maybe that's why she didn't *really*…

SSS F REALLY_PPP SBC001_mono 1425 I = 102, W = 317, PsP = 937

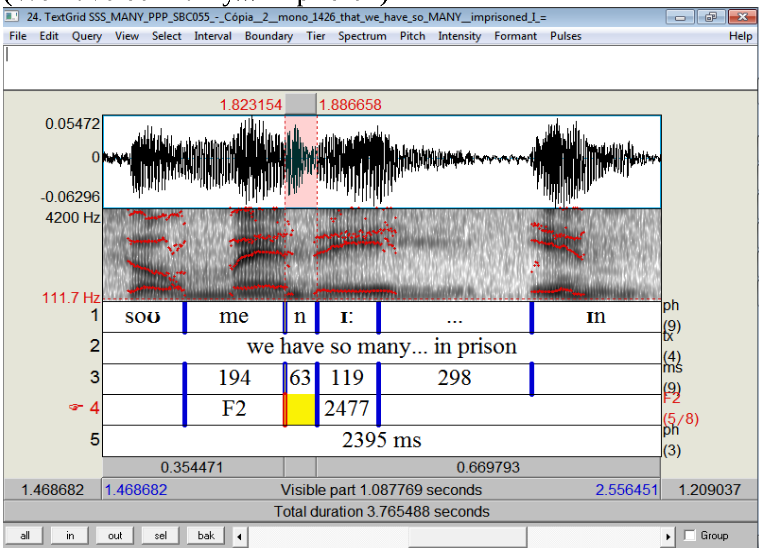
(May-be-that's-why-she-didn't-real-ly…)



Spectrogram 4.2 - SBC - High F2 transition from [n] into [ɪː]# and canonical initial F2 in post-pause [ɪ] in the word *in* of the phrase We have so *many*…

SSS F MANY_PPP SBC055_mono 1426 I = 119, W = 376, PsP = 298

(We-have-so-man-y... in-pris-on)



Plosives and nasals, like [p] and [n], have different loci, or characteristic F2 positions, from which the second formant moves into the vowel, depending, basically, on consonant place of articulation (e.g., labial, alveolar or velar). According to Ladefoged, 1993 (op. cit., p. 204), a bilabial consonant (e.g, [p]) has a low second formant locus, meaning that F2 in the transition

[p]-[ɪː]# will start at a low point. The nasal [n], being alveolar, has a higher F2 starting point than [p]. These articulatory differences indicate, therefore, that [n] should transition into [ɪː]# with the highest F2 average of the three words, since the values presented here are average: a higher start should generally make for a higher average. Because of that, a longer [ɪː]# after [l], as in *really*, will tend to have a higher F2 average than a shorter [ɪː]#.

d) In relation to the durations of INT [p], [n] and [l], Umeda (apud Pickett, op. cit., pp. 86-88), claims that intervocalic [p, b, m] are about three times as long as intervocalic [t, d, n]. Intervocalic [n] is said to average 34 ms and [p], 89 ms. This appears to be strongly related with characteristics of the active articulators for those consonants: the tip of the tongue, used in alveolar consonants, is much more agile than the lower lip, raised for bilabials (or the tongue body, for velar consonants, so that alveolars will tend to be faster and shorter). It is also an worthy of note that alveolar plosives ([t] and [d]) are frequently involved in processes of assimilation "Coronals usually assimilate to other consonants, rather than being assimilated" (Paradis & Prunet (op. cit., p. 11). It is not hard to remember processes of BP haplology, cited in this thesis (subsection 2.1.3) and the typical case in American English of intervocalic taps substituting for [t] and [d] in phrases like *not at all* [nɑɾæɾol]. It seems that the high speed and the ease with which the tongue tip can move has a lot of influence in those processes.

Still unanswered are the questions of the much shorter INT consonants in LIN (especially because LIN [ɪː]#-WORDS are longer and, therefore, should be expected to have longer, and not shorter, INT consonants) (Table 4.1, line-columns 4 and 5 and 11 and 12B). One possible explanation for the consistently longer INTs in SBC could be the "strongly marked syllable stresses of English" already mentioned in subsection 2.1.5. (Stetson, 1945, apud Pickett, op. cit., pp. 149-150). This suggests stronger consonant constrictions and a longer time to complete the consonant movements. Also because of the fact that many consonants in English are arguably ambisyllabic, as [p] in *happy*, it is likely that N-SPK-E treat many consonants as coda consonants and, at the same time, onsets of following vowels as well in cases where N-SPK-BP or B-LNR-E would treat those consonants simply as onsets of following syllables, after an open preceding syllable (i.e., SBC speakers would syllabify, e.g., *happy* as /hap.py/ while Brazilians would syllabify it simply as /ha.py/).

4.1.3.3 - The measurements of formants in the stressed vowel in *happy* and *really*: large differences between SBC and LIN

Table 4.4, below, shows expected F1 and F2 values for some American English vowels and Table 4.5 gives the formant values obtained for [ɪː]# in the words *happy* and *really* in the SBC and LIN files analyzed. For segmentation of the two SYL-1 vowels in the words *happy* and *really*, instructions from Tunley (op. cit., pp. 22-24) were followed. According to the author, after [h] and [l], vowel onset may be defined consistently as a sudden change in the waveform – either in terms of amplitude, or waveshape, or both (Spectrograms 4.3 and 4.4).

The next table shows that the fronter and higher a vowel is, the larger is its F2 – F1 difference. According to Ball & Rahilly (op. cit. pp. 91-92 and 100), the vowel area ranges from the pharyngeal to the palatal region, i.e., it is limited well behind the positions for the constrictions of alveolar consonants, such as [t] and [d] (anterior coronal consonants), as shown in Figure 3.3, for the front vowels [i] (as in *seed*) and [ɪ] (as in *sid*), exemplified in Odden (op. cit., p. 13).

Figure 3.3 - Tongue positions for the tense and lax front vowels, [i], (*ee*) **and [ɪ],** (*i*)**. (Odden, 2005)**

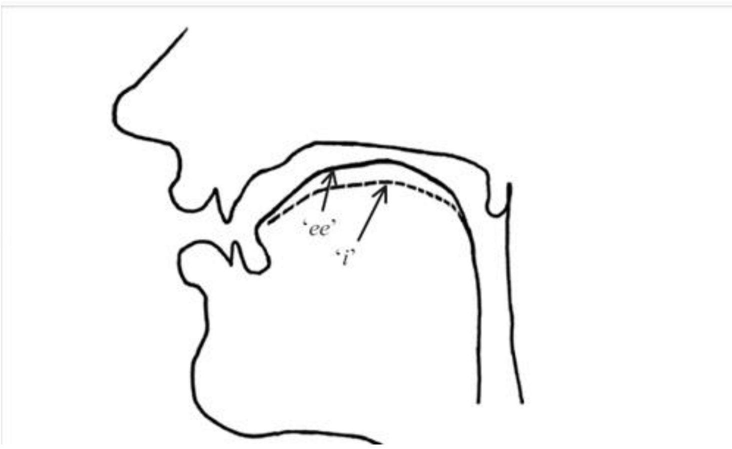


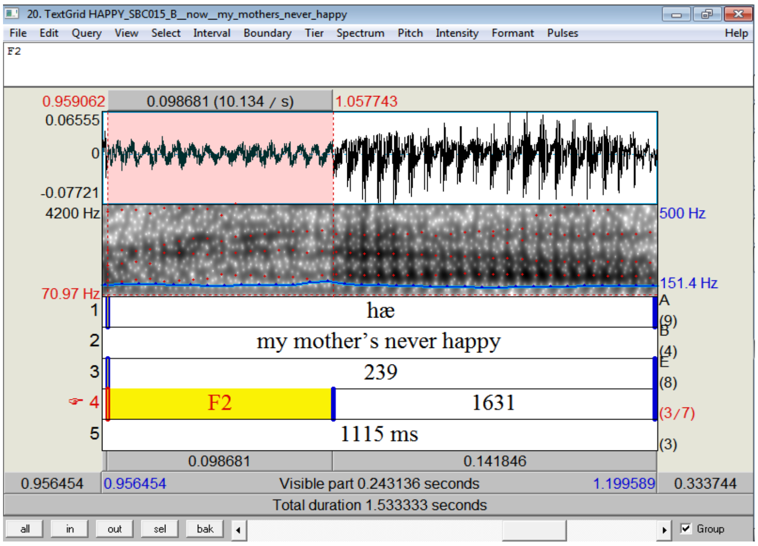
Table 4.4 - First and second formant values in American English vowels
(adapted from Ladefoged, 2010)

Formants		**F1**	**F2**	**F2 – F1**
VOWELS	e.g. WORDS			
[i]	***really***	280	2250	**1970**
[ɪ:]	***really***	?	?	**n/a**
[ɪ]	***bit***	400	1920	**1520**
[ɛ]	***bet***	550	1770	**1220**
[æ]	***happy***	690	1660	**970**

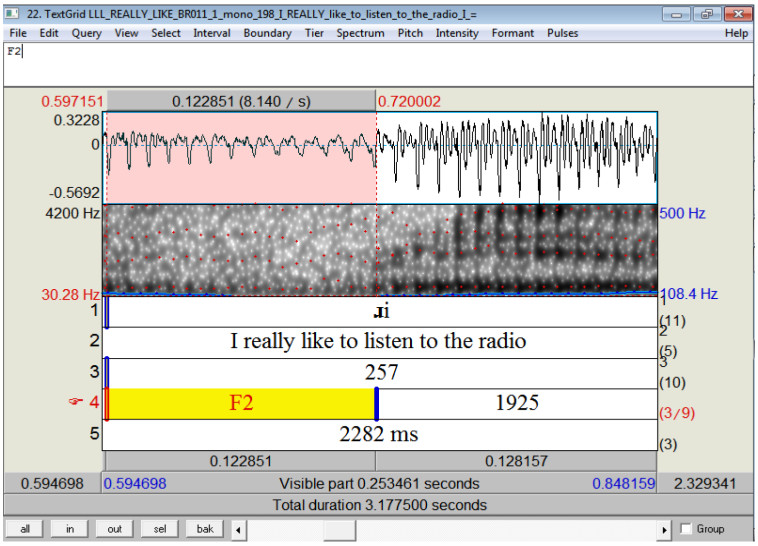
Table 4.5 - Average formant values found for the SYL-1 vowels /i/ (in *really*) and /æ/ (in *happy*) in SBC and LIN vs American English averages (Ladefoged, 2010)

1	CORPUS	WORDS	/i/ F1	/i/ F2	/i/ F2 – F1
2	**SBC**	***really***	534	**1615**	1081
3	**LIN**	***really***	446	**1948**	1502
4	**Ladefoged's**		**280**	**2250**	**1970**
5			**/æ/ F1**	**/æ/ F2**	**/æ/ F2 – F1**
6	**SBC**	***happy***	820	**1659**	839
7	**LIN**	***happy***	631	**1868**	1237
8	Ladefoged's		**690**	**1660**	**970**
	A	B	C	D	E

Spectrogram 4.3 - SBC - Transition of onset [h] into vowel in the word *happy*



Spectrogram 4.4 - LIN - Transition of onset [ɹ] into vowel in the word *really*



4.1.3.3.1 - /i/ in *Really*

As observed earlier, SBC had some very low F2s for SYL-1 in realizations of *really*. The SBC F2 average for /i/, of only 1615 Hz, as shown in Table 4.5 (line-column 2D), is markedly low compared with canonical /i/ (4D). And the /i/ F1 average of 534 Hz in SBC (line-column 2C) is considerably higher than Ladefoged's 280 Hz (4C). These differences from expected values represent a striking disparity between the F2 – F1 distance for SBC's *really* /i/ and canonical values (2E vs 4E). The mouth should be very narrowly opened (low F1) and the tongue should be comparatively very front (very high F2) for the production of a long (tense) /i/. *Really* /i/ formants in SBC were much too close together, much too centralized for a tense high front vowel (indicating a less closed mouth and a less frontal tongue position).

However, the centralization of /i/ in SBC *really* was not generalized. It was observed that the SBC realizations of the stressed vowel in *really* could be subdivided according with two groups of speakers: those who produced a very low F2 vowel and those who produced a higher second formant. This is shown in Table 4.6 below.

Concerning the LIN measurements of F1 and F2, *really* /i/s were located somewhere between SBC's centralized vowel (small distance between formants) and the canonical vowel (very large distance between F1 and F2). The *really* /i/ F2 in LIN averaged 1948 Hz and F1, 446 Hz. The (F2 – F1) difference was of 1502 Hz. The /i/ F2 – F1 difference in LIN is about 50% higher than the difference in SBC (See Table 4.5, line-columns 2,3 and 4; C, D and E).

It has been observed, in this thesis, that the F2 of /i/ in *really* tends to lower just before the closure for [l], which is to be expected, since alveolar [l] is an approximant (non-abrupt) sound, with low F2, i.e., formants move gradually into and out of the /l/. In addition, the influence in *really* may be double-sided: As described by Tunley (op. cit., p. 26), high front vowels are observed to be lowered by a preceding [ɹ] (maybe due to effects of persevering lip rounding). Therefore, the first vowel in *really* may be lowered both by its preceding approximant consonant as well as by its following one (i.e., [ɹ] - /i/ - [l]).

The four following Tables (4.6 through 4.9) show all the measured averages of first and second formants and F2 – F1 differences for SBC and LIN *really* and *happy* tokens analyzed (with one exception). For comparison, the F2 for [ɪ:]# is also given. Nine out of the 17 *really* phrases in SBC had /i/ F2 averaging below 1700 Hz, and some values were far below that, indicating a schwa-like vowel. Pickett (op. cit., p. 44), describles English central vowels as having formant values of F1, F2 and F3 of respectively 600, 1200 and 2500 Hz for [ʌ] and of 500, 1500 and

2500 Hz for [ə]. In the PRAAT segmentations, the symbol [ɨ] (known as 'barred' [i]) was used for /i/ (i.e., the first, stressed vowel in *really*) whenever its F2 averaged below 1700 Hz. Concerning the research vowel of this thesis, [ɪ:]#, out of the 17 realizations of phrases with *really* in SBC, on one occasion, speaker ANN in SBC049 produced the word with a very low F2 in the final vowel (1375 Hz). For that unique case, another special symbol, [ᵻ:]#, for a shorter, but also centralized vowel, was used. These 'barred' /i/ symbols do not actually seem to correspond to the sounds heard in the SBC files (they sounded like lower central vowels, not just like less-fronted /i/s), but I found it too far-fetched to use [ʌ] as the symbol for the vowels of *really*, so I settled for **[ɨ]** and [ᵻ:]# instead. Tables 4.6 through 4.9 are ordered from the lowest to the highest SYL-1 F2**.**

Table 4.6 - Measurements of /i/ F1 and F2 and [ɪ:]# F2 in SBC *really*

	SBC REALLY 9 PHRASES [i]	[i] F2	[i] F1	[i] F2 – [i] F1	[ɪ:]# F2
1	SSS F REALLY_F FUNNY SBC001_mono 260 I = 72, W = 289	1247	537	710	2030
2	SSS M REALLY_T TEACHES SBC027_mono 950 I = 38, W = 153	1280	509	771	2184
3	SSS F REALLY_G GLAD SBC001_mono 623 PrP = 365, I = 40, W = 165	1291	583	708	1926
4	SSS M REALLY_L LIKE SBC030_mono_24 I =80, W = 221	1418	507	911	1934
5	SSS F REALLY_L LIKE SBC040_mono 1121 I = 58, W = 184	1431	596	835	1842
6	SSS F REALLY_H HARD SBC001_mono 1008 I = 36, W = 346	1512	609	903	1876
7	SSS F REALLY_PPP SBC001_mono 1425 I = 102, W = 317, PsP = 937	1515	667	848	2134
8	SSS F REALLY_G GOOD SBC056_mono 932 I = 50, W = 259	1551	486	1065	1921
9	SSS F REALLY_N NICE SBC049_mono 348 I = 50, W = 244	1576	587	989	1720
	Formant averages	**1424,56**	**564,56**	**860**	**1951,89**
A	B	C	D	E	F
		[i] F2	[i] F1	[i] F2 – [i] F1	[ɪ:]# F2
10	SSS F REALLY_TH THINKING SBC028_mono 214 I = 83, W = 275	1707	543	1164	2218
11	SSS M REALLY_L LOVE SBC020_mono 212 I = 124, W = 471	1720	492	1228	1964
12	SSS M REALLY_QQQ SBC028_mono 226 I = 60, W = 385	1728	424	1304	1895
13	SSS F REALLY_D DOESNT SBC049_mono 396 I = 54, W = 214	1747	539	1208	2119
14	SSS F REALLY_B BEAUTIFUL SBC028_mono 344 I = 95, W = 275	1879	480	1399	2138
15	SSS M REALLY_PPP SBC021_mono 1291 I = 65, W = 420, PsP 268	2023	587	1436	2268
16	SSS F REALLY_D DONT SBC055_mono 1418 I = 86, W = 379	2208	398	1810	2303
	Formant averages	**1858,86**	**494,71**	**1364,14**	**2129,29**
A	B	C	D	E	F
		[i] F2	[i] F1	[i] F2 – [i] F1	[ɪ:]# F2
17	SSS F REALLY_D DO SBC049_mono 979 I = 73, W = 183	0	0	0	1375
A	B	C	D	E	F

Four *really* phrases by the main speaker in SBC001, MAE, were analyzed. In each one of them, she produced /i/ with very low F2s, as shown in phrases 1, 3, 6 and 7 (column C of Table

4.6). It is noticeable, though, that hers, and all the other SBC speakers' F2s for the word *really*, were within normal height ranges in the word-final vowel, [ɪ:]# (column F) (with the exception of SBC049 speaker ANN, as commented above). In phrase nr 1 of Table 4.6, the first (stressed) vowel of *really* had F2 averaging only 1247 Hz but [ɪ:]# had a rather high F2, of 2030 Hz. The speakers in phrases 10 through 16 realized /i/ with higher F2s. The /i/ F2 difference between the two SBC *really* groups (i.e., 1 to 9 and 10 to 16) was of over 434 Hz, considering the two groups' averages (i.e., 1858,9 – 1424,6, from column C values), while the [ɪ:]# F2 difference was just over 177 Hz (i.e., 2129 – 1952, from column F). This means that while the variation range of F1 – F2 in SBC *really* SYL-1 /i/ was wide, in [ɪ:]#, it was quite narrow.

The F2 measurements for *really* /i/ in LIN were quite different from SBC's. In all of the 14 FULL-[ɪ:]# segmentations made, the /i/ F2 was higher than 1700 Hz. The three ZERO-[ɪ:]# realizations of *really* in LIN (Table 3.6) were also produced with high F2 in the SYL-1 vowel, as shown in the lower part of Table 4.7 (column C) (LIN has 17 realizations of *really*, and three of those were ZERO-[ɪ:]#s, as shown in Table 3.6).

Table 4.7 - Measurements of /i/ F1 and F2 and [ɪ:]# F2 in LIN *really*

	LIN REALLY 14 PHRASES /i/ in FULL-[ɪ:]#-WORDS	/i/ F2	/i/ F1	/i/ F2 – /i/ F1	[ɪ:]# F2
1	LLL M REALLY_QQQ BR042_3_mono 99 I = 112, W = 410	1720	348	1372	1807
2	LLL M REALLY_L_LOST BR011_1_mono 34 I = 66, W = 249	1721	435	1286	1875
3	LLL M REALLY_D DIFFERENT BR048_3_mono 189 I = 54, W = 552	1733	372	1361	1724
4	LLL F REALLY_D_DONT BR028_2_mono 108 I = 77, W = 263	1754	576	1178	2103
5	LLL F REALLY_K CANT BR028_2_mono 45 I = 39, W = 251	1780	580	1200	1809
6	LLL M REALLY_PPP BR011_1_mono 209 I = 201, W = 464, PsP = 567	1827	379	1448	2170
7	LLL M REALLY_L_LIKE BR011_1_mono 198 I = 38, W = 358	1914	402	1512	1892
8	LLL F REALLY_T_ TIRED BR009_2 210 PRP = 298, I = 24, W = 258	1925	383	1542	1970
9	LLL M REALLY_H HARD BR042_2_mono 116 I = 108, W = 545	1975	310	1665	2097
10	LLL F REALLY_B BEAUTIFUL BR029_1_mono 133 I = 36, W = 243	2039	452	1587	2055
11	LLL F REALLY_L LIKE BR029_2_mono 59 I = 84, W = 363	2113	515	1598	2241
12	LLL M REALLY_QQQ BR035_1 298 I = 35, W = 283, PsP = 115	2219	395	1824	1990
13	LLL F REALLY_T TRAUMATIZED BR025_1_mono 170 I = 36, W = 315	2267	466	1801	2199
14	LLL F REALLY_N NERVOUS BR008_1_mono 51 I = 76, W = 252	2275	565	1710	1905
	Formant averages	**1947,6**	**441,29**	**1506**	**1988,36**
	(Speaker experience levels by color): blue: experienced; green: advanced; white: intermediate				
A	B	C	D	E	F
	LIN REALLY 3 PHRASES /i/ in ZERO-[ɪ:]#-WORDS				
15	LLL F REALLY_L_LOVE_BR009_2_mono 47 I = 0, W = 310, LL = 118, 56	1920	532	1388	0
16	LLL F REALLY_L LIKE BR025_1_mono 27 I = 0, W = 254, LL = 79, 60	1946	579	1367	0
17	LLL M REALLY_L_LIKE BR035_1_mono 26 I = 0, W = 214	1810	436	1374	0
	Formant averages	**1892**	**515,67**	**1376,33**	**0**
	(Speaker experience levels by color): green: advanced; white: intermediate				

From Table 4.7, it can be seen that the experienced, advanced and intermediate LIN speakers realized F2 in both the stressed and post-tonic vowels in *really* with no apparent tendency related with levels of experience with English. The formant measurements are well-balanced among the three groups (i.e., members of the three LIN groups realized [ɪ:]# with both lower and higher F1 and F2 values).

4.1.3.3.2 - /æ/ in *Happy*

According to Tables 4.5 and 4.8, SBC shows average values of F1 of 820 Hz and F2 of 1659 Hz for SYL-1 /æ/ in the word *happy*. These measurements are close to canonical values given by Ladefoged. However, F1 is higher in SBC (which suggests a mouth more open than in canonical [æ]). The LIN data for *happy* (Table 4.9), on the other hand, show /æ/ F2 markedly higher than canonical values (a fronter tongue position). The LIN F2 – F1 difference of 1237 Hz in LIN is actually typical of a different vowel, [ɛ], according to Table 4.4 (1220 Hz). Therefore, the data in this thesis indicate that B-LNR-E tend to realize English /æ/ as [ɛ]. Besides the two FULL [ɪ:]# *happy* phrases by LIN speakers analyzed in this thesis, there are two other *happy* phrases, realized with ZERO-[ɪ:]# (BR019), also with higher-than-canonical F2 values for [æ].

Table 4.8 - Measurements of /æ/ F1 and F2 and [ɪ:]# F2 in SBC *happy*

	SBC HAPPY 7 PHRASES /æ/	/æ/ F2	/æ/ F1	/æ/ F2 – /æ/]F1	[ɪ:]# F2
1	SSS F HAPPY_t TO SBC006 166 I = 33, W = 266	1642	786	856	1969
2	SSS F HAPPY_N NOW SBC015_mono 848 I = 52, W = 233	1760	788	972	2177
3	SSS F HAPPY_M SBC015 849 I = 56, W = 407	1631	918	713	2470
4	SSS F HAPPY_N NOW SBC015_mono 862 I = 60, W = 388	1578	759	819	2315
5	SSS M HAPPY_QQQ SBC028_mono 545 I = 43, W = 247	1654	944	710	2428
6	SSS M HAPPY_F FOR SBC047_mono 175 PrP = 141, I = 44, W = 368	1514	751	763	2033
7	SSS F HAPPY_T TO SBC055_mono 1371 I = 76, W = 370	1833	793	1040	2249
	Formant averages	1658,86	819,86	839	2234,43
A	B	C	D	E	F

Table 4.9 - Measurements of /æ/ F1 and F2 and [ɪ:]# F2 in LIN *happy*

	LIN HAPPY 3 PHRASES /æ/ in FULL-[ɪ:]#-WORDS		/æ/ F2	/æ/ F1	/æ/ F2 – /æ/F1	[ɪ:]# F2
2	LLL F HAPPY_PPP BR044_3 123 I = 52, W = 423, PsP = 380		1887	697	1190	2256
1	LLL M HAPPY_F FOR BR046_5_mono 2 I = 55, W = 394		1848	564	1284	1892
	Formant averages	0	1867,5	630,5	1237	2074
	(Speaker experience levels by color): green: advanced; white: intermediate					
A	B		C	D	E	F

	LIN HAPPY 2 PHRASES /æ/ in ZERO-[ɪ:]#-WORDS	/æ/ F2	/æ/ F1	/æ/ F2 – /æ/F1	[ɪ:]# F2
4	LLL F HAPPY_B BR019_2_mono 54 I = 0, W = 482	2149	733	1416	0
5	LLL F HAPPY_B BECAUSE... BR019_2 96 I = 0, W = 266	1973	757	1216	0
	Formant averages	2061	745	1316	0
	(Speaker experience levels by color): white: intermediate				

4.1.4 - What kinds of contexts exhibited ZERO-[ɪ:]-WORDS and FULL-[ɪ:]#-WORDS by the same speakers in LINDSEI-BR?

Ten of the 32 research words in LIN were pronounced without an [ɪ:]#, and one noteworthy thing about it is that, in each of those ZERO-[ɪ:]#-WORDS, the INT consonant exhibited similarities with the NXT-SGM: either the two were the same phoneme (e.g., *rea**l**ly **l**ike*), or shared place or manner of articulation (e.g., *ha**pp**y **b**ecause*, ma**n**y **m**ovies) or NXT-SGM was adapted to BP phonology and thus was made to coincide with INT for place of articulation (e.g., *ma**n**y **t***ings*). Those 10 ZERO-[ɪ:]#-phrases are shown in Table 4.10, accompanied by six FULL-[ɪ:]# phrases by the same speakers. As mentioned earlier, for every phrase analyzed by any speaker in this thesis there was a search for a second segmentable one by the same person, in order to compare a speaker with him/herself in similar or different contextual conditions. This was especially the case for those speakers who produced ZERO-[ɪ:]#s. The 10 such words from the English corpora were all realized by six LIN speakers. Table 4.10 shows ZERO-[ɪ:]#-phrases in orange and FULL-[ɪ:]#-phrases in blue; single speaker phrases are presented in sequential order (e.g., 1-2, by the BR009 interviewee). The only speaker in this group for whom it was not possible to segment a FULL-[ɪ:]#-phrase was BR019. Actually, such a phrase was found but, due to poor acoustic quality of the stretch, it had to be excluded from the analysis (the phrase was *very good*, with an audible, but acoustically compromised [ɪ:]# in the visually and auditorily complex word *very*). The phrases in which this group of speakers did produce [ɪ:]# were characterized by pauses and emphases (phrases 9, 13 and 15) or by a different consonant than the INT as NXT-SGM (phrases 2, 6 and 16).

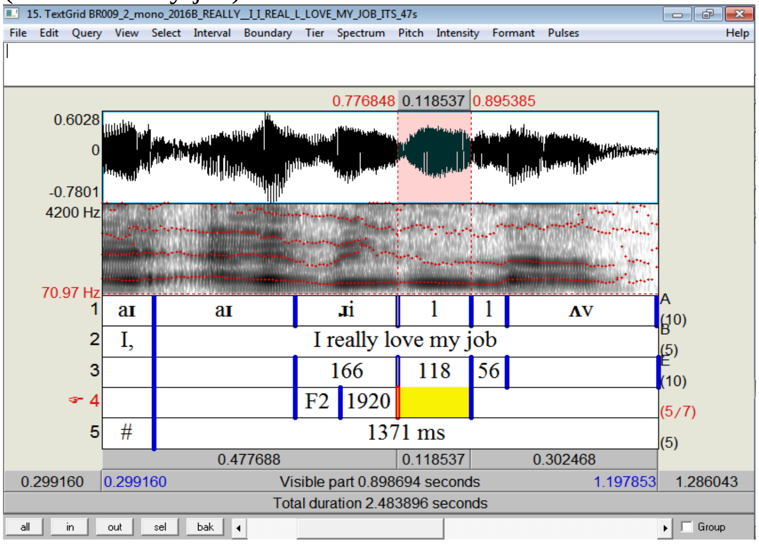
Table 4.10 - 10 ZERO-[ɪː]#-WORDS and 6 FULL-[ɪː]#-WORDS by same LINDSEI-BR speakers								
	FILE	WORD	NXT-SGM	PHRASE TITLE	SYL-1	INT	[ɪː]#	W SIZE
1	BR009	REALLY	L	LLL F REALLY_L_LOVE_BR009_2_mono 47 I = 0, W = 310, LL = 118, 56 I-real-love-my-job	166	118	0	284
2	BR009	REALLY	T	LLL F REALLY_T_ TIRED BR009_2 210 PrP = 298, I = 24, W = 258 I'm-real-ly-ti-red	183	51	24	258
3	BR019	HAPPY	B	LLL F HAPPY_B BR019_2_mono 54 I = 0, W = 482 I'm-ver-hap-b-cause...	201	281	0	482
4	BR019	HAPPY	B	LLL F HAPPY_B BECAUSE... BR019_2 96 I = 0, W = 266 I'm-hap-b-cause... How-can-I-say?	145	121	0	266
5	BR025	REALLY	L	LLL F REALLY_L LIKE BR025_1_mono 27 I = 0, W = 254, LL = 79, 60 I-real-like-it	175	79	0	254
6	BR025	REALLY	T	LLL F REALLY_T TRAUMATIZED BR025_1_mono 170 I = 36, W = 315 But-she's-real-ly-trau-ma-tized	232	47	36	315
7	BR025	STUDY	D*	LLL F STUDY_d THE BR025_2_mono 100 I = 0, W = 363 with pre-S I = 77 To-is-tud-the-Bi-ble	191	36	0	227
8	BR035	REALLY	L	LLL M REALLY_L_LIKE BR035_1_mono 26 I = 0, W = 214 There-is-one-that-I've-watched-and-I-real-like	154	60	0	214
9	BR035	REALLY	???	LLL M REALLY_QQQ BR035_1 298 I = 35, W = 283, PsP = 115 Real-ly?	179	69	35	283
10	BR038	MANY	T*	LLL F MANY_T THINGS BR038_2_mono 5 I = 0, W = 267 I-for-got-man-things	148	119	0	267
11	BR038	VERY	R	LLL F VERY_R RICH BR038_3 165 I = 0, W = 347 She-was-a-ver-rich-girl	277	70	0	347
12	BR038	VERY	W	LLL F VERY_W WELL BR038_3_mono 106 I = 0, W = 217 He-fits-ver-well	138	79	0	217
13	BR038	VERY	PPP	LLL F VERY_PPP BR038_3_mono 255 I = 296, W = 656, PsP = 2286 This-rich-girl-was-ver-y...	230	130	296	656
14	BR048	MANY	M	LLL M MANY_M MOVIES BR048_2_mono 144 I = 0, W = 209 I-didn't-watch-so-man-mo-vies	178	31	0	209
15	BR048	MANY	PPP	LLL M MANY_PPP BR048_2_mono 76 I = 85, W = 360, PsP = 363 I-didn't-watch-so-man-y... of-his-mo-vies	234	41	85	360
16	BR048	REALLY	D	LLL M REALLY_D DIFFERENT BR048_3_mono 189 I = 54, W = 552 It's-real-ly-dif-ferent	441	57	54	552

4.1.4.1 - Some comparative details of the ZERO-[ɪː]#-WORDS in LIN

Here follows an analysis of different types of sequences of INT – NXT-SGM in LIN for the 16 phrases from Table 4.10. Let us look at the types of INT – NXT-SGM relationships mentioned above.

Type a) same phoneme. This was the case with phrases 1, 5 and 8 (*really love, really like, really like*). In these cases, the research word was followed by an [l] and there was no strong F2 between INT and NXT-SGM. In phrase nr 1, particularly, the [l] of *really* was very long.

Spectrogram 4.5 - LIN - I *really* love my job
LLL F REALLY_L_LOVE_BR009_2_mono 47 I = 0, W = 310, LL = 118, 56
(I-real-love-my-job)



In Spectrogram 4.5 it is possible to see a weakening of F2 towards the central constriction for [l] in *really*. The closure is also observable in the waveform above the spectrogram (0.118537). The separation of the two [l-l] was made at another constriction in the waveform and a change in the pattern of F3 in the spectrogram (0.895385). There is no strong F2 in the area of the [l-l], (which is appreciably long, lasting 174 ms, i.e., 118 + 56 ms) and strong F2 energy only resumes later, in the vowel for the word *love*, which was produced with [ʌ] (in BP, there is no /ʌ/ phoneme and the typical pronunciation of *love* as a loanword is [lɔvɪ:]. This means that the BR009 speaker produced the vowel in *love* correctly, suggesting a better-than-basic knowledge of English pronunciation, although she failed to produce the [ɪ:]#, possibly without noticing it).

Type b) same place of articulation. This was the case with the BR019 speaker, in phrases 3 and 4. She realized *happy* ***b****ecause* twice without [ɪ:]#. (See Spectrogram 4.7 below).

Type c) same manner of articulation. This was the case of phrases 12 and 14, *very well* and *many movies*. In the first phrase, [ɹ] and [w] share *approximant* manner of articulation and, in the second one, [n] and [m] share *nasal* manner of articulation.

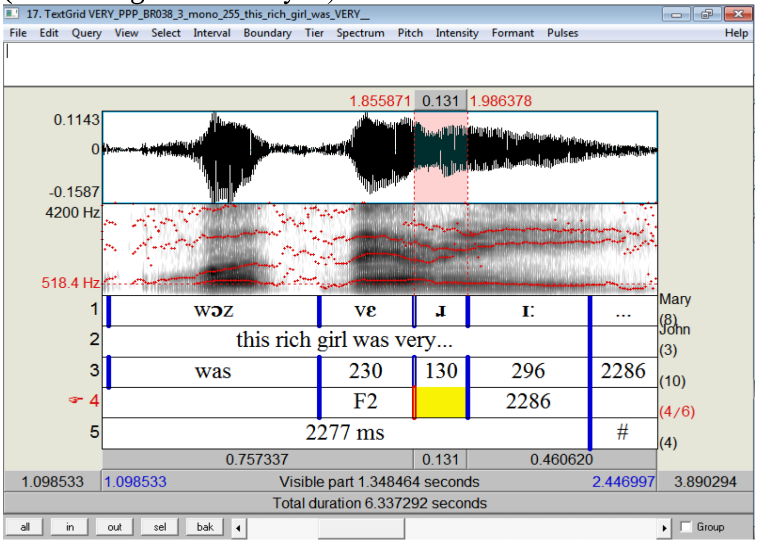
Type d) 'borrowed' NXT-SGM place of articulation. Apparently because BP phonology does not have interdental fricative phonemes, the speakers of phrases 7 and 10 replaced English [ð] and [θ] with lenis versions of [d] and [t], respectively, i.e., *stud(y) d** and *man(y) t**, in *study the Bible* and *many things*.

4.1.4.2 - FULL-[ɪː]#s by speakers who also produced ZERO-[ɪː]#s in LIN

Type e) phrase ends and pauses. The research words in phrases 9, 13 and 15 end with a question (9) and pauses (13 and 15). The pause cases had the longest [ɪː]#s of all six segmentations analyzed in this subsection. The most striking case was with the BR038 speaker, who produced three ZERO-[ɪː]#s (phrases 10, 11 and 12) but who also produced the longest [ɪː]# in the present study (13), with 296 ms of duration. The [ɪː]# is followed by a 2286 ms pause (Spectrogram 4.6).

Type f) different INT and NXT-SGM consonants. This occurred in phrases 2, 6 and 16 and it should be noted that all three NXT-SGMs, besides being phonologically different from INT, are also the onsets of strong (actually, stressed) syllables: *really **t**ired, really **t**raumatized, really **d**ifferent*. The just mentioned INT – NXT-SGM sequences sharply contrast with the ZERO-[ɪː]# cases in 3, 4 and 7. In 7, *study* is followed by the unstressed word *the (study the Bible)*; in 3 and 4, /b/ in *because* is also unstressed (*happy because*). Actually, as shown in Spectrogram 4.7, the word *because* was pronounced (twice) as [b.kɔz] by the BR019 interviewee. Some ZERO-[ɪː]# cases in LIN look similar to some other incomplete words in C-ORAL-BRASIL (section 4.2). It seems that, in both corpora, a NXT-SGM in a stressed syllable tends to inhibit the reduction of the final sound(s) in the [ɪː]#-WORD (i.e., [ɪː]# in LIN and both INT and [ɪː]# in C-ORAL-BRASIL).

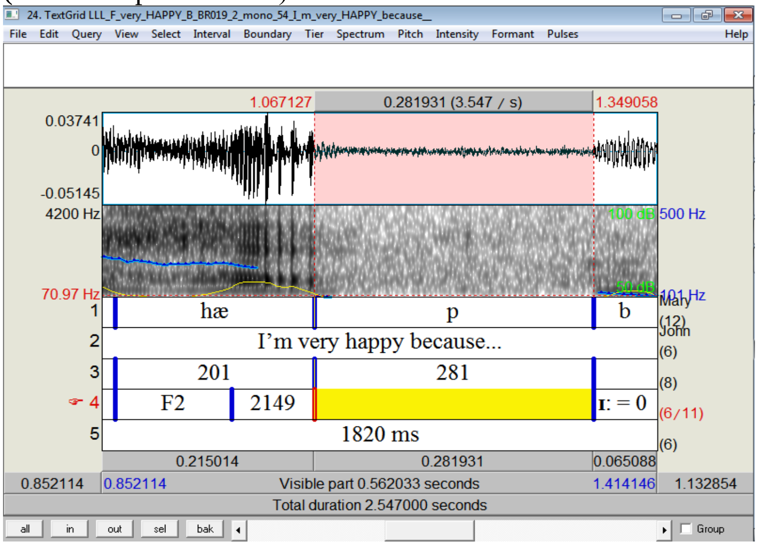
Spectrogram 4.6 - LIN - This rich girl was *very*…
LLL F VERY_PPP BR038_3_mono 255 I = 296, W = 656, PsP = 2286
(This-rich-girl-was-ver-y…)



4.1.4.3 - 'Skip' or 'stick'?

In the C-ORAL-BRASIL, several [ɪ:]#-phrases revealed the omission of the research vowel and some others also revealed the absence of the consonant preceding it. This may be associated with either an unconscious or deliberate 'skipping' of phonemes. In LIN, it seems that, rather than deliberate, the process is unconscious, and there may be some articulatory difficulty involved (sticking?). I suggest that, in ZERO-[ɪ:]#-WORDS, when the INT's duration is below average, there would be what one might call 'skipping' (the elimination of [ɪ:]# and the direct connection between INT and NXT-SGM). When, on the other hand, INT is markedly longer than average, there would be 'sticking' or an inability to move articulators in particular contexts. A noticeable example of long INT consonant is seen in phrase nr 8 (Table 4.10), in which [p] is spoken in 281 ms (Spectrogram 4.7). The average [p] in *happy* (FULL-[ɪ:]#-WORDS) is of 131 ms in LIN and 95 ms in SBC, as shown in Table 4.3. Note that, in Spectrogram 4.7, the preceding vowel becomes devoiced (creaky voice) some time before the consonant [p].

Spectrogram 4.7 - LIN - I'm very *happy* because…
LLL F HAPPY_B BR019_2_mono 54 I = 0, W = 482
(I'm-ver-hap-b-cause…)



4.1.4.3.1 - The possible LIN speaker difficulty with [l]-[ɪ:]-[l] and [ɹ]-[ɪ:] sequences, as in *really like* and *very*

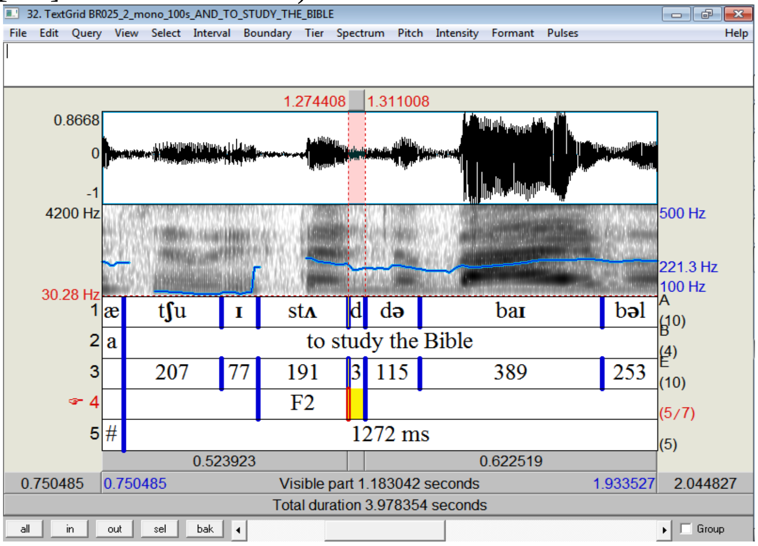
Most English ZERO-[ɪ:]#s in this study have been observed in the words *very* and *really*, especially *very*. However, most pre-analyzed *very* samples in the present research were discarded, due to difficulties commented above. Besides this, several *really* samples were left out because most of those samples were in the phrase *really like*, and it soon appeared that enough samples of that phrase had already been segmented. It could be that [ɹ] is particularly difficult for some B-LNR-E or that similar sounds in sequence could make articulation difficult, i.e., /r/, /l/, /l/, in *really like*. Although the /r/ is not an approximant sound in all varieties of English, B-LNR-E will usually tend to emulate either General American or RP, two approximant /r/ varieties and the ones used in English courses in Brazil. Most varieties of BP do not use the approximant /r/ and many which do, do not use it phonologically. Many BP speakers use [ɹ] in syllable codas but not in syllable onsets. One such example was observed in C-ORAL-BRASIL, in the phrase CCC F GENTE_M_MARCA bfamcv02_mono 193 I = 34, W= 460 (*Gen-te! Ma*[ɹ]*-k'es-sa da-ta!).* The sounds in /r/ positions, in Belo Horizonte Portuguese, as in most of Brazil, are normally /h/ word-initially and [ɾ] intervocalically). e.g. *rara* [ha.ɾɐ] (rare, fem. adj.).

4.1.4.3.2 - 'Borrowed' BP phonemes to substitute for English labiodental consonants [θ] and [ð]

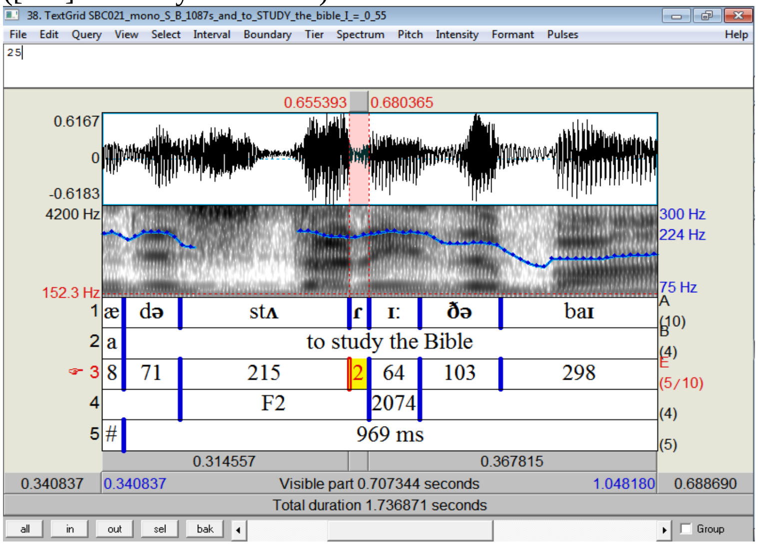
The English phonemes [θ] and [ð] seem to have, auditorily, the (unaspirated) plosives [t] and [d], respectively, as their closest corresponding sounds in BP.

In the sequence *stud(y) the Bible*, the BR025 speaker pronounced *the* as [də] (she correctly produced the schwa, i.e., she did not use the typical B-LNR-E beginners' pronunciation [de] for *the*), but instead of [stʌɾɪ: ðə baɪbəl], she realized [istʌd də baɪbəl] (Spectrograms 4.8). There is an identical sequence in SBC, by the main speaker in file SBC021 (WALT), reproduced below (Spectrogram 4.9). The SBC021 word had the sound in the /d/ INT position pronounced as a simple tap [stʌɾɪ:].

Spectrogram 4.8 - LIN - (and) to *study* the Bible [ænd tʃu istʌd də baɪbəl]
LLL F STUDY_D sic THE BR025_2_mono 100 I = 0, W = 363 with pre-S I = 77
([and]-to-is-tud-the-Bi-ble)



Spectrogram 4.9 - SBC - (and) to *study* the Bible [æn də stʌɾɪ: ðə baɪbəl]
SSS M STUDY_DH THE SBC021_mono 1087 I = 64, W = 293
([and]-to-stud-y-the-Bi-ble)



Note that the durations of /stʌ/, /d/ and /ðə/ are all similar in the two spectrograms. However, a large difference in duration is observable in the preceding [tʃu] / [də] by the Brazilian and American speakers.

A prothetic high front vowel is observed before the word *study* in Spectrogram 4.8 [tʃu ɪstʌd də baɪbəl].[22] The prothesis (and also the epenthesis, as in, e.g., *head* [hɛdʒ(ɪː)]) is common among B-LNR-E at basic levels, pointing toward influences of BP phonology in English words. BP does not accept /sC/ in onsets, e.g., *es.tu.do* (study); *es.tre.la* (star, from Latin, *stella*). Because of that, analyses of sequences like, e.g., *very strong*, should be avoided for B-LNR-E, since it might be difficult to establish whether an /i/ sound between the two words is 'intended for' the final sound in *very* or for the first sound in *strong*.

As another possible example of 'sticking', BR038 produced *man(y) t*ings* (*many things*) with a 128 ms /n/. INT [n] has been observed to be noticeably short in both English corpora: In LIN, it averaged only 39 ms and 47 ms in SBC (Table 4.3), and is considered by Umeda, cited above, to be around 34 ms, intervocalically (Pickett, op. cit., p. 87).

4.1.4.4 - A summary of *really* measurements in SBC and LIN

Table 4.11, below, shows measurements of FULL-[ɪː]#-WORDS restricted to *really*, in the two English corpora. Also shown are measurements of the three ZERO-[ɪː]# *really* samples from LIN. The bottom part exhibits the *really* values from SBC (lines 25-29) so that they can be promptly compared with each LIN speaker group's averages (i.e., experienced, advanced and intermediate speakers).

[22] In Spectrogram 4.8, the prothetic /i/ was transcribled as [ɪ] rather than [i], because its average F2 measured only 1993 Hz.

Table 4.11 - All 34 realizations of ***Really*** in LIN and in SBC

1		**LIN EXPERIENCED 6 [ɪ:]#-PHRASES WITH REALLY**							
2	data	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	F2 SYL-1	F2 [ɪ:]#	SPK RATE
3	tt	1292	327	456	2075	1,3	11381	12112	1390,13
4	av	215,33	54,5	76	345,83	22%	1896,83	2018,67	231,69
5	pct	62,27%	15,76%	21,98%					
6		A	B	C	D	E	F	G	H
7		**ADVANCED LIN 5 [ɪ:]#-PHRASES WITH REALLY**							
8	data	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	F2 SYL-1	F2 [ɪ:]#	SPK RATE
9	tt	927	263	416	1606	1,23	9967	9832	998,56
10	av	185,4	52,6	83,2	321,2	25%	1993,4	1966,4	199,71
11	pct	57,72%	16,38%	25,90%					
12		A	B	C	D	E	F	G	H
13		**INTERMEDIATE LIN 3 WITH REALLY**							
14	data	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	F2 SYL-1	F2 [ɪ:]#	SPK RATE
15	tt	856	155	114	1125	0,31	5925	5893	875,11
16	av	285,33	51,67	38	375	10%	1975	1964,33	291,7
17	pct	76,09%	13,78%	10,13%					
18		A	B	C	D	E	F	G	H
19		**LIN 3 ZERO-[ɪ:]# PHRASES**							
20	data	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	F2 SYL-1	F2 [ɪ:]#	SPK RATE
21	tt	673	288	0	961	0	5676	0	1129,13
22	av	224,33	96	0	320,33	0%	1892	0	376,38
23	pct	70,03%	29,97%	0,00%		0		0	
24		A	B	C	D	E	F	G	H
25		**REALLY SBC 17 [ɪ:]#-PHRASES**							
26	data	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	F2 SYL-1	F2 [ɪ:]#	SPK RATE
27	tt	2431	1183	1166	4780	4,18	24105	31957	3363,65
28	av	143	69,59	68,59	281,18	24%	1506,56	1879,82	197,86
29	pct	50,86%	24,75%	24,39%					
30		A	B	C	D	E	F	G	H

Table 4.11 shows that LIN had 17 segmentations of *really,* being 14 FULL-[ɪ:]#-WORDS and three ZERO-[ɪ:]#-WORDS. SBC had 17 segmentations of *really*, all with realizations of [ɪ:]#. The complete *Really* [ɪ:]# realizations in LIN are given by group of speakers: the experienced group had six realizations, the advanced group had five realizations and the intermediate group had three realizations. The incomplete realizations of *really* in LIN were one by an advanced speaker and two by intermediate speakers.

The LIN group of speakers expected to show the least influences from BP phonology in the realization of [ɪ:]#-WORDS and phrases is the experienced group (lines 1 to 6). The LIN group considered most likely to show influences from BP is the intermediate one (lines 13 to

18). The very short [ɪ:]# average by the intermediate group (38 ms, line-column 16C) may be an indication of difficulty to realize strong post-tonic sounds.

Second language acquisition, according to Gass & Selinker (op. cit., Introduction) "is the study of how learners create a new language system with only limited exposure to a second language."

The [ɪ:]# F2 (line G) was remarkably similar among the four non-ZERO-[ɪ:]# subtables. The vowel in SYL-1, /i/, was also very similar among experienced, advanced and intermerdiate LIN groups. As shown earlier, several SBC speakers centralized that vowel (i.e., [rɨl.ɪ:]#), a fact that greatly lowered the /i/ final average in that corpus (28F).

In relation to phrase spk rate (column H), SBC was (expectedly) the fastest (28H), but followed very closely by the advanced group (10H). The slowest realizations of phrases are shown in the LIN ZERO-[ɪ:]# subtable, (22H), almost twice as slow as SBC.

The longest W duration average was registered for the intermediate LIN group and the shortest for the SBC. SYL-1 was also longest for the intermediate LIN group (16 and 17A). This contrasts with the very short [ɪ:]# in that group: an average size of only 38 ms or 10% of the W (16 and 17C). Therefore, the pattern for the intermediate LIN group was a very long SYL-1 with a very short [ɪ:]#. Also observable for the intermediate group is the shortest INT of all five groups (13,78% of the W, as opposed to 24,75% of the W in SBC) (17 and 29B).

Also remarkable is the long duration of the INT in the ZERO-[ɪ:]# subtable (96 ms), indicating a considerable elongation of the INT consonant when LIN speakers failed to produced the research vowel in the three incomplete *really* samples (that elongation is even greater in the general averages, considering all 10 ZERO-[ɪ:]#s in LIN, with an INT average of 100,3 ms, as shown in Table 3.5). Probably because of its very long INT-turned-coda consonants, the ZERO-[ɪ:]# realizations of *really* in LIN had longer average W durations than the full realizations of *really* in SBC (320 ms vs 281 ms, as shown in line-column 22 and 28D).

It should be noted that the ZERO-[ɪ:]# 'group' of speakers is almost entirely composed by intermediate level learners (9 out of 10). Table 4.11 B presents details of the distribution of [ɪ:]#-WORDS realized in LIN.

Table 4.11 B - FULL-[ɪ:]#-WORDS and ZERO-[ɪ:]#-WORDS realizations in LIN according to speaker level of experience with English

SPEAKER LEVEL	FULL-[ɪ:]#-WORDS	ZERO-[ɪ:]#-WORDS
EXPERIENCED LIN SPEAKERS	**9** **really (6)** **many (2)** **study (1)**	**0**
ADVANCED LIN SPEAKERS	**7** **really (5)** **happy (1)** **very (1)**	**1** **really (1)**
INTERMEDIATE LIN SPEAKERS	**6** **really (3)** **happy (1)** **many (1)** **very (1)**	**9** **really (2)** **happy (2)** **many (2)** **very (2)** **study (1)**

4.1.5 - The NXT-SGM influences on *really* [ɪ:]# durations and F2 values in SBC and LIN

In this subsection, durations and F2 heights of *really* [ɪ:]# are related with NXT-SGM sound types (e.g., voiced vs voiceless) in three different Tables (4.12, 4.13 and 4.14) with values summarized in Table 4.15. Table 4.16 measures [ɪ:]# F2 in relation to place of articulation of the NXT-SGM (e.g., bilabial, alveolar, velar) in all FULL-[ɪ:]# *really* phrases.

As explained above, it was decided that the general measurements of [ɪ:]# in relation to NXT-SGM could only be 'fully' comparable in SBC and in LIN if they were made with the same [ɪ:]#-WORD type(s). In subsection 4.1.3, it was concluded that it is not viable to compare, e.g., three realizations of *really* in LIN with three realizations of *happy* in SBC, because measurements are predicted to be very different between the two word types. The word *really* was chosen for most comparisons because it was the most segmented word in this thesis. The reason why it was the most segmented word is that, early on in this study, I decided to give preference to segmentation of phrases with similar word sequences in the two English corpora and *really* showed same NXT-SGM and same (or similar) NXT-WORD in an interesting number of occasions, which was 'not really' the case with other [ɪː]#-WORDS.

Measurements of [ɪː]# duration related to NXT-SGM for all FULL-[ɪː]#-WORDS in this thesis are depicted in Table 4.23, with the intent to reveal some minimum and maximum values found in the corpora and some general tendencies among speakers. The measurements restricted to *really* tokens, in this subsection, are an attempt to compare [ɪː]# durations and F2 under 'same conditions' in SBC and LIN.

In order to make as many tests as possible on possible effects of NXT-SGM on [ɪː]# duration and F2 height in *really,* comparisons were made with different groups of following sounds or pauses. NXT-SGMs were divided into six categories for contrastive analysis, two by two. [ɪː]# is measured in relation to the following types of NXT-SGMs: voiced vs voiceless, stop vs fricative and lateral vs pause (this pair were put together simply because they were the last two of six different NXT-SGM types).

The three following Tables (4.12 through 4.14) have four lists each: two from SBC and two from LIN. In the first part of Table 4.12, there are measurements of SBC *Really* [ɪː]# followed by 10 voiced consonant samples. Column A gives an ordering of words in each list; Column B shows the durations of [ɪː]#, from shortest to longest; Column C has the percent proportions of the [ɪː]# in specific words (e.g., the nr 1 [ɪː]# [before the word *glad*], with 40 ms, represents 24% of the word of origin, because *really* lasted 165 ms on that occasion); Columns D and E inform the NXT-SGMs and the actual words they are parts of; Column F gives [ɪː]# F2 averages.

4.1.5.1 - Voiced vs voiceless NXT-SGM

Table 4.12 shows that, in both English corpora, [ɪː]# tends to be longer before voiced than voiceless consonants (column B - averages) but it also shows that [ɪː]# F2 is higher before voiceless consonants in both corpora (column F - averages). Table 4.12 also indicates that [ɪː]# duration varies more than [ɪː]# percentages and that [ɪː]# percentages vary more than its F2, as shown by examples of the word *like* in LIN: in the second part of the table (voiced NXT-SGM LIN), [ɪː]# samples in LIN *like* (words nr 12 and 17) measure 38 and 84 ms (column B), respectively (a difference around 121% in duration); the percent proportions of each *like* are or 11% and 23% of the respective words (column C) (a difference around 109% in proportion between the two vowels); and the [ɪː]# F2 of the first word is 1892 Hz and the second has F2 of 2241 (column F) (a difference of only 18% in favor of the longer vowel). These values suggest that, contrary to initial speculation in this thesis, the duration of the research vowel might be somewhat circumstantial, while, on the other hand, its F2 seems to be rather stable (i.e., depending on specific word types, as shown in Table 4.3).

Pickett (op. cit., pp. 60-62) claims that a bigger vocal effort makes the second and higher formants more intense in relation to F1).

Thus, it may be that the impression of a shorter or weaker [ɪː]# by some LIN speakers may be caused by a weaker vocal effort in the particular production of post-tonic sounds rather than by the actual short durations of those sounds or by markedly different values of F2 in relation to SBC.

Table 4.12 - SBC and LIN *really* [ɪ:]# measurements before voiced and voiceless sounds

REALLY#	VOICED		10 PHRASES SBC		
	[ɪ:]#	[ɪ:]# %	NXT-SGM	NXT-WORD	[ɪ:]# F2
1	40	24	G	glad	1926
2	50	20	N	nice	1720
3	50	19	G	good	1921
4	54	25	D	doesn't	2119
5	58	32	L	like	1842
6	73	40	D	do	1375
7	80	36	L	like	1934
8	86	23	D	don't	2303
9	95	35	B	beautiful	2138
10	124	26	L	love	1964
tt	710	280			19242
av	71	28			1924,2
A	B	C	D	E	F
REALLY#	VOICED		7 PHRASES LIN		
	[ɪ:]#	[ɪ:]# %	NXT-SGM	NXT-WORD	[ɪ:]# F2
11	36	15	B	beautiful	2055
12	38	11	L	like	1892
13	54	10	D	different	1724
14	66	27	L	lost	1875
15	76	30	N	nervous	1905
16	77	29	D	don't	2103
17	84	23	L	like	2241
tt	431	145			13795
av	61,57	20,71			1970,71

REALLY#	VOICELESS		4 PHRASES SBC		
	[ɪ:]#	[ɪ:]# %	NXT-SGM	NXT-WORD	[ɪ:]# F2
18	36	10	H	hard	1876
19	38	25	T	teaches	2184
20	72	25	F	funny	2030
21	83	30	TH	thinking	2218
tt	229	90			8308
av	57,25	22,5			2077
A	B	C	D	E	F
REALLY#	VOICELESS		4 PHRASES LIN		
	[ɪ:]#	[ɪ:]# %	NXT-SGM	NXT-WORD	[ɪ:]# F2
22	24	9	T	tired	1970
23	36	11	T	traumatized	2199
24	39	16	K	can't	1809
25	108	20	H	hard	2097
tt	207	56			8075
av	51,75	14			2018,75

4.1.5.2 - Stop vs fricative NXT-SGM

Table 4.13 exhibits the research vowel in *really* as longer before fricatives than before stops in both English corpora, although the difference in LIN is much greater than in SBC (108 vs 49 ms in LIN; 64 vs 61 ms in SBC). But there was only one example of [ɪ:]#-fricative from LIN. Still, the [ɪ:]# average of less than 49 ms in LIN before stops was quite short. In SBC, [ɪ:]# F2 was much higher before stops than fricatives while in LIN it was lower before stops. It seems that, before stops, the vowel was tenser than before fricatives in SBC, what could have favored higher F2 averages.

Table 4.13 - SBC and LIN *really* [ɪ:]# measurements before stop and fricative sounds

REALLY#	STOP		3 PHRASES SBC		
	[ɪ:]#	[ɪ:]# %	NXT-SGM	NXT-WORD	[ɪ:]# F2
1	38	25	T	teaches	2184
2	40	24	G	glad	1926
3	50	20	N	nice	1720
4	50	19	G	good	1921
5	54	25	D	doesn't	2119
6	73	40	D	do	1375
7	86	23	D	don't	2303
8	95	35	B	beautiful	2138
tt	486	231,33			17688,67
av	60,75	28,92			2211,08
A	B	C	D	E	F
REALLY#	STOP		7 PHRASES LIN		
	[ɪ:]#	[ɪ:]# %	NXT-SGM	NXT-WORD	[ɪ:]# F2
9	24	9	T	tired	1970
10	36	15	B	beautiful	2055
11	36	11	T	traumatized	2199
12	39	16	K	can't	1809
13	54	10	D	different	1724
14	76	30	N	nervous	1905
15	77	29	D	don't	2103
tt	342	120			13765
av	48,86	17,14			1966,43

REALLY#	FRICATIVE		3 PHRASES SBC		
	[ɪ:]#	[ɪ:]# %	NXT-SGM	NXT-WORD	[ɪ:]# F2
16	36	10	H	hard	1876
17	72	25	F	funny	2030
18	83	30	TH	thinking	2218
tt	191	65			6124
av	63,67	21,67			2041,33
A	B	C	D	E	F
REALLY#	FRICATIVE		1 PHRASE LIN		
	[ɪ:]#	[ɪ:]# %	NXT-SGM	NXT-WORD	[ɪ:]# F2
19	108	20	H	hard	2097
tt	108	20			2097
av	108	20			2097

4.1.5.3 - Lateral vs pause NXT-SGM

Before laterals, *really* [ɪ:]# was a lot longer in SBC than in LIN, but before pauses [ɪ:]# was markedly longer in LIN. Interestingly, the longer [ɪ:]#s had lower F2 in these words

Table 4.14 - SBC and LIN *really* [ɪ:]# measurements before lateral sounds and pauses

REALLY#	LATERAL		3 PHRASES SBC		
	[ɪ:]#	[ɪ:]# %	NXT-SGM	NXT-WORD	[ɪ:]# F2
1	58	32	L	like	1842
2	80	36	L	like	1934
3	124	26	L	love	1964
tt	262	94			5740
av	87,33	31,33			1913,33
A	B	C	D	E	F
REALLY#	LATERAL		3 PHRASES LIN		
	[ɪ:]#	[ɪ:]# %	NXT-SGM	NXT-WORD	[ɪ:]# F2
4	38	11	L	like	1892
5	66	27	L	lost	1875
6	84	23	L	like	2241
tt	188	61			6008
av	62,67	20,33			2002,67

REALLY#	PPP/QQQ/###		3 PHRASES SBC		
	[ɪ:]#	[ɪ:]# %	NXT-SGM	NXT-WORD	[ɪ:]# F2
9	60	16	QQQ		1895
8	65	15	PPP		2268
7	102	32	PPP		2134
tt	227	63			6297
av	75,67	21			2099
A	B	C	D	E	F
REALLY#	PPP/QQQ/###		3 PHRASES LIN		
	[ɪ:]#	[ɪ:]# %	NXT-SGM	NXT-WORD	[ɪ:]# F2
10	35	12	QQQ		1990
11	112	27	QQQ		1807
12	201	43	PPP		2170
tt	348	82			5967
av	116	27,33			1989

4.1.5.4 - Summary of *really* measurements data in relation to six types of NXT-SGM

Table 4.15 - [ɪ:]# durations (ms) in SBC and LIN *really* in relation to NXT-SGM
(rounded values)

49	52	57	61	62	63	64	71	76	87	108	116
STOP	VOICELESS	VOICELESS	STOP	VOICED	LATERAL	FRICATIVE	VOICED	PAUSE	LATERAL	FRICATIVE	PAUSE
SBC	LIN										

The longest [ɪ:]#s in the 12 subdivisions (six NXT-SGM types for each English corpus) in Tables 4.12 through 4.14 were those followed by pauses in LIN (116 ms), fricatives in LIN (108 ms) and laterals in SBC (87 ms). The shortest [ɪ:]#s were the ones before stops in LIN (49 ms) and voiceless consonants in LIN (52 ms) and in SBC (57 ms). The data show the SBC with most of the middle durations and LIN with the most variable values. The min-max variation in LIN averages (between 49 and 116 ms) was of 136% while in SBC the variation of averages (between 57 and 87 ms) was of only 52,6%. One similarity in the measurements of the two corpora was that the [ɪ:]# was shortest before stops and voiceless consonants both in SBC and LIN.

In what concerns [ɪ:]# F2 averages, the highest values were found in SBC before stops (2211 Hz), in SBC before pauses (2099 Hz) and in LIN before voiceless sounds (2077 Hz). The lowest F2 values for [ɪ:]# were found in SBC before laterals (1913 Hz), in SBC before voiced sounds (1924 Hz) and in LIN before stops (1966 Hz). These data suggest that SBC does produce tenser and less voiced sounds than LIN, and also shows the F2 lowering quality of [l] (both with intervocalic [l] [*really* [ɪ:]# already has low F2 compared with other [ɪ:]#-WORDS], as well as NXT-SGM [l]).

4.1.5.5 - [ɪ:]# measurements in relation to place of articulation of NXT-SGM

Table 4.16 - [ɪ:]# F2 values for *really* in SBC and LIN in relation to place of articulation of NXT-SGM

bilabial plosives (blue), alveolar plosives, nasals and laterals (orange), velar plosives (green)

1	**1375**	REALLY-SBC	**D (do)**	**1**	**1724**	REALLY-LIN	**D (different)**
2	**1720**	REALLY-SBC	**N (nice)**	**2**	**1807**	REALLY-LIN	**???**
3	**1842**	REALLY-SBC	**L (like)**	**3**	**1809**	REALLY-LIN	**K (can't)**
4	**1876**	REALLY-SBC	**H (hard)**	**4**	**1875**	REALLY-LIN	**L (lost)**
5	**1895**	REALLY-SBC	**???**	**5**	**1892**	REALLY-LIN	**L (like)**
6	**1921**	REALLY-SBC	**G (good)**	**6**	**1905**	REALLY-LIN	**N (nervous)**
7	**1926**	REALLY-SBC	**G (glad)**	**7**	**1970**	REALLY-LIN	**T (tired)**
8	**1934**	REALLY-SBC	**L (like)**	**8**	**1990**	REALLY-LIN	**???**
9	**1964**	REALLY-SBC	**L (love)**	**9**	**2055**	REALLY-LIN	**B (beautiful)**
10	**2030**	REALLY-SBC	**F (funny)**	**10**	**2097**	REALLY-LIN	**H (hard)**
11	**2119**	REALLY-SBC	**D (doesn't)**	**11**	**2103**	REALLY-LIN	**D (don't)**
12	**2134**	REALLY-SBC	**ppp**	**12**	**2170**	REALLY-LIN	**ppp**
13	**2138**	REALLY-SBC	**B (beautiful)**	**13**	**2199**	REALLY-LIN	**T (traumatized)**
14	**2184**	REALLY-SBC	**T (teaches)**	**14**	**2241**	REALLY-LIN	**L (like)**
15	**2218**	REALLY-SBC	**TH (thinking)**				
16	**2268**	REALLY-SBC	**ppp**				
17	**2303**	REALLY-SBC	**D (don't)**				
	A	B	C		D	E	F

Table 4.16 shows *really* [ɪ:]# F2 heights ranked from lowest to highest in SBC and LIN *really*. NXT-SGM place of articulation influences are studied. It can be seen that alveolars are everywhere: in SBC, in lines 1, 2, 3, 8, 9, 11, 14 and 17; in LIN, in lines 1, 4, 5, 6, 7, 11, 13 and 14. According to Paradis & Prunet, (op. cit., pp 10-11), coronals are, by far, the most frequent consonant sounds in virtually all the world's languages). Bilabials are in intermediate rankings (13 in SBC and 9 in LIN), but with rather high values of F2. Velars are in low positions in both

corpora (6 and 7 in SBC and 3 in LIN). The other NXT-SGMs (fricatives and pauses) had higher positions.

Longer [ɪː]#s tended to have slightly higher F2 values. Two factors, actually, seem to influence F2 height in *really* **[**ɪː]#. A longer duration of the vowel seems to partially compensate for its low F2 start, on the average; and a tenser sound as NXT-SGM also seems to raise the **[**ɪː]# F2 value, as suggested in Table 4.15.

The data in Table 4.16 is also used to explore the question of whether the NXT-SGM may be influenced by its own NXT-SGM (i.e., [g] in *glad* would be different from [g] in *good* because of the sound following each of the [g] consonants, i.e., [glæd] vs [gʊd]). The table shows [ɪː]# F2 in relation with place of articulation of NXT-SGM (bilabial, alveolar, velar), and additionally gives the word type that NXT-SGM is the onset of. However, coincidentally or not, initial sounds in different pairs of words, such as *good* and *glad* (SBC nrs 6 and 7) and *like* and *love* (SBC nrs 8 and 9), besides *lost* and *like* (LIN nrs 4 and 5), were all preceded by [ɪː]#s with very similar average F2 measurements.

4.2 - The data from the C-ORAL-BRASIL

The analysis of the C-ORAL-BRASIL data, in this section, is used to partly answer the questions of how N-SPK-BP actually realize [ɪ:]#-WORDS in Portuguese and of how those realizations might be related with the oral productions in LIN.

4.2.1 - The three realization types of [ɪ:]#-WORDS in C-ORAL-BRASIL

While the SBC data analyzed in this thesis presented no zero realizations of the research vowel in 32 words studied, the LIN presented 10 ZERO-[ɪ:]#s out of another 32 words. The C-ORAL-BRASIL, in turn, besides exhibiting FULL-[ɪ:]#s and ZERO-[ɪ:]#s, revealed yet another kind of [ɪ:]#-WORD: the word missing the two last canonical phonemes (ZERO-SYL-2-WORD). Eighteen words were analyzed from C-ORAL-BRASIL, five of which were FULL-[ɪ:]#-WORDS, nine were ZERO-[ɪ:]#-WORDS and the other four were ZERO-SYL-2-WORDS:

Sabe? Vendo assim… [**sabɪ:** vẽnɐsĩ]

Sabe como? [**sab** komʊ]

Sabe que que é? [**sa** ke k'jɛ]

Table 4.17 shows the distribution of the three different forms of realizations of [ɪ:]#-WORDS in the three corpora studied.

Table 4.17 - Three different realizations of [ɪ:]#-WORDS in SBC, LIN and C-ORAL-BRASIL

Corpus	FULL-[ɪ:]#-WORDS	ZERO-[ɪ:]#-WORDS	ZERO-SYL-2-WORDS	tt
SBC	32	0	0	**32**
LIN	22	10	0	**32**
C-ORAL-BRASIL	5	9	4	**18**

In view of the dissimilar distribution of the [ɪ:]# in the three corpora, ZERO-[ɪ:]#-WORDS might be considered rather the norm than the exception in C-ORAL-BRASIL. As shown in Table 4.17, in the C-ORAL-BRASIL, 13 words were incomplete out of 18. Therefore, reasons must be sought for such apparently curious behavior.

4.2.2 - Some more on BP haplology studies (Leal, 2006) vs the C-ORAL-BRASIL data

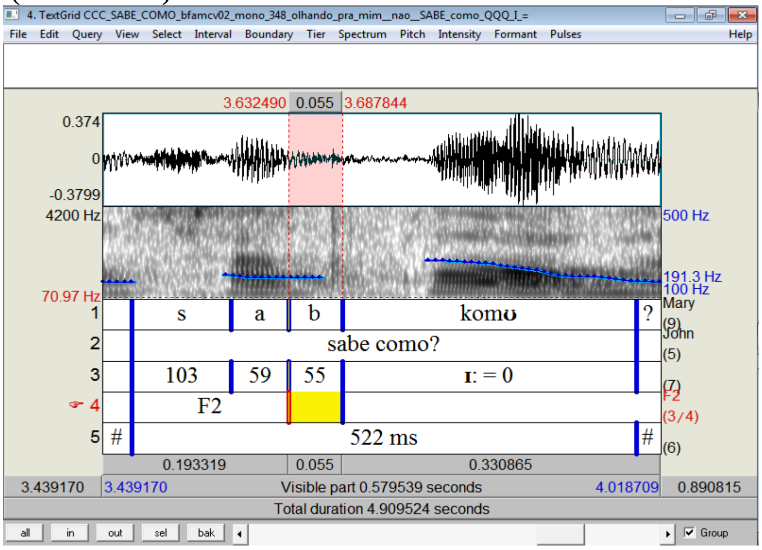
According to Leal (op. cit.), BP haplology is usually considered to involve specifically the sounds [t] / [d] in the onsets of final post-tonic syllables in W1, followed by one of those same consonants in the onset of W2, favoring the elimination of the whole final syllable in W1. In the example *tape(te) de vime* (wicker rug), the third syllable of W1, (*te*), may be fully eliminated (p. 44). But the researcher claims that several of the examples found in her study are clearly outside of the [t] / [d] restrictions. The word *pode*, for example, may be followed by just any consonant and its SYL-2 be fully eliminated just the same. e.g., *po(de) ficar* (you may stay; you may keep at it)*; po(de) passar* (you may pass) (p. 106). Another W1 which frequently was reduced, notwithstanding NXT-SGM, is *sabe*. *Sa(be) que meu nome é André?* (Did you know that my name is André?) (p. 111). The word *sabe* was found to be elided before any NXT-SGM consonant, but not before a pause (pp. 112 and 114). Nevertheless, according to examples given in pages 115, 116 and 119, it can be postulated that it is easier for a SYL-2 to be eliminated before a coronal consonant (e.g., [t], [d], [n]) than before other sounds and also that SYL-2 elimination is more common when the SYL-1 of W2 is not stressed (e.g., *de* after *tapete*). In *tapete de vime,* (*ta-<u>pe</u>-te de <u>vi</u>-me*)*,* the sequence of syllables would be *sSw s Sw*.

The results found in C-ORAL-BRASIL partly coincide with Leal's findings. Of the four examples of total loss of SYL-2 in the corpus, one was within the [t] / [d] restriction (*a gen**t**e **d**isseca*); another one was very similar (*a gen**t**e **n**ão procurou*), and the other two had different INT and NXT-SGM sequences (*Sa**b**e **q**ue que é?* [b - k]) and (*E**l**e **q**uer saber…* [l - k]). These last ones seem possibly related with some words and expressions becoming functional within BP. Levels of formality are also suggested to influence realizations. e.g., when speaker EVN, in bfamcv01, realized the sequence *gente não* once with a ZERO-SYL-2-WORD, [ʒẽ], and another time with a ZERO-[ɪ:]#-WORD, [ʒẽtʃ]. In the second sample, he was using reported speech (i.e., more formal speech).

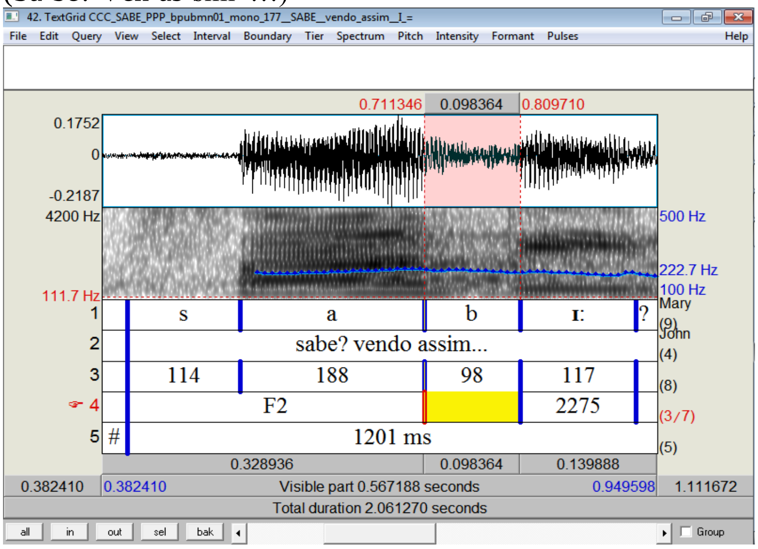
4.2.3 - Some visual examples of realization / non-realization of the research vowel in C-ORAL-BRASIL

The incomplete research words are often clearly identifiable in spectrograms by the absence of voicing or strong vowel formants in SYL-2.

Spectrogram 4.10 - C-ORAL-BRASIL - Example of ZERO-[ɪː]#-WORD (*Sabe* como?)
CCC F SABE_K COMO QQQ bfamcv02_mono 348 I =0, W = 217
(Sab-co-mo?)



Spectrogram 4.11 - C-ORAL-BRASIL - Example of FULL-[ɪː]#-WORD (*Sabe?* Vendo assim...)
CCC F SABE_QQQ bpubmn01_mono 177 I = 117, W = 517
(Sa-be? Ven-as-sim*…)



In Spectrogram 4.10, with the research word *sabe,* it is possible to see that the blue line for voicing disappears just before the [b] burst and only reappears more than 100 ms later, in the beginning of the vowel [o] . It is also observable that there are strong formants in the [a] of *sabe* and in the [o] of *como*, and some energy also in the nasal [m]. But there is no formant energy after the [b] (3.687844), where [ɪː]# was supposed to be located.

Spectrogram 4.11 shows another example with the word *sabe*, now exhibiting strong [ɪː]# F2 after [b], with full voicing (the asterisk in syllabification indicates that the sequence *vendo assim* was pronounced in a simplified manner). After [ɪː]#, there is reduction of energy for the labiodental fricative [v]. The [a] in Spectrogram 4.11 has stronger energy than the [a] in Spectrogram 4.10. Another difference between the two stressed [a] vowels, barely noticeable in the images above, is that [a] was produced with a slightly falling pitch in Spectrogram 4.10 and with a slightly rising pitch in Spectrogram 4.11. Also, in Spectrogram 4.11, the [a] is especially long. A long SYL-1 vowel was typical of most FULL-[ɪː]#-WORDS in C-ORAL-BRASIL.

4.2.4 - Durations, F2 and spk rate differences between C-ORAL-BRASIL [ɪː]#-WORDS

After a general analysis was made of the 18 C-ORAL-BRASIL words (shown below), some recurring contexts are tentatively pointed as favoring each of the three types of realization of the [ɪː]#-WORDS. Different types of realizations of the research words were made by single speakers in some cases. As mentioned above, when a ZERO-[ɪː]#-WORD was segmented in LIN, an attempt always followed to find at least one more word, fit for acoustic analysis, by the same speaker. This procedure was also tried with C-ORAL-BRASIL. For example, four words from speaker TER, in file bfamcv02, were analyzed. Two of them presented FULL-[ɪː]#s, one was a ZERO-[ɪː]# and the fourth one was a ZERO-SYL-2. In what follows, the three realization types of [ɪː]#-WORDS in C-ORAL-BRASIL will be separately analyzed as *Word Type A* (FULL-[ɪː]#-WORDS), *Word Type B* (ZERO-[ɪː]-WORDS) and *Word Type C* (ZERO-SYL-2-WORDS).

The differences in average durations among the three types of words in the C-ORAL-BRASIL are considerable. The overall size of the research word in C-ORAL-BRASIL was of 255 ms, but while the FULL-[ɪː]#-WORDS averaged 380 ms (Table 4.18), the ZERO-[ɪː]#-WORDS averaged 235 ms and the ZERO-SYL-2 WORDS measured only 147 ms. Concerning spk rate, FULL-[ɪː]#-WORDS were within quite slow phrases (241) and, interestingly, both ZERO-[ɪː]-WORDS and ZERO-SYL-2 WORDS showed around the same average phrase spk rates (176-178). Apparently, another important detail to be considered is the distance between two stressed syllables, i.e., between the research word's stressed syllable and the next stressed syllable. As explained above, BP pre-tonic syllables are labeled *s* (strong) and post-tonic syllables are labeled *w* (weak) (subsection 2.1.2), under the influence of Câmara Jr. (op. cit.). A stressed syllable is labeled *S*. It has been observed that, when one or more non-stressed syllables follow the [ɪː]#-WORD in C-ORAL-BRASIL, speakers show more of a tendency to eliminate one or the two final phonemes of the [ɪː]#-WORD, e.g., [sab] and [sa]. When pauses immediately follow the research word, the vowel is realized, e.g., [sabɪː].

As suggested in Costa, 2008 (op. cit.), word-boundary simplification processes often do not occur in BP when pauses or lengthening intervene.

Table 4.18, column B, below, shows that complete words had long initial syllables (1B). ZERO-SYL-2-WORDS, on the other hand, despite having only SYL-1 to represent whatever meaning they conveyed, had that single syllable shorter than the other two types of realizations (3B). ZERO-[ɪː]#-WORDS in C-ORAL-BRASIL were different from LIN ZERO-[ɪː]#s in several respects as, e.g., for having INT consonants of 'normal' durations (column C), while LIN had markedly long INT consonants in the same contexts (See Table 3.5).

Table 4.18 indicates the average durations of the three [ɪː]#-WORD subdivisions in C-ORAL-BRASIL, according to their three different types of realization (line-columns 1,2 and 3; B, C and D), with W durations given in column E. Column F gives the average number of syllables intervening between two stressed syllables, counted after SYL-1 in the research word, in each group of words. Column G gives phrase spk rates.

Table 4.18 - Summarized measurements of [ɪ:]#-WORDS in C-ORAL-BRASIL word subdivisions and phrase spk rate averages

Durations; number of intervening syllables between stresses; spk rates	SYL-1	INT	[ɪ:]#	word size	*S* ( ) *S*	spk rate
1 C-ORAL-BRASIL 5 FULL-[ɪ:]#-WORDS	230,4	72,2	77,2	**379,8**	0	241,4
2 C-ORAL-BRASIL 9 ZERO-[ɪ:]#-WORDS	167,89	66,67	0	**234,6**	1,1	176,1
3 C-ORAL-BRASIL 4 ZERO SYL-2 WORDS	146,75	0	0	**146,8**	2	177,8
A	B	C	D	E	F	G

FULL-[ɪ:]#-WORDS in C-ORAL-BRASIL presented no intervening non-stressed syllables between the research word and the following stress (if the research word was followed by a pause or was spoken in a questioning tone, those features should prevail over number of intervening syllables between stresses, and following syllables were not considered.

4.2.5 - An analysis of C-ORAL-BRASIL [ɪ:]#-WORDS according to syllable sequences

For any [ɪ:]#-WORD in C-ORAL-BRASIL, ***Sw*** is considered to be the initial canonical sequence of syllables, considering the two syllables in each research vowel, e.g., *gente* **(*Sw*)**. In the first example below, (*Gen-te!*-Marc-e-sa-da-ta!), *Gente!* is followed by *Marca*, i.e., the two syllables in *gente* are followed by a stressed initial syllable in *Marca*, **(*Sw S*)**.

The weak sounds (SYL-2) that do not have realization of [ɪ:]# (in incomplete [ɪ:]#-WORDS) are crossed **(~~*w*~~)** in ZERO-[ɪ:]#-WORDS and represented with an empty set symbol, (**Ø**), in ZERO-SYL-2-WORDS.

a) Syllable sequences in FULL-[ɪ:]#-phrases in C-ORAL-BRASIL

Gen-te! Marc-e-sa-da-ta! **(*Sw S*)** / [Gente! Marca]

Gen-te-véi… / **(*Sw S*)** / [Gente véi...] (same phonological phrase)

Cê-pen-sa-qu'e-le… / **(*Sw*)** PPP / [qu'ele...]

Che-gou-na-sal'-e-la-men-tou-pra-gen-te… / **(*Sw*)** PPP / [gente...]

Sa-be? Ven-as-sim*…   / **(*Sw*)** ??? / [Sabe???]

b) Syllable sequences in ZERO-[ɪ:]#-phrases

Mai-gent-con-tro-la-dim-tam-bém   / **(*Sw sssS*)** / [Gente controladim]

Sab-co-mo?   / **(*Sw Sw*)**   / [Sabe como?]

A-gent-pod-le-var-um-tam-bém   / **(*Sw-Sw*)** / [gente pode]; **(Sw sS)** / [pode levar]

De-poi-des-mo-men-ti-mo-ti-va-ção   / **(Sw *sSw*)**   / [desse momento]

E-vou-con-se-guir... sab-ven-cer-es-sas-di-fi-cul-dad*s-a-í   / **(Sw sS)**   / [Sabe, vencer]

Ti-nham-uns-dois-que-fa-la-r'was-sim: Gent-a-gent-per-deu-no-cam-pwa-gent-num-per-deu-por-cau-sa-dis-não   /   **(*Sw s Sw*)** / [Gente, a gente];   **(*Sw sS*)** / [gente perdeu]; /   **Sw s *sS*)** / [gente não perdeu]

c) ZERO-SYL-2-phrases syllable sequences

Sa* que-q'j*é?   / **(*SØ s s S*)**   / [Sabe que que é?]

Pa-co-brir-o-car-nei-ri-nho,-c'a-gen-d*se-ca   / **(*SØ sSw*)**   / [gente disseca]

O-ne-gó-c'é-k'ja-gen-não-pro-cu-rou   / **(*SØ s ssS*)** / [gente não procurou]

E*-quer-sa-ber-a-ond-é-que-cê-quer-sal-var-o-flash-vi-deo*   / **(*SØ s sS*)**   / [ele quer saber]

Table 4.19 - Measurements of 5 FULL-[ɪ:]#-WORDS in C-ORAL-BRASIL

	WORD	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	NXT-SGM/WORD	[ɪ:]# F2	PHRASE SPK RATE
1	GENTE	222	50	23	295	8%	PPP	2356	147 (5)
2	GENTE	348	78	34	460	7%	M (marca)	2212	241 (15)
3	GENTE	218	95	117	430	27%	V (velho)	2320	288 (17)
4	ELE	62	40	95	197	48%	PPP	2215	291 (18)
5	SABE	302	98	117	517	23%	V (vendo)	2275	240 (14)
	tt	**1152**	**361**	**386**	**1899**			**11378**	**1207**
	av	**230,4**	**72,2**	**77,2**	**379,8**			**2276**	**241,4**
	pct	61%	19%	20%					
	A	B	C	D	E	F	G	H	I

Table 4.20 - Measurements of 9 ZERO-[ɪ:]#-WORDS in C-ORAL-BRASIL

	WORD	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	NXT-SGM/WORD	PHRASE SPK RATE
6	GENTE	180	**50**	0	230	0,00%	K (controladinho)	185 (11)
7	GENTE	109	**34**	0	143	0,00%	P (pode)	134 (1)
8	PODE	143	56	0	199	0,00%	L (levar)	134 (1)
9	DESSE	82	89	0	171	0,00%	M (momento)	165 (6)
10	SABE	162	55	0	217	0,00%	K (como)	174 (7)
11	GENTE	231	48	0	279	0,00%	A (a)	177 (8)
12	GENTE	156	60	0	216	0,00%	P (perdeu)	177 (8)
13	GENTE	158	87	0	245	0,00%	N (não)	177 (8)
14	SABE	289	122	0	411	0,00%	V (vencer)	262 (16)
	tt	**1511**	**600**	**0**	**2111**			**1585**
	av	**168**	**67**	**0**	**235**			**176,11**
	pct	71%	29%	0%				
	A	B	C	D	E	F	G	H

Table 4.21 - Measurements of 4 ZERO-SYL-2-WORDS in C-ORAL-BRASIL

	WORD	SYL-1	INT	[ɪ:]#	W	[ɪ:]# %	NXT-SGM/WORD	PHRASE SPK RATE
15	GENTE	179	0	0	179	0,00%	N (não) ʒẽ não	135 (3)
16	SABE	235	0	0	235	0,00%	K (que)	220 (13)
17	GENTE	125	0	0	125	0,00%	D (disseca) ʒẽ d seka	216 (12)
18	ELE	48	0	0	48	0,00%	K (quer) e ke	140 (4)
	tt	**587**	**0**	**0**	**587**			**711**
	av	**147**	**0**	**0**	**147**			**177,75**
	pct	100%	0%	0%	pct			
	A	B	C	D	E	F	G	H

Tables 4.18 through 4.21 show that the FULL [ɪ:]#-WORDS are much longer than the incomplete ones in the BP corpus. Complete words tended to be spoken with emphasis. The emphatic pronunciations of FULL-[ɪ:]#-WORDS in C-ORAL-BRASIL slowed down their whole phrases' spk rates. The 18 words are ranked according to phrase spk rate averages, from fastest (1) to slowest (18) (column I in Table 4.19 and column H, in Tables 4.20 and 4.21). The shorter words, in Tables 4.20 and 4.21, seemed to be spoken 'in passing', while it seems intuitive that, to speak emphatically, one should not speak very fast.

The FULL [ɪ:]#-WORDS in C-ORAL-BRASIL are the longest of all three corpora (379,8 ms); they are much more than twice as long as the ZERO-SYL-2-WORDS in the same corpus (146,75 ms).

4.2.6 - Durations of voiced vs voiceless NXT-SGM after ZERO-[ɪ:]#-WORDS in C-ORAL-BRASIL

In ZERO-[ɪ:]#-phrases, the INT consonants followed by voiced NXT-SGMs averaged 88,5 ms (Table 4.20, column C, words 8, 9, 13 and 14, in blue) while the ones followed by voiceless consonants averaged only 49,5 ms (words, 6, 7, 10 and 12, in gray). The same pattern was repeated for both *gente* and *sabe*. Concerning Table 4.21 (the ZERO-SYL-2-WORDS), the word *ele* pronounced [e], measured only 48 ms. It should be observed that *ele* is the only [ɪ:]#-WORD analyzed that has three canonical segments [e-l-e]; eight other words have four canonical segments and the word *study* has five canonical segments (Table 3.1).

4.2.7 - Some seemingly typical contexts favoring each of the three different realization types of [ɪ:]#-WORDS in C-ORAL-BRASIL

Word Type A - FULL-[ɪ:]#-WORDS in C-ORAL-BRASIL

The following set of features seems to favor the realization of FULL-[ɪ:]#-WORDS in C-ORAL-BRASIL:

- a very long SYL-1;
- an emphatic pronunciation of the stressed vowel;
- a pause just after the research word.

Word Type B - ZERO-[ɪ:]#-WORDS in C-ORAL-BRASIL

The ZERO-[ɪ:]#-WORD in C-ORAL-BRASIL and following context appear to show some or all of the following properties:

- no post-pauses (PsP);
- no particular emphases within the research word;
- usually different places of articulation in INT and NXT-SGM (if place of articulation is the same, there would be a tendency for total loss of SYL-2, or BP type haplology.

Word Type C - ZERO-SYL-2-WORDS in C-ORAL-BRASIL

The ZERO-SYL-2-WORD in C-ORAL-BRASIL appears to be related with the following characteristics:

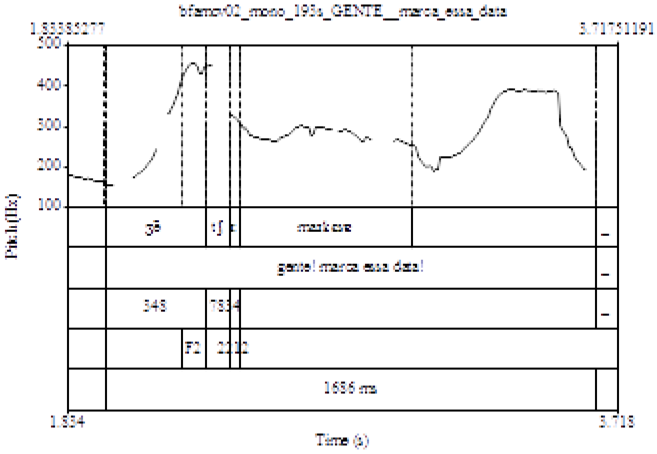
- a longer distance between two stressed syllables;
- the same place of articulation of INT and NXT-SGM;
- very rapid speech, as indicated by duration measurements.

4.2.7.1 - A brief analysis of some FULL-[ɪ:]#-WORDS in C-ORAL-BRASIL

A - 1 (speaker: TER)

Gente! Marca essa data! (Folks! Set that date!)

Pitch contour and textgrid 4.1 - C-ORAL-BRASIL - ***Gente!*** **Marca essa data!**
CCC F GENTE_M_MARCA bfamcv02_mono 193 I = 34, W= 460
(Gen-te!-Marc-e-sa-da-ta!)



(A - 1) Phrase / syllables								
canonical	Gen	te!	Mar	ca	es	sa	da	ta!
realized	**ʒe**	**tʃɪ!**	**maɹ**	**kɛ**		**sɐ**	**da**	**tɐ!**

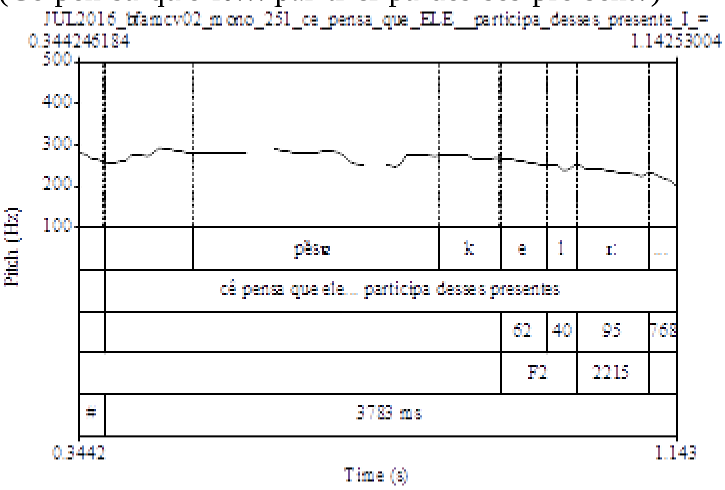
The phrase, *Gente!*, does not have a PsP, but, on the other hand, it is produced very emphatically. There is an F0 variation of 197% in SYL-1, as shown in Pitch contour and textgrid 4.1. F0 rises from 153 to 455 Hz in the stressed syllable, which is also very long (348ms). The same emphatic pattern seen in the vowel [ẽ] of *gente* was repeated in the second phrase (*Marca essa data!*), shown in the same pitch contour, with the word *data*. These phrases are also shown in Spectrogram 2.1, above. The *realized* line was fully colored in green because none of the syllables spoken is in conflict with BP established phonological rules.

A - 2 (speaker: RUT)
Cê pensa que ele… (Do you think that he...)

(A - 1) Phrase / syllables						
canonical	Vo	cê	pen	sa	que	e	le...
realized	Ø	**se**	**pẽ**	**sɐ**	**k'e**		**li...**

The research word *ele* in this phrase is followed by a long pause, of 768 ms, which seems to largely favor the realization of [ɪː]#. The [ɪː]# lasts 95 ms.

Pitch contour and textgrid 4.2 - C-ORAL-BRASIL - Cê pensa que *ele*… (Do you think that he...)
CCC F ELE_PPP bfamcv02_mono 251 I = 95, W = 197, PsP = 768
(Cê-pen-sa-qu'e-le… par-ti-ci-pa-des-ses-pre-sent?)

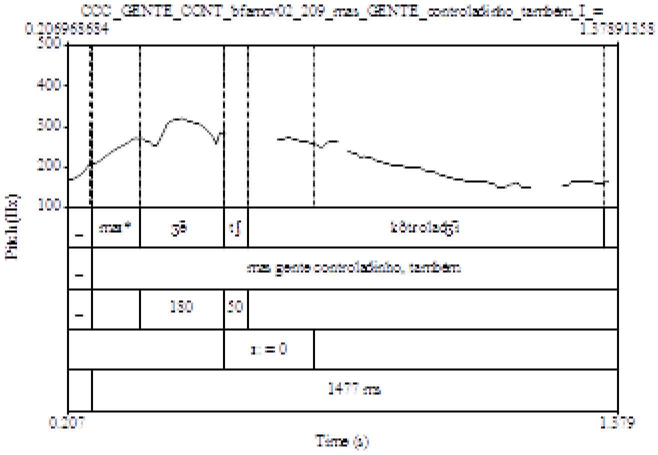


4.2.7.2 - A brief analysis of ZERO-[ɪː]#-WORDS in C-ORAL-BRASIL

B - 1 (speaker: TER) (same speaker of word A - 2 above)
Gente controladinho (disciplined people)

(B - 1) Phrase / syllables							
canonical	Gen	te	con	tro	la	di	nho
realized	**ʒẽ**	**tʃ**	**kõ**	**tɾo**	**la**	**dʒĩ**	**Ø**

Pitch contour and textgrid 4.3 - C-ORAL-BRASIL - *Gente* controladim
CCC F GENTE_K CONTROLADINHO bfamcv02 209 I = 0, W = 230
(Mai-gent-con-tro-la-dim-tam-bém)



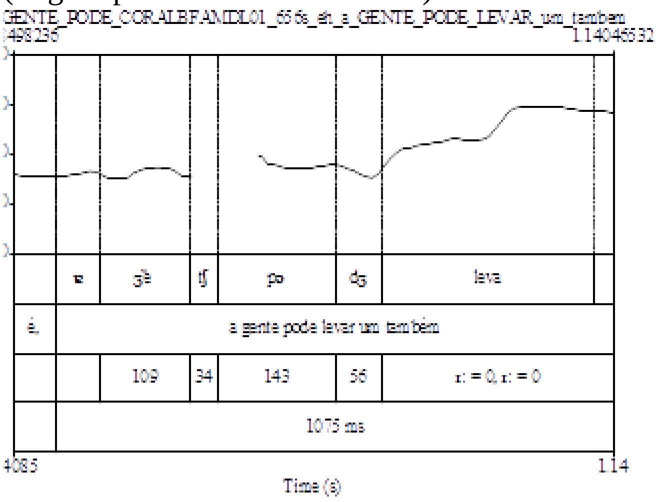
It is apparent from Pitch contour and textgrid 4.3 that there is no voicing just after the nasal vowel in *gente*. And voicing only resumes much later, in the first vowel of *controladinho*. After SYL-1, there is a sequence of postalveolar affricate [tʃ] and velar plosive [k]. The distance between two stressed syllables (***Sw*** *sssS*), (*gen.te con.tro.la.dim*) is shortened by the simplification of SYL-2, [ʒẽ.tʃɪː] → [ʒẽtʃ]: (***Sw*** *sssS*).

The word *gente* in B - 1 has all of the 'pre-requisites' suggested above for a ZERO-[ɪː]#-WORD: no post-pause, no special emphasis within the word and different places of articulation of INT [tʃ] and NXT-SGM [k].

B - 2 and **B - 3 (speaker: REN)**

A gente pode levar um também (We could take one as well)

Pitch contour and textgrid 4.4 - C-ORAL-BRASIL - A *Gente* pode levar um também
CCC F PODE_L LEVAR bfamdl01 656 (I = 0, W = 143), I = 0, W = 199
(A-gent-pod-le-var-um-tam-bém)



In Pitch contour and textgrid 4.4, it is possible to observe that there is no voicing after [tʃ] (*gente*) but that there is full voicing after [dʒ] (*pode*).

(**B - 2** and **B - 3)** Phrase / syllables										
canonical	A	gen	te	po	de	le	var	um	tam	bém
realized	**ɐ**	**ʒẽ**	**tʃ**	**pɔ**	**dʒ**	**le**	**va**	**ũ**	**tã**	**bẽɪ**

Similarly to phrase B - 1 (*Gente controladim*), the word *gente* in B - 2 has a clear break in F0 just before the INT. The NXT-SGM has different place of articulation from the INT: /t/ vs /p/ (*gente pode*). In B - 3, the same Pitch contour and textgrid, 4.4, shows that there is no break in the F0 line, as all sounds are voiced after [p], in *pode levar*. It is also possible to observe that the duration of INT in *gente* (34 ms) is shorter than the duration of INT in *pode* (56 ms). The NXT-SGM, in the first case, is voiceless [p] while the NXT-SGM in the second case is voiced [l]. It was not possible to verify whether INT was longer, discounting voicing, in phonological sequences ***Sw*** *Sw* (e.g., *gente pode*) or ***Sw*** *sS* (*pode levar*), due to the meagerness of the number of samples available.

Despite the fact that B - 2 has a different syllable sequence than B-3, both research words are realized as ZERO-[ɪ:]#s, [ʒẽtʃ] and [pɔdʒ]. That is, if in *pode levar* it could be argued that the elimination of [ɪ:]# helps to approach two stressed syllables [<u>pɔ</u> dʒ le<u>va</u>], in *a gente pode,* the elimination of [ɪ:]# in *gente* seems to bring two stressed syllables very close together, with only [tʃ] standing between them: [ɐ <u>ʒẽ</u> tʃ <u>pɔ</u>dʒ]. A consonant left between SYL-1 (e.g., [ʒẽ]) and the first syllable of the following word (e.g., [kõ]), was very common in the C-ORAL-BRASIL data, notwithstanding whether the following syllable was a non-stressed syllable, as in the example above *<u>gen</u>(te) con<u>tro</u>la<u>dim</u>* (***Sw*** *sssS*) or a stressed syllable as in *<u>sa</u>(be) <u>co</u>mo?* [sa b ko mʊ], (***Sw*** *Sw*) .

The words B - 2 and B - 3 have no post-pauses, no special emphases and B - 2 has different places of articulation of INT and NXT-SGM ([tʃ] vs [p]). B - 3 has [dʒ] followed by [l], which may be considered a sequence of coronal sounds. "laterals are almost always coronals" (Paradis & Prunet, op. cit., p. 15) and this would suggest a possibility of reduction (as mentioned in section 2.1.3 above), which is actually a well-known example in informal BP: *pode levar* [<u>pɔ</u> dʒɪ le<u>va</u>] realized as [<u>pɔ</u> le<u>va</u>]. The ZERO-SYL-2 form [pɔ], in [pɔ leva], sounds a lot more natural than [ʒẽ] in *a gente pode,* when realized as [a ʒẽ pɔdʒ], maybe because of the place of articulation similarities of the INT consonant with NXT-SGM in the first case ([dʒ] and [l]) but not in the second one ([t] and [p]).

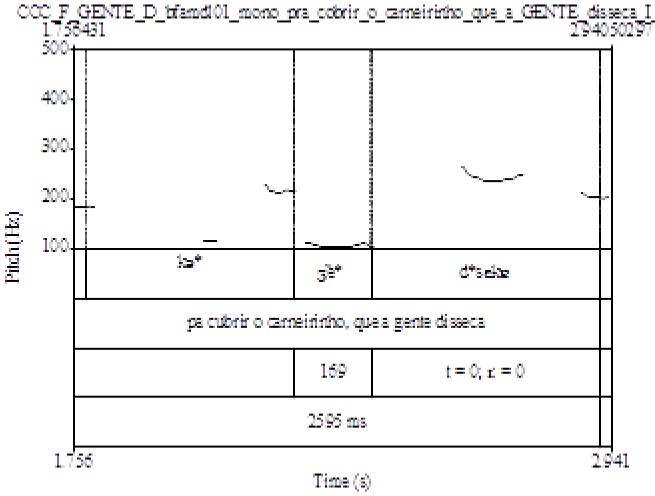
4.2.7.3 - A brief analysis of ZERO-SYL-2-WORDS in C-ORAL-BRASIL

C - 1 (speaker: FLA)

A *gente* disseca

(we dissect)

Pitch contour and textgrid 4.5 - C-ORAL-BRASIL (...que a gente disseca)
CCC F GENTE_D DISSECA bfamdl01 mono 103 T = 0, I = 0, W = 179
(Pa-co-brir-o-car-nei-ri-nho,-c'a-gen-d*se-ca)



In the above example, the word *gente* is followed by *disseca*, i.e., the NTX-SGM [d] has the same place of articulation as INT [t].

[ɐ ʒẽ.**tʃɪ**: dʒi.sɛ.kɐ] → [ɐ ʒẽ**tʃ** dʒi.sɛ.kɐ] → [ɐ ʒẽ dʒi.**sɛ**.kɐ]→ [ɐ ʒẽ d.sɛ.kɐ]

Canonically, this phrase has two non-stressed syllables between two stressed ones (*w **Sw** sSw*), but it was realized with loss of the whole of SYL-2 /te/. Besides, the first syllable of *disseca* is reduced, with the loss of the vowel after [d]. In *disseca*, /i/ is lost between two coronal consonants ([d] and [s]). Because of these reductions, C - 1 ends up looking like the words in B - 1, B - 2 and B - 3 (i.e., with only an intervocalic-turned-coda consonant separating SYL-1 and NXT-SYL).

(**C - 1**) Phrase / syllables							
canonical	que	a	gen	te	dis	se	ca
realized	**k'ə**		**ʒẽ**	**ø**	**d**	**sɛ**	**kɐ**

C - 2 (speaker: TER)

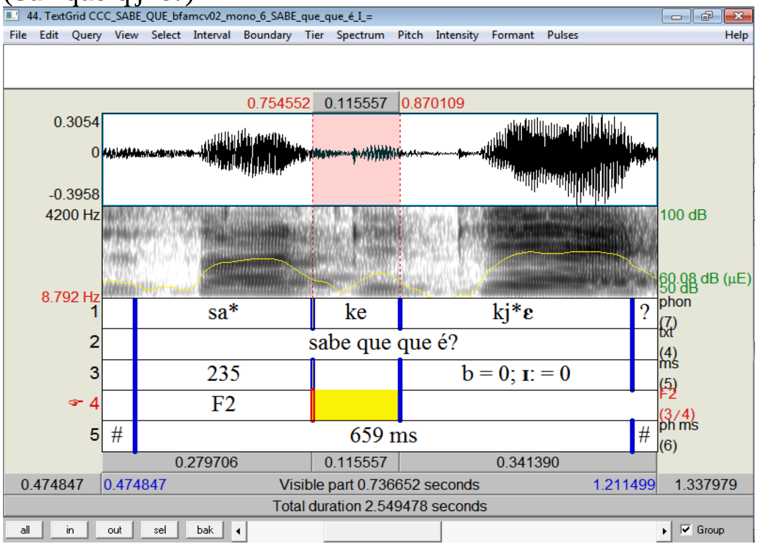
Sabe que que é?

(Do you know what the problem is? literally: Do you know what [it] is?)

In this phrase, the research word *sabe* is pronounced without either of the final segments. Similarly to C - 1, there is some distance between two originally stressed syllables (***Sw*** *s s S*).

Phrase / syllables					
canonical	Sa	be	que	que	é?
realized	**sa**	**ø**	**ke**	**k'j'ɛ?**	

Spectrogram 4.12 - C-ORAL - *Sabe* que que é?
CCC F SABE_K QUE bfamcv02_mono 6 B = 0, I = 0, W = 235
(Sa* que-q'j*é?)



In C - 2, besides fully eliminating SYL-2, the speaker went 'one step further' and made the two final words into a single one by means of reducing the vowel of *que* into a glide connected directly with *é*. (*que é* [ki ɛ] → [k'jɛ]).

4.2.8 - Natural vs non-natural speech and BP word codas

Non-natural speech, such as, e.g., the reading of lists of words, tends to allow for the full (and usually elongated) pronunciation of words. Words tend to be spoken with emphasis and are often followed by pauses. They tend to be much longer than words in natural, connected speech. It seem that, when read in isolation, every word seems to be considered, by the reader, to have a 'personality' of its own. But it seems that those same word types lose that individual status when spoken in connected speech, especially when they do not carry special information or when their simplification does not compromise intelligibility.

What status should be given to sounds like [tʃ], when they are left between canonical BP syllables after the deletion of vowels? As mentioned in subsection 2.1.3.1, according to traditional analysis, BP does not have consonant sounds other than the ones translatable as /s/, /l/ and /r/ in coda positions. However, several examples of simplification of canonical forms, giving words ending in sounds outside of the predicted consonantal allophones are observable in the C-ORAL-BRASIL. When the whole of SYL-2 is eliminated (ZERO-SYL-2-WORDS), then, naturally the remaining syllable (SYL-1) stays in accordance with phonological predictions. However, when only one segment is deleted from SYL-2, (ZERO-[ɪ:]#-WORDS), the new configuration may or may not be adaptable as an /s/, /l/ and /r/ allophone.

FULL-[ɪ:]# phrases in C-ORAL-BRASIL proved to be in accordance with the three coda consonants prediction. For example, in phrase A -1, *Marca essa data*, the elimination of the final sound, /a/, in *Marca*, causes the SYL-2 onset /k/ to be followed by a different vowel /e/, from the word *essa*.

maɹ	**kɛ**	**sɐ**	**da**	**tɐ!**

Obviously, /k/ and /e/ form a predicted syllable sequence in BP. A similar change happens in phrase A - 2: *Cê pensa **q'e**le...*).

In the ZERO-[ɪ:]#-WORDS, the elimination of one single (final) vowel leaves canonical onset segments in coda positions. e.g.,

(B - 1) *Gente controladim*

ʒẽ	**tʃ**	**kõ**	**tɾo**	**la**	**dʒĩ**

(B - 1 and B - 3) *A gente pode levar um também*

ɐ	**ʒẽ**	**tʃ**	**pɔ**	**dʒ**	**le**	**va**	**ũ**	**tã**	**bẽɪ**

In phrase (C - 1), the word following the research word *gente* has the elimination of the vowel /i/ (*disseca*), so that the word-onset [d] is followed by [s], which is not predicted in BP phonology.

(C - 1) *A gente disseca*

k'ə	**ʒẽ**	**ø**	**d**	**sɛ**	**kɐ**

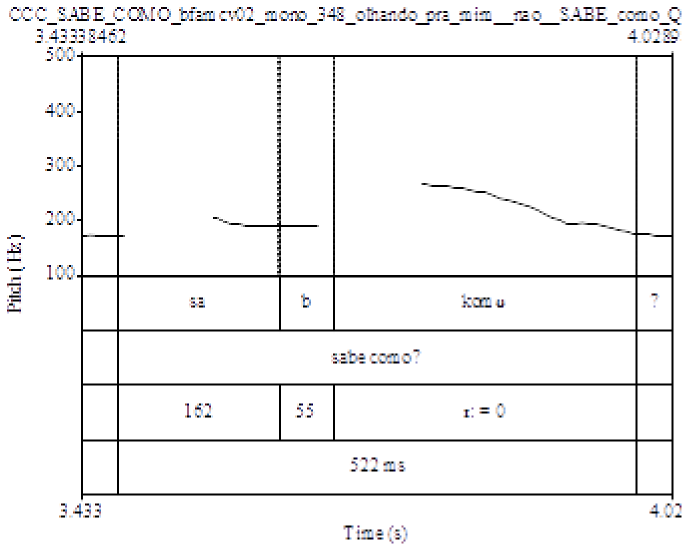
Referring to the reduction of the articulation of phonemes in connected speech, Rechziegel, 1998 (Introduction), claims that "The so-called canonical form of a phoneme should be interpreted as one of its variants realized under specific conditions, i.e., in isolation."

4.2.9 - One more Type B word

The last word in this analysis will be a ZERO-[ɪ:]#, a representative of the most common type of word segmented from the C-ORAL-BRASIL data.

B - 4 (speaker: RUT)Pitch contour and textgrid 4.6 - C-ORAL-BRASIL

CCC F SABE_K COMO QQQ bfamcv02_mono 348 I =0, W = 217
Sab-co-mo?
(Do you know how it is?; Do you know what I mean?)



(**B - 4**) Phrase / syllables				
canonical	Sa	be	co	mo?
realized	**Sa**	**b**	**ko**	**mʊ?**

This last word analyzed from C-ORAL-BRASIL (Spectrogram 4.10, above) repeats a pattern seen with other ZERO-[ɪ:]#-WORDS in LIN: the research word is followed by a NXT-SGM with different place of articulation than the INT (here, [b] vs [k]) and there is no pause after [ɪ:]#. This time, not even the 'optimal' canonical sequence of syllables ***Sw*** *Sw* (*<u>Sa</u>be <u>co</u>mo?*) was enough for the [ɪ:]# to be produced. The phonetic realization was [sa b komʊ], with one consonant, [b], remaining between two canonical syllables, as has been seen in several other C-ORAL-BRASIL phrases.

Articulatorily, it would seem more 'economical' (Ball & Rahilly, op. cit., p. 133) to produce the sequence [sa b k] rather than the sequence [sa bɪ: k] since, in the first example, there is no need to open the mouth after [b], but merely to change active articulators. After [sa], it suffices to raise the lower lip for [b] then to raise the tongue body for [k]; in the canonical case [sa bɪ: k], there is the need to open the mouth and position the tongue for [i] after [b]. It just might be that BP, due to a large number of words starting and ending in vowel sounds, quite differently from English, as suggested in Table 2.1, above, has less the need or the habit of constant or rhythmic "alternations between open and constricted phases of the upper vocal tract" for vowel-consonant-vowel sequences (Pickett, op. cit., p. 146). In BP, vowels are frequently followed by vowels, leading, it seems, to different degrees of lip openness rather than repeated complete occlusions and openings. Could it have come to the point of seeming 'costly' for some Brazilian speakers to make those full movements?

According to Cristófaro Silva (op. cit., p. 27), voiced plosives represented by the phonemes /b/, /d/ and /g/ in Portuguese are more voiced than voiced plosives in English. This suggests that English, besides having more full opening and closing upper vocal tract movements to produce speech sounds, would also make those constrictions usually tighter (tenser) than in BP.

4.2.10 - Some qualities of coronal sounds /s/ and /i/ related to C-ORAL-BRASIL and LIN, plus some impressionistic data

The sibilant sound in *gente* [ʃ] can easily give the acoustic impression of a high front vowel. Even when the word is pronounced without the final vowel, [ʒẽtʃ], it often sounds like the [ɪ:]# is there. Besides, maybe because N-SPK-BR tend to think that words such as *gente* and *sabe* are naturally bisyllables, there may be a tendency among them to have a bias for 'hearing' a full two-syllable word even when that is not the phonetic reality.

According to Ganong (Fox, apud Tohkura et al., op. cit., p. 22), top-down effects may influence actual phonetic processing and according to Fox (ibid.), that effect might result from post-perceptual biasing.

A connection between /i/ and coronal consonants is claimed by several authors. Ball & Rahilly (op. cit., p. 100) group /i/ with palatal consonants; Ladefoged, 1993 (op. cit., p. 22) informs that high pitch is associated with the high front vowel and low pitch is associated with the back vowels; Lahiri & Evers, apud Paradis & Prunet (op. cit., p. 81) note that coronal consonants and front vowels have a concentration of energy in the higher frequencies.

A habit is observable among many speakers of BP to constantly insert a high front vowel between a (non-high front) vowel and a final /s/ in the ends of words. Example words are *faz, dez, fez, pos, luz* (meaning, respectively: [he] does, ten, [he] did, [he] put, light). Normal pronunciations are [fas], [dɛs], [fes], [pos], [lus]. These words usually end phonetically in [s]/[ʃ] when followed by a pause or a voiceless sound. They usually end in [z]/[ʒ] when followed by a voiced sound. Examples: *Faz dez meses* [faz dɛz mezɪs] (it's been ten months); *Ela fez todas as tarefas* [ɛlɐ fes todɐz as taɾɛfɐs] (she has done all the chores). Therefore, in slow speech, those words will usually end in [s] or, very commonly, [ʃ]. For some BP speakers, the pronunciations of the five example words are, respectively, [faɪs] or [faɪʃ], [dɛɪs] or [dɛɪʃ], [feɪs] or [feɪʃ], [poɪs] or [poɪʃ] and [luɪs] or [luɪʃ]. It might be that /i/ is chosen by some BP speakers as a natural transitional sound between a lower pitched vowel (e.g. [a], [o] and the high pitched /s/ consonants. Also, maybe the inserted /i/ serves the purpose of closing the mouth in two stages, by forming a smooth diphthong, slowing the closure, in words such as *faz* (i.e., [fas] → [fais]).

A high front vowel is occasionally eliminated around coronal consonants in BP, e.g., *a gente disseca.* Example C – 1, above, has a canonical sequence of alveolar sounds, i.e., [d], [i], [s], in W2, but the /i/ was not spoken in the stretch. Another example given above, *p'siza* for *precisa*, is analogous. Another related example with /i/ is analyzed above (See Spectrogram 4.8), in which a prothetic high front vowel is placed in front of [s] in *study* by a LIN speaker [istʌd].

4.2.11 - Differences in C-ORAL-BRASIL and LIN realizations of FULL-[ɪ:]# and ZERO-[ɪ:]#-WORDS

B-LNR-E realized [ɪ:]# in most contexts analyzed (nine out of the 10 ZERO-[ɪ:]#s in LIN were from intermediate level learners). Subsection 4.1.4 shows that LIN learners who produced ZERO-[ɪ:]#s also produced FULL-[ɪ:]#-WORDS. The condition under which some of those complete words were produced are interestingly similar to C-ORAL-BRASIL FULL-[ɪ:]#-WORDS, though. In BP, the research vowel was realized when favored by pauses, questioning intonation or emphases. In LIN, FULL-[ɪ:]#-WORDS were also produced when followed by pauses, questioning intonation or when the NXT-SGM was in a stressed syllable. On the other hand, the non-realization of the vowel in C-ORAL-BRASIL and LIN showed considerable differences in that LIN had very long INT consonants and tensioning in those sounds (sticking?) while the BP corpus showed flat F0 and no observable lengthening or even reduction of the INT (skipping?).

4.3 - The research questions and further analyses

This section shows analyses of all the data obtained in relation to the initial ideas. The initial suppositions turned out useful for the attainment of important conclusions.

4.3.1 - Answering the research questions

1) What are the proportions of the LINDSEI-BR, the SBCSAE and C-ORAL-BRASIL [ɪː]#-WORDS with full, reduced and null realizations of [ɪː]#?

The idea of a 'reduced' [ɪ]# did not find much support in the data analyzed. A very short [ɪ]# (e.g., 23 ms) or an unusually long one (e.g., 296 ms) (See Table 4.24) both sounded like /i/ in the present analysis. There was a distinction between FULL-[ɪ]# and ZERO-[ɪ]# but not of an intermediary sound, maybe with different proportions between formants. Actually, [ɪ]# formants appeared to be very similar among the three corpora, at least on what concerns measurements within the vowel.

In what concerns the objective measurements of full vs null [ɪː]#, SBC exhibited 32 FULL-[ɪː]#-WORDS; from LIN, 22 FULL-[ɪː]#-WORDS and 10 ZERO-[ɪ]#-WORDS were segmented; from C-ORAL-BRASIL, five FULL-[ɪ]#-WORDS, nine ZERO-[ɪ]#-WORDS and four ZERO-SYL-2-WORDS were analyzed.

2) What contextual elements, such as pre- and post-pauses, emphases, as well as features of voicing, place of articulation etc., of the segment immediately following the [ɪː]# (NXT-SGM) would favor or disfavor the full realization of the research word?

a) [ɪː]#-favorable contexts

The only 'guarantee', empirically speaking, for the realization of [ɪː]# in C-ORAL-BRASIL and in LIN was the presence of a PsP (post-pause).

b) [ɪː]#-unfavoring contexts

Different things may be pointed in relation to [ɪː]#-obstructing contexts. In SBC, no such contexts were observed in terms of the realization of the research vowel; In C-ORAL-BRASIL, on the contrary, [ɪː]# was realized only under some special circumstances; in LIN, the contexts in which [ɪ:]# was not produced were analogous to those defined for haplology (Crystal, op. cit., p. 224).

3) How are sounds distributed in duration, e.g., in an occurrence of the word *very,* how long are [v], [ɛ], [ɹ] and [ɪ:]#?

3.1) When the [ɪ:]# is not produced, how are durations of sounds rearranged in relation to 'normal' realizations ? e.g., the word *very* realized with only the three initial segments ([v], [ɛ] and [ɹ]) in relation to a normally pronounced, four-segment word?

It was initially expected that when a canonically four-segment bisyllabe was produced with only three segments, there would be a 'redistribution' of typical proportions in durations of sounds in which segments would be elongated (especially the third one, the INT consonant). As shown in Table 4.24, in C-ORAL-BRASIL, what happened was contrary to that expectation: the fewer the segments in the BP word , the shorter those segments became. This makes sense if one thinks that some [ɪ:]#-WORDS in C-ORAL-BRASIL were spoken very quickly, as if they were relatively unimportant or maybe easily retrievable in context. However, as shown in Table 4.22, the INT consonants of ZERO-[ɪ:]#s were very long in LIN (4C) if compared with the other INT consonants in the same corpus in the FULL-[ɪ]#-WORDS (2C) (100,3 vs 61,45 ms). The INT consonants in LIN ZERO-[ɪ:]#s are also much longer than in SBC (69,03) (3C). Still, in LIN, the complete words were longer than the incomplete ones, thanks to a very long SYL-1 (2B and 4B). The 22 complete LIN words have measurements very similar to the five C-ORAL-BRASIL complete words (lines 1 and 2 of Table 4.22). In the ZERO-[ɪ:]#-WORDS, LIN and C-ORAL-BRASIL are also remarkably similar in SYL-1 (4 and 5B), but they differ widely in the INT consonant measurements (100,3 vs 66,67 ms, a difference of around 50%) (4 and 5C).

Table 4.22 - Measurements of parts of complete and incomplete [ɪ:]#-WORDS with phrase spk rates in SBC, LIN and C-ORAL-BRASIL

Corpus/nr of words		**SYL-1**	**INT**	**[ɪ:]#**	**WORD SIZE**	**SPK RATE**
C-ORAL-BRASIL 5 FULL-[ɪ:]#-WORDS	1	230,4	72,2	77,2	379,8	241,4
LIN 22 FULL-[ɪ:]#-WORDS	2	225,36	61,45	85,09	369,64	248,41
SBC 32 FULL-[ɪ:]#-WORDS	3	156,53	69,03	67,03	293,08	201,78
LIN 10 ZERO-[ɪ:]#-WORDS	4	177,9	100,3	0	278,2	294,1
C-ORAL-BRASIL 9 ZERO-[ɪ:]#-WORDS	5	167,89	66,67	0	234,56	176,1
C-ORAL-BRASIL 4 ZERO SYL-2 WORDS	6	146,75	0	0	146,75	177,75
A		B	C	D	E	F

Table 4.23 - SBC (32) and LIN (22) [ɪ:]# durations with following pauses and words

1	[ɪ:]# ms SBC	NXT-WORD	diff from av	[ɪ:]# ms LIN	NXT-WORD	diff from av
2						
3	124	love	56,97	296	ppp	210,91
4	119	ppp	51,97	201	ppp	115,91
5	108	happy	40,97	180	because	94,91
6	102	ppp	34,97	112	???	26,91
7	95	beautiful	27,97	108	hard	22,91
8	86	don't	18,97	85	ppp	0,09
9	83	thinking	15,97	84	like	1,09
10	80	like	12,97	83	people	2,09
11	76	to	8,97	77	don't	8,09
12	76	times	8,97	76	nervous	9,09
13	73	do	5,97	73	things	12,09
14	72	funny	4,97	66	lost	19,09
15	71	parts	3,97	62	happy	23,09
16	69	many	1,97	55	for	30,09
17	69	times	1,97	54	different	31,09
18	65	ppp	2,03	52	ppp	33,09
19	64	the	3,03	39	can't	46,09
20	60	???	7,03	38	like	47,09
21	60	now	7,03	36	beautiful	49,09
22	58	like	9,03	36	traumatized	49,09
23	56	my	11,03	35	???	50,09
24	54	doesn't	13,03	24	tired	61,09
25	52	now	15,03			
26	50	nice	17,03			
27	50	good	17,03			
28	44	for	23,03			
29	43	???	24,03			
30	40	glad	27,03			
31	39	cases	28,03			
32	38	teaches	29,03			
33	36	hard	31,03			
34	33	to ([rə])	34,03			
35	2145	tt	595,06	1872	tt	943,08
36	av ms		av variation	av ms		av variation
37	67,03		18,6	85,09		42,87
38						
39						
40	SBC: 5 ppp / 27 non-ppp words			LIN: 6 ppp / 16 non-ppp words		
41	non-ppp av	tt av	ppp av	non-ppp av	tt av	ppp av
42	65,4	67,3	77,8	68,19	85,09	130,17
43	A	B	C	D	E	F

Differently from the analyses made in several preceding tables, which measured [ɪ:]# only in *really*, Table 4.23 measures the occurrences of the research vowel in all the 54 FULL-[ɪ:]#-WORDS in SBC and in LIN, in relation to both NXT-SGM and NXT-WORD.

Columns A and D show [ɪ:]# durations in SBC and LIN, respectively. Line-column 35A and 35D give the total measurements of the vowel in the 54 complete words from the two corpora, and line-columns 37A and D give the averages of those measurements. 37C and F give the average differences of all realizations in each corpus in relation to the general averages. In SBC, all 32 [ɪ:]#s are compared with the general average of 67,03 while in LIN, all 22 [ɪ:]#s are compared with 85,09. The first [ɪ:]# in SBC, line-column 3-A, measures 124 ms, which means that its difference from general average (of 67,3 ms) is 56,97 ms, as shown in 3-C (i.e., 124 – 67,03 = 56,97). All [ɪ:]# realizations considered, 37C and 37F show that the average [ɪ:]# in SBC varied in 18,6 ms per word from the general average (67,03 ms) while the average [ɪ:]# in LIN was much more variable in duration: it varied 42,87 per word from the general average of 85,09 ms. The largest difference from an average is shown in line-column 3F (LIN): 210,91 ms.

4) What are the effects of pauses and emphases on the durations of [ɪ:]# samples studied in each corpus?

Pauses showed a big influence in the LIN measurements. As seen in Table 4.23 (line 42-D, E and F), while all the 22 words measured in LIN had the average [ɪ]# duration at 85,09 ms, the six [ɪ]#s followed by pauses had the average of 130,17 ms whereas the remaining 16 [ɪ]#s in LIN (42-D) had the modest average duration of 68,19 ms. In comparison, SBC was much more stable between phrases followed by pauses or not (line 42-A, B and C) with general [ɪ]# average for all 32 words at 67,3 ms, five paused words with [ɪ]#s at 77,8 ms and the other 27 [ɪ]#s with average of 65,4 ms. The average [ɪ]#-duration difference between the two SBC types of realizations (pause vs no-pause) was of only 12,4 ms, while that difference in LIN was of 61,98 ms (130,17 – 68,19), i.e., the [ɪ:]#s before pauses in LIN were almost twice as long as the other [ɪ:]#s analyzed in the same corpus. In the few C-ORAL-BRASIL FULL-[ɪ:]#-WORDS analyzed, emphases were observed to be useful in the production of [ɪ:]#, besides pauses as in LIN. PsPs were also much longer in LIN than in SBC.

5) How recurrent are pauses in LIN in comparison with the N-SPK-E corpus?

Pauses were comparatively common in LIN, i.e., interspersed during whole conversations, rather than specifically in [ɪ:]#-WORD environments. Such frequent pauses were not typical of either the SBC or the C-ORAL-BRASIL (native speaker corpora). But LIN had very different kinds of speakers, some very fluent and accurate, others fluent but not so accurate, and also subjects who preferred to speak more slowly and more carefully, not forgetting those who were neither fluent nor accurate, which is expected in the language learning process. But the fact that some LIN speakers frequently paused due to apparent difficulties with English had the clear effect of helping them pronounce the [ɪ:]# when those pauses occurred just after the [ɪ:]#-WORD.

5.1) Are pauses and emphases also used purposefully in the C-ORAL-BRASIL?

Pauses were not apparently used purposefully in the segmented words except maybe once by an SBC speaker (a preacher), from SBC021. In other cases, it seemed mostly that speakers paused to think about what to say next. Emphases were used in the three corpora but it is uncertain whether they were purposeful, dialectal or speaker-specific.

6) What are the average measurements of the second formant in the research vowel?

6.1) Is the [ɪ:]# F2 by B-LNR-E and N-SPK-BP similar to that of N-SPK-E? Does the Brazilian [ɪ:]# seem 'unclear ' because it is actually a different articulation?

The F2 was actually very stable within and between the corpora. It was much more stable than measurements of duration and percentual proportions, probably because that stability may be required for intelligibility.

7) Do the three corpora differ in the reasons why they exhibit suprasegmental features of pauses and emphases? How so?

In this respect, what was most clearly observed was that many LIN speakers appeared to struggle with the syntax and the vocabulary of English and, because of this, made frequent pauses and sometimes spoke very slowly or made many false starts. Emphases were observed in C-ORAL-BRASIL in words in which [ɪ:]# was realized.

8) How does the C-ORAL-BRASIL relate with the LINDSEI-BR in the production of [ɪː]#-WORDS in English?

Pauses greatly favored both corpora in the phonetic realization of [ɪː]#, but LIN never failed to produce an INT consonant, as was frequently the case in C-ORAL-BRASIL. A considerable difference was observed in ZERO-[ɪː]#-WORDS, in which LIN speakers used very long INT consonants, usually with rising F0, while C-ORAL-BRASIL seemed to produce those incomplete words with flat F0 and no alongations of the INT consonants.

For a general comparison of [ɪː]# durations across the three corpora studied, Table 4.24 shows [ɪː]# measurements from all 59 complete [ɪː]#-WORDS. SBC had the most [ɪː]#s in the middle group (14). SBC [ɪː]# size varied generally less than in the other corpora.

Table 4.24 - 59 [ɪ:]# durations in SBCSAE (32 words), LINDSEI-BR (22 words) and C-ORAL-BRASIL (5 words) (in ms)-BRASIL (6 WORDS) (in ms)

SBC pink, LIN green, C-ORAL-BRASIL yellow; Durations in ms

23	GENTE-COR	**54**	REALLY-SBC	**80**	REALLY-SBC
24	REALLY-LIN	**54**	REALLY-LIN	**77**	REALLY-LIN
33	HAPPY-SBC	**55**	HAPPY-LIN	**83**	MANY-LIN
34	GENTE-COR	**56**	HAPPY-SBC	**83**	REALLY-SBC
35	REALLY-LIN	**58**	REALLY-SBC	**84**	REALLY-LIN
36	REALLY-LIN	**60**	HAPPY-SBC	**85**	MANY-LIN
36	REALLY-SBC	**60**	REALLY-SBC	**86**	REALLY-SBC
36	REALLY-LIN	**62**	VERY-LIN	**95**	ELE-COR
38	REALLY-SBC	**64**	STUDY-SBC	**95**	REALLY-SBC
38	REALLY-LIN	**65**	REALLY-SBC	**102**	REALLY-SBC
39	MANY-SBC	**66**	REALLY-LIN	**108**	REALLY-LIN
39	REALLY-LIN	**73**	REALLY-SBC	**108**	VERY-SBC
40	REALLY-SBC	**69**	MANY-SBC	**112**	REALLY-LIN
43	HAPPY-SBC	**69**	MANY-SBC	**117**	GENTE-COR
44	HAPPY-SBC	**71**	MANY-SBC	**117**	SABE-COR
50	REALLY-SBC	**72**	REALLY-SBC	**119**	MANY-SBC
50	REALLY-SBC	**73**	MANY-LIN	**124**	REALLY-SBC
52	HAPPY-SBC	**76**	HAPPY-SBC	**180**	HAPPY-LIN
52	HAPPY-LIN	**76**	REALLY-LIN	**201**	REALLY-LIN
		76	MANY-SBC	**296**	VERY-LIN

4.3.2 - An analysis of the initial hypothesis

The initial hypothesis for this thesis is taken here for a post-analysis

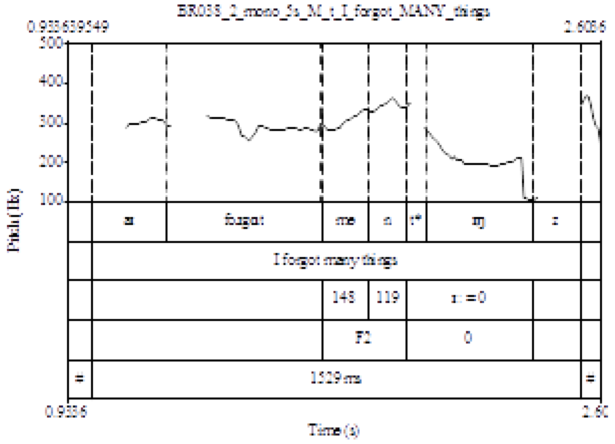
> **1.3 - Hypothesis**
>
> In English, the types of words proposed for investigation are very often distinguishable from similar, monosyllabic ones, by the presence of [ɪː]#, as in the comparison, *store / story*. Advanced B-LNR-E are expected to know the phonological differences. Considering, however, that the final vowels of similar BP trochaic bisyllables do not need to be distinctive in the same way (i.e., presence vs absence of a high front vowel after the intervocalic consonant), LINDSEI-BR speakers could be expected to frequently hesitate or pause before the English [ɪː]#-WORDS, for considering them somehow 'marked'. Thus, B-LNR-E would tend to overemphasize the pronunciation of the [ɪː]#-WORDS, but when they did not pay special attention or spoke fast, they would tend to produce BP-like, short [ɪː]#s or no vowel at all. Therefore, very different [ɪː]# realizations should be expected for the LINDSEI-BR [ɪː]#, duration-like: sometimes overlong, sometimes unsuitably short or null.
>
> In relation to the SBCSAE, since 'remarkable stability' is supposed to be the norm, contextual influences on the duration and second formant of the research vowel should be comparatively immaterial.

It is correct that [ɪː]# durations in LIN varied a lot more than in SBC, but the reasons predicted are not borne out by details of the data analyzed. For one thing, B-LNR-E did not really seem to change their normal pronunciation just before uttering [ɪː]#-WORDS. The behavior expected from LIN speakers, or rather, the intentions behind that behavior, have generally not found support either in the data objectively analyzed or in the impressions obtained. However, those suppositions in the initial hypothesis have served as food for thought in the development of this thesis. For example, the exemplified comparison *store – story* helps to bring to mind the fact that BP does not have more than a handful of content words which are phonological monosyllables. It seems that this is, indeed, a considerable difference in the ways trochaic bisyllables seem to work in English and in BP, since BP, for not having monosyllables similar to the research words, would tend to simplify those bisyllables without generally making them ambiguous (e.g., [sabɪː], [sab], [sa]). More experienced LIN speakers appeared to be always assertive in their [ɪː]# realizations but it seems that occasionally some difficulties surfaced, especially with the words *really* and *very*.

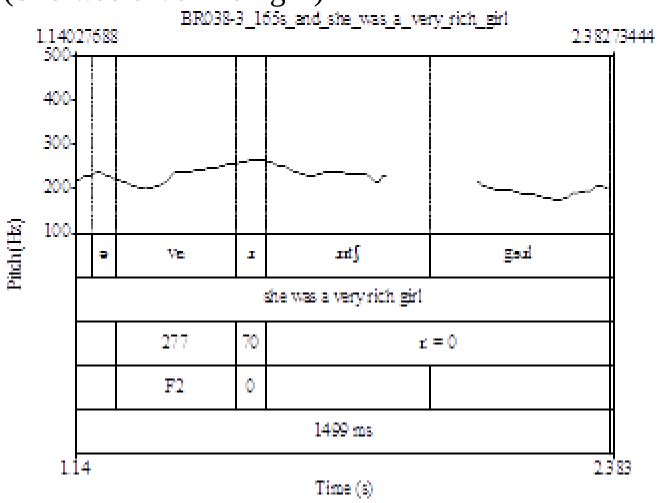
In relation to the supposition that LIN speakers would 'hesitate' before saying [ɪː]#-WORDS and consciously see them as 'marked' in comparison with similar Portuguese words, the conclusion is that they did not seem to hesitate before the English [ɪː]#-WORDS any more than they hesitated before any other word. Actually, pre-pauses (PrP), as a possible kind of preparation for the [ɪː]#-WORD, did not improve the measured [ɪː]# realizations at all. Besides, B-LNR-E did not really sound aware of their phonological mistakes as they glibly said, e.g., *men tings* or *real like*. Still, it is interesting that, at the same time that B-LNR-E sounded unaware of their English incorrections, their INT consonants were long and F0 usually rose in the ends of those incomplete [ɪː]#-WORDS (Pitch contour and textgrids 4.7, 4.8 and 4.9 show high or rising F0 in some LIN intervocalic consonants). The fact that English has long INT consonants and a phonological [ɪː]# could be unconsciously in LIN speakers' minds, or some phonological features of English might simply be internalized through practice with the language. A rising F0 in INT consonants of incomplete words was not at all the case for C-ORAL-BRASIL (as exemplified by Pitch contour and textgrid 4.10 below). Differently from LIN, incomplete [ɪː]#-WORDS in the BP corpus did not have a tensioning in the end, and F0 remained flat. Besides, duration measurements in C-ORAL-BRASIL did not suggest any particular lengthening which might be associated with compensation for an excluded segment.

It was not possible to observe a rising, falling or level F0 in the INT consonant when it was voiceless (e.g., [tʃ] in *gente*). But the [tʃ] of *gente* has another feature, as observed above. Sibilant sounds (such as [s] and [ʃ]) tend to have transitions related with high frequencies, as can be partly observed in Pitch contour and textgrids 3.2, 4.1, 4.3, 4.4, 4.5 and 4.6, shown above.

Pitch contour and textgrid 4.7 - LIN
LLL F MANY_T THINGS BR038_2_mono 5 I = 0, W = 267
(I-for-got-men-things)



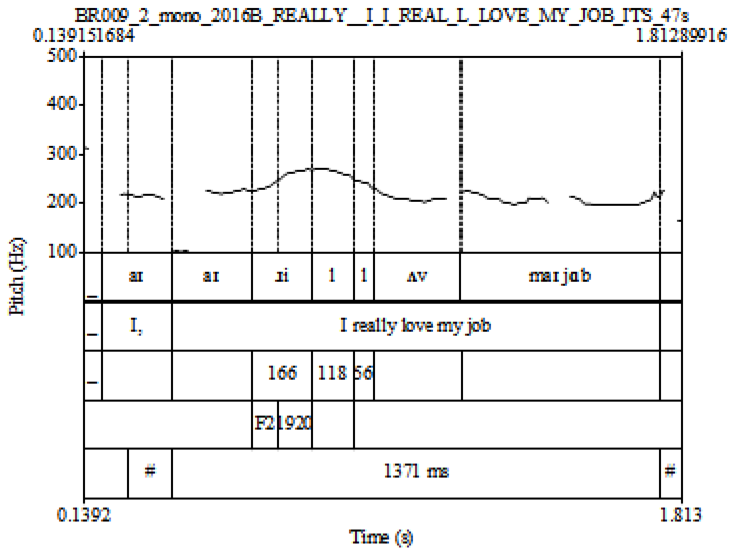
Pitch contour and textgrid 4.8 - LIN
LLL F VERY_R RICH BR038_3 165 I = 0, W = 347
(She-was-a-ver-rich-girl)



Pitch contour and textgrid 4.9 - LIN

LLL F REALLY_L_LOVE_BR009_2_mono 47 I = 0, W = 310, LL = 118, 56

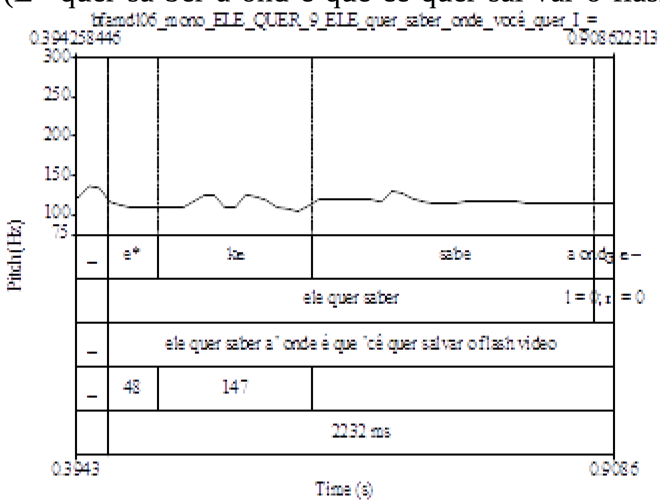
(I-real-love-my-job)



Pitch contour and textgrid 4.10 - C-ORAL-BRASIL

CCC M ELE_K QUER bfamdl06_mono 8 L = 0, I = 0, W = 48

(E*-quer-sa-ber-a-ond-é-que-cê-quer-sal-var-o-flash-vi-deo*)



It could be suggested that, because BP does not have nearly as many content words which are monosyllables as English, there is, comparatively, a great reduction of the possibility of ambiguity when those bisyllables are realized in BP with one or even two segments less. Here I reproduce part of the citation from Kreidler in subsection 2.3.1.1 above (Kreidler, op. cit., p. 7). Because so many words in the stretch are monosyllables, I italicized the bisyllables instead. In comparison with BP, English 'teems' with monosyllables.

"If you get *ready* to *pronounce* – but don't *pronounce* – meet, moot, beet, boot, you will find that all four words *begin* with lips closed. You should *also* find that with meet and beet the lips are stretched but with moot and boot they are *slightly* pursed or *rounded*."

From the excerpt above, we realize that English has a very high number of heavy monosyllables. Because of this, a trochaic bisyllable might be viewed by a N-SPK-E as a word which could be easily confused with a CVC monosyllable. The trochaic bisyllable is probably perceived by a N-SPK-BP in a very different way. And a B-LNR-E probably also has a lot of difficulty in keeping in mind the relevance of the difference in the foreign language. From the data analyzed in this thesis, it seems that some LIN speakers really did not appear to notice the possibilities of ambiguity between similar monosyllables and bisyllables in English, as suggested by the samples in which they realized a ZERO-[ɪː]#-WORD before a consonant and a FULL-[ɪː]#-WORD before a pause .

> A monosyllable like English *pat* contains little redundancy. None of its constituting phonemes are fully predictable from the other ones. The situation is different for a polysyllabic word like *hippopotamus*, which is highly redundant in the sense that the word remains recognizable even when a few of its constituting phonemes are missing completely. From a listener's point of view this means that the word *hippopotamus* remains recognizable when it is rapidly and sloppily pronounced, whereas the word *pat* can only be recognized correctly when it is pronounced carefully.
> (Nooteboom & Eefting, apud Tohkura et al., op. cit., p. 440)

4.3.3 - Some possible examples of lack of ambiguity in some contexts in English and in BP

As mentioned above, in subsection 2.12, Ball & Rahilly, 1999 (op. cit., p. 133) comment that Spanish /s/ tends to vary a lot more than English /s/, probably due to the non-existence of an /ʃ/ phoneme in Spanish.

In this thesis, it has been observed that several SBC speakers realized *really* with a positively centralized vowel in SYL-1: instead of a tense [i] they produced a vowel sound with very low F2 (as shown in Table 4.6). It seems that the replacement or simplification of the canonical /i/ vowel in that position does not risk to make the word sound ambiguous. Similarly, but to a much higher degree, N-SPK-BP seem to test the limits of intelligibility by saying words 'cut in half," like [sa] (*sabe*) and [e] (*ele*) and still make themselves promptly understood. Maybe it is all a matter of densely vs sparsely populated vowel and consonant spaces in specific contexts which ultimately induce speakers to be more or less precise in what concerns canonical sounds. Pickett (op. cit., p. 160) claims that speakers tend to articulate words more clearly when, e.g., speaking to a foreigner, suggesting that it is context which makes people more careful with their pronunciation.

Chapter 5 - Conclusions and suggestions for further research

With this thesis, I contend for the major importance of phonetics in linguistic analysis, due to the high degree of descriptive detail that it can provide.

This thesis has proposed to compare the phonetic realizations of the word-final vowel, [ɪː]#, in trochaic bisyllables in the speech of N-SPK-E and B-LNR-E. It was hypothesized that B-LNR-E may be influenced by BP phonology in the realizations of English words and a corpus of BP was used to sample how N-SPK-BP actually realize trochaic bisyllables in Portuguese. The results indicate that it is very common for N-SPK-BP to reduce trochaic bisyllables in one or two phonemes. Actually, the Portuguese words analyzed seemed to be pronounced in full canonical forms only when emphasized or followed by pauses. There remains doubt as to whether the reductions observed in C-ORAL-BRASIL are influenced by low levels of formality or by the supposedly content words having become functional. B-LNR-E, for their part, seemed to show difficulties with some combinations of sounds, but their reductions were different from those in the BP corpus in that the words never lost more than the final canonical phoneme and there usually appeared that speakers made some effort to produce that final vowel (e.g., by producing a very long INT consonant).

I have come to the conclusion that perhaps the biggest difference between monosyllables and bisyllables in English and in Brazilian Portuguese is the fact that English has an uncountable number of minimal pairs and similar pairs involving such words, while Portuguese tends to have several optionally reducible bisyllables and very few possibly confusable monosyllables. Small words in English can very easily be mistaken for one another, while that seems to rarely be the case in Portuguese.

The literature mentions that English tends to sometimes eliminate what is pre-tonic (Cutler, apud Tohkura et al., op. cit., pp. 419-422). The data analyzed and conclusions reached in this thesis indicate that English has strong reasons to keep what is post-tonic. BP, quite on the contrary, tends to keep what is pre-tonic (Câmara Jr., op. cit., pp. 47-48) and eliminate what is post-tonic (BP haplology studies). Post-tonic simplification in BP seems to be favored by a 'lack of ambiguity' in several word-end contexts. If English keeps what is post-tonic, this suggests that post-tonic has become natural to English; if BP preserves pre-tonic, that suggests that pre-tonic has become natural to BP. i.e., in most trisyllables and many iambic bisyllables, since in trochaic bysillables the stress is on the first syllable. e.g, *menino* (*sSw),* *natal* (*sS*), *gente* (*Sw*). This reasoning, if accurate, would leave BP with stress frequently in the end of the word or there would be rather weak syllables after the stress. English, therefore, would tend to be trochaic (tonic / post-tonic) and BP would tend to be iambic (pre-tonic / tonic). Brazilians tend to be comfortable with words that end in stressed syllables while English speakers seem to feel natural with stress on the initial syllable (or anyways, with a strong initial syllable, as in the case of trisyllables in which both the initial and final syllable are strong. e.g., ***an***-*a*-***lyze***). If this is accurate at the level of the word, it also seems to be the case in compounds and phrases. As a native speaker of BP, I would feel more natural saying, e.g., *bus* ***stop*** than ***bus*** *stop.* I constantly have to remind myself that I am an ***English*** *teacher* and not an *English* ***teacher.***

This thesis has also shown me that phonetics is 'for real'. The analysis of the words *happy, many* and *really,* as a group, was initially just one more test intended simply to check if N-SPK-E would realize those words with regular duration measurements and formant values for [ɪː]# in different environments in comparison with B-LNR-E, but the test ended up showing me that everything counts in phonetics. Each word type proved to have different measurements because the sequences of interacting segments within those words were different from the ones in the other words.

As for further works related with phonetics and phonology, I suggest that comparative research be done with B-LNR-E of different levels of proficiency. This could allow for a better understanding of how the adaptation of N-SPK-BP to English phonology might happen. Such research could be done with the use of learner mini-corpora. I consider that a N-SPK-E corpus should be taken as model. Not as a model for imitation but as a model for the development of listening comprehension. I think that the old question, *Do you speak English?* is somewhat biased, because it is based on the point of view of N-SPK-E and not on the reality of the learner, as it suggests that understanding English is always easier than speaking it. Nobody ever seems to bother to ask, *How well do you understand English? What do you find most challenging to understand?* As model speakers, N-SPK-E are likely to give English learners a lot more auditory challenge than would another foreign speaker. A non-native speaker of English (taken as a model) is likely to command a smaller vocabulary and use 'competing' grammar rules (but learning one English set of rules is work enough).

Apparently, there is a whole lot of research to be done on BP in what concerns processes such as segment- and syllable elision. The basic question seems to be, *Under which circumstances can a reduced word still be understood in BP?* I suggest that studies on (BP) haplology and related research utilize more natural language (e.g., oral corpora) rather than readings of word lists, for example. It seems to me that the reading of lists of words might produce a strong bias for the use of more formal language. Besides, the realization of words with much longer durations than in natural language and the typical presence of pauses might interfere with the results. Actually, while listening to the BP files in the present study, I often found myself under the impression that several speakers began the conversations with rather formal language, probably because of a very strong notion that their words were being recorded. Only further into the conversations did they seem to begin to speak more naturally. This might be an inescapable problem for the analysis of readings of lists of words and phrases. It would be interesting if speakers recorded in the LINDSEI-BR and the C-ORAL-BRASIL were invited to read lists of words, so that durations and other measurements could be studied in relation to the two very different forms of data collection.

I also think that aspects of etymology, grammar and syntax, in each specific language or dialect under analysis, should not be underestimated. Nor should we forget about that fascinating thing, which is Culture.

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