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PRODUCTION OF IN THE ENGLISH CODA BY BRAZILIAN EFL LEARNERS

AN ACOUSTIC-ARTICULATORY ANALYSIS

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To my family:
Sandra
Anna
Giovanni
Dirceu
Iraci

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ABSTRACT

PRODUCTION OF IN THE ENGLISH CODA BY BRAZILIAN EFL LEARNERS
AN ACOUSTIC-ARTICULATORY ANALYSIS

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This research focused on the articulatory and acoustic properties of the productions of in the English coda by EFL Brazilian learners. Considering that BP in coda position is normally vocalized, it was expected that Brazilian EFL learners would realize it in the English coda with different degrees of vocalization due to the action of L1 transfer and interlanguage development processes. Moreover, it was also expected that the degree of vocalization would be influenced by the phonological environment due to coarticulation processes. Also, considering that the acoustic properties of sonorant consonants are related to the action of the articulators, the first formant frequencies and duration of and its syllable peak were expected to denounce its articulatory properties. The data were collected from a group of 20 Brazilian EFL learners. The results revealed three realizations of : (a) partially vocalized, (b) vocalized and (c) non-vocalized. Concerning the effects of the phonological environment, the results indicated that: (a) a 'pause' and a 'consonant

across the word' triggered significantly more vocalization than a 'consonant within the word'; (b) voiceless consonants favored significantly more vocalization than voiced ones; and (c) place of articulation was the decisive factor affecting vocalization. As regards acoustic phonetics, the results revealed that: (a) the F3/F1 and F2/F1 ratios of the vowel in the syllable peak were higher the more vocalized the was ('W' > 'Lw' > 'L'). However, they were only significantly higher for the realizations of as 'W'; (b) it was statistically possible to identify the realizations of as 'Lw' by looking at the F3/F1 of ; and (c) it was possible to identify the realization of / by looking at its duration.

112 pages (excluding appendix)
28,575 words (excluding appendix)

PRODUÇÃO DO EM SÍLABA CODA POR BRASILEIROS ESTUDANTES DE INGLÊS COMO LINGUA ESTRANGEIRA – UMA ANÁLISE ACÚSTICO-ARTICULATÓRIA

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Esta pesquisa focalizou as propriedades acústicas e articulatórias do do Inglês em coda silábica produzido por estudantes Brasileiros de EFL. Considerando que o do português brasileiro é normalmente vocalizado em coda silábica, estudantes brasileiros produziriam o do Inglês com diferentes graus de vocalização devido a transferência do som da L1 e ao desenvolvimento da interlíngua. Além disso, o grau de vocalização do seria influenciado pelo ambiente fonológico, devido ao processo de co-articulação. Também, considerando que as propriedades acústicas das sonorantes são relacionadas à ação dos articuladores, era esperado que a freqüência dos primeiros formantes e a duração, do e do núcleo silábico, denunciariam as propriedades articulatórias dos . Os dados foram coletados com um grupo de 20 estudantes brasileiros de EFL. Os resultados revelaram três realizações do : (a) parcialmente vocalizado, (b) vocalizado e (c) não-vocalizado. Com referência aos efeitos do ambiente

fonológico, os resultados indicaram que: (a) uma ‘pausa’ e uma ‘consoante na palavra seguinte’ significantemente provoca mais vocalização do que uma ‘consoante na mesma palavra’; (b) consoantes surdas significantemente favorecem mais vocalização do que as consoantes sonoras; e (c) o ponto de articulação foi o fator decisivo que afetou a vocalização do . Com referência aos parâmetros acústicos, foi revelado que: (a) as razões F3/F1 e F2/F1 da vogal do núcleo silábico foram mais altas quanto mais vocalizadas foi a produção do (‘W’ > ‘Lw’ > ‘L’). Entretanto, elas foram somente significantemente mais altas para as realizações do como ‘W’; (b) foi estatisticamente possível identificar as realizações do como ‘Lw’ através da observação da razão F3/F1 do ; e (c) foi possível identificar as diferentes realizações do / através da análise da sua duração.

112 páginas (excluindo anexos)
28.575 palavras (excluindo anexos)

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CHAPTER 1

INTRODUCTION

1.1 Background to the study

In many varieties of English, the phoneme in coda position is characterized as a coronal lateral approximant that involves the combination of a salient dorsal (vocalic) gesture followed by a weaker coronal (consonantal) gesture. The vocalic gesture refers to tongue dorsum retraction whereas the consonantal gesture refers to the tongue tip or blade touching the dental/alveolar area (Giles & Moll, 1975; Sproat & Fujimura, 1993).

The Brazilian Portuguese (BP) in coda position is mainly characterized by the loss of the consonantal gesture, which makes it similar to the glide or the back vowel (Cristórafo Silva, 2002; Lamprecht, 2004; Netto, 2001; Tasca, 2002).

According to Baptista (2001), the fact that the BP final is usually pronounced as may lead the English learner to mispronunciation, which might result in misunderstandings. In fact, Moore (2004) and Baratieri (2005) found evidence that BP learners of English vocalize both the BP and the English final . Hence, it seems plausible to hypothesize that transfer might operate in the vocalization of in the English coda.

Recent studies by Baptista (2000), Rauber (2002), Koerich (2002), Kluge (2004), and Silveira (2004) have provided evidence to the process of transfer, that is, the influence of BP on the acquisition of English sounds, such as final obstruents, initial /s/ clusters and final nasals. However, some studies reveal that not only L1 transfer occurs

but also interlanguage development processes operate in the acquisition of foreign language speech sounds. For example, Baptista (l992) claims that in the beginning of the process of acquisition of English, BP learners' vowels are clearly produced with features of the native language, but eventually learners tend to acquire the new L2[1] vowels.

In this line of thought, it can also be hypothesized that BP EFL learners may realize the in the English coda with different degrees of vocalization due to L1 transfer and to interlanguage development.

Besides investigating the operation of transfer and developmental processes, foreign language acquisition studies have also investigated the influence of the phonological environment in which the target sound is inserted in its realization (e.g., Baptista & Silva Filho, 1997; Carlisle, 1992, 1997, 2001; Koerich, 2002; Rebello, 1997). Focusing specifically on the final , both Moore's (2004) and Baratieri's (2005) studies of BP learners of English indicated that vocalization was influenced by the following phonological environment. However, owing to the small scope of both studies it was not possible to provide substantial data accounting for the effect of the variable.

In this sense, the present study intends to add to those, investigating the influence of the phonological environment following in either favoring or inhibiting its vocalization. The field for this investigation was set by the study of Blandon and Al-Bamerni (1976), who investigated coarticulation of embedded in several

[1] For the participants of the present study L2 means foreign language. Hence, L2 and foreign language are used interchangeably.

phonological environments, and concluded that coarticulation occurred freely from both left to right and right to left.

More specifically regarding the effect of the following phonological environment on vocalization, it is traditionally believed that vocalization more frequently occurs in prepausal position, as well as before velars and labials, than before apicals and palatals. However, in a considerable number of Romance languages vocalization is more frequent before coronals than before labials, velars and pause (Recasens, 1996). In BP, for example, the following coronal consonant seems to favor the vocalization of the liquid in comparison to bilabial and dorsal consonants (Lamprecht, 2004).

Another issue addressed in the present study regards acoustic phonetics. It is argued that the first formant frequencies are the result of the action of the vocal tract shape on the sound source, and thus good indicators of vowel and voiced approximant qualities (Ladefoged, 2001). Hence, the different ways is produced would be directly related to the action of the articulators in the vocal tract, which in turn would directly reflect on the acoustic properties of the segment. In summary, different realizations of would present particular acoustic properties, thus it would be possible to deduce articulatory features by analyzing its acoustic properties.

Moreover, considering that the segments are affected by its neighbors due to coarticulation, different realizations of in the English coda would affect the realization of the syllable peak and consequently its acoustic properties. Thus, it would be possible to deduce articulatory features by analyzing the acoustic properties of the syllable peak.

1.2 Statement of purpose

The present study aimed at analyzing the production of the phoneme in the English coda by BP learners of English as a foreign language (EFL) in order to investigate the effect of the following phonological environment on the production of the . Moreover, it also aimed at analyzing some acoustic properties of and the syllable peak in order to investigate whether there is a relationship between them and the articulatory realizations of / .

1.2.1 Research questions and hypotheses

According to the objectives of this research, the following research questions and hypotheses were investigated:

Question 1: How do Brazilian EFL learners produce in the English coda?

H_1: Brazilian EFL learners present different realizations for in the English coda.

Question 2: Does the following phonological environment in terms of: (a) a pause, (b) a consonant within the word, or (c) a consonant across the word influence the vocalization of in the English coda?

H_2: The degree of vocalization of varies according to the following phonological environment.

Question 3: Does voicing of the following consonant influence the vocalization of in the English coda?

H_3: The degree of vocalization of is influenced by voicing of the following consonant.

Question 4: Does place of articulation of the following consonant influence the vocalization of in the English coda?

H_4: The degree of vocalization of is influenced by place of articulation of the following consonant.

Question 5: Does manner of articulation of the following consonant influence the vocalization of in the English coda?

H_5: H_1: The degree of vocalization of is influenced by manner of articulation of the following consonant.

Question 6: Which is the decisive factor in influencing the vocalization of in the English coda: place or manner of articulation of the following consonant?

H_6: Place of articulation of the following consonant determines the degree of vocalization.

Question 7: Do different realizations of in the English coda affect the acoustic properties of the syllable rhyme?

H_7: The F3/F1 and F2/F1 ratios of the vowel in the nucleus vary according to the realization of .

H_8: The F3/F1 and F2/F1 ratios of vary according to its realization.

H_9: The duration of the vowel plus the varies according to the realization of .

1.3 Significance of the s t to its realo it iny

final consonantal sounds that are considered difficult for Brazilian EFL learners to acquire, as is the case of the final .

Moreover, the present study is a pioneer attempt at linking the difficulties in producing in the English coda to the influence of the following phonological environment. Besides that, it is also a pioneer study investigating the acoustic and articulatory properties of different realizations of the phoneme in coda position, and the influence of that on the acoustic behavior of the syllable peak.

As a pioneer study, this investigation aimed at contributing with data that will provide helpful insights for writers and teachers to create and implement pronunciation materials on the issue.

1.4 Organization of the thesis

The thesis is divided into five chapters. The next two chapters present the theoretical background for the present study. More specifically, chapter 2 presents a general overview of the articulatory properties of the phoneme , the phenomenon of vocalization, and the effects of the phonological environment in favoring or inhibiting vocalization; and chapter 3 reviews the acoustic theories of speech production, presents some considerations about the visual representation of speech and reports on the literature on acoustic properties of the phoneme , its allophones and its neighboring sounds. Chapter 4 describes the method employed for data collection, including information about the participants, the materials and the procedures. Chapter 5 reports and discusses the results obtained in the present study under the light of the literature reviewed and the hypotheses raised. Finally, chapter 6 presents the

conclusions and discusses the theoretical and pedagogical implications based on the findings of the present study. Furthermore, it points out the limitations of the present study and gives suggestions for further research.

CHAPTER 2

ARTICULATORY FEATURES OF THE PHONEME

2.1 Introduction

Since part of the objective of this study is related to articulatory phonetics of , the relevant literature was reviewed in order to give support to the hypotheses raised, or at least to enlighten suggestions and propositions. The following topics are treated in this chapter: (a) the features of the phoneme in English and in BP, encompassing mainly articulatory properties and allophones; (b) vocalization: A natural phenomenon, which basically consists of being pronounced as a vowel, which would be an articulatory simpler segment**;** and (c) the phonological environments that may favor or inhibit vocalization of the dark .

2.2 The faces of the phoneme in English and in BP

The lateral sounds are part of the class of the liquids, which, in turn, belong to the approximant group of sounds. According to the literature, the phonemes as in 'wet', as in 'yet', as in 'let' and as in 'rat' are classified as approximants due to the fact that they are articulated in such a way that the active articulator (the tongue) approximates the passive articulator (the roof of the mouth), narrowing the passage of air at some point, but without interrupting its flow (Ladefoged, 2005).

Concerning the liquids, Câmara Jr. (1977) says that the Greeks baptized them as liquids due to the fact that whenever the airflow encounters an obstruction it acts as a

liquid that manages to change its direction in order to keep its flow. The class of liquids encompasses the phonemes and due to the fact that their articulation forms an obstruction inside of the mouth, but the airflow manages to escape.

The phoneme is the representative of the class of lateral sounds. In summary, lateral sounds stand for any sound in which the air flows out of the mouth freely, over the sides of the tongue, through the channels formed by the tongue lowering just behind its point of contact or approximation with the roof of the mouth (Ladefoged, 2005; Ladefoged & Maddieson, 1996; Tasca, 2002).

In the *Sounds of World's Languages*, chapter 6, Ladefoged and Maddieson group various types of sounds of the world's languages which carry a lateral feature and define them as "sounds in which the tongue is contracted in such a way as to narrow its profile from side to side so that a greater volume of air flows around one or both sides than over the center of the tongue" (p. 182). In summary, this definition stands for any sound whose articulation forms (a) a complete central obstruction, hence forming a central occlusion, albeit the air is allowed to flow by its sides (for example, the English in onset position); or (b) a partial central obstruction, which results in an incomplete medial closure, allowing the air to flow by one or both sides, as well as over the center of it (for example, some forms of British English in postvocalic positions).

Concerning the specific features of the lateral sounds, Ladefoged and Maddieson point out that they are among the most sonorous of the oral consonants and thus form a special class in the phonotactics of a language, being the segments with the greatest freedom to occur in consonant clusters. Also, the authors say that the laterals vary in terms of (a) phonation (voiced, voiceless, breathy voice and laryngealized); (b) stricture (approximants, fricatives, affricates, flaps and taps); and (c) place of articulation (apical

dental, laminal dental, apical alveolar, laminal alveolar, apical post-alveolar, laminal post-alveolar, sub-laminal palatal, laminal palatal, and velar). However, although several types of lateral sounds are found in the world's languages, the authors state that the least marked ones are the voiced approximants with point of articulation in the dental/alveolar region. All the other realizations of lateral sounds are more marked, occurring mainly in some varieties of aboriginal Australian, Indian, Tibetan and Native American Languages.

Finally, the authors compare the realization of the most common laterals in the world's languages with the realization of the alveolar stops (and). They say that the active articulator (the tongue) contact (apical/laminal) with the dental/alveolar region acts similarly in both realizations, but for the lateral segment there is a lowering of the active articulator just behind the occlusion, creating paths through which the air flows out freely, instead of being blocked at the sides of the tongue as it occurs with the alveolar stops.

Concerning English, several researchers (e.g., Blandon & Al-Bamerni, 1976; Halle & Mohanan; 1985; Ladefoged, 2001; Wells, 1982), agree that in some forms of the language, including American and British English, the phoneme is a voiced lateral approximant which has two allophones: a) a pre-vocalic , also called "light" or "clear" , as the onset of *lip* , which involves contact between the tongue tip or blade with the dental or alveolar region, but in which, instead of the air being blocked, it passes down the tongue sides; and b) a post-vocalic and syllabic , also termed "dark" or "velarized" , as in the coda of *pill* and *milk* which involves a secondary gesture of tongue retraction and its raising toward the velum.

The allophones – clear and dark act in complementary distribution in RP[2] and GA[3], that is, the clear allophone occurs in onset position and the dark one in rhyme position. However, there are accents in which the clear/dark dichotomy is not present. For example, in SSE[4] is realized with a dark quality in all phonological environments, whereas in Welsh and southern Irish English only the clear occurs in any syllable position (Giegerich, 1992).

As regards the specific articulatory features of the clear and dark s, some authors point out that the tongue is more retracted for the dark (e.g. Gartenberg, 1984, cited in Sproat & Fujimura, 1993; Giles & Moll, 1975), and raised toward the velum (Ladefoged, 2001). However, using acoustic and X-ray data for English in both pre-vocalic and post-vocalic phonological boundaries in the phonological environments, Sproat and Fujimura (l993) brought some light to the realization of the phoneme, saying that it involves two gestures: (a) a vocalic dorsal gesture (tongue retraction and dorsum lowering), and (b) a consonantal apical gesture (the tongue tip touching the dental/alveolar region). The authors propose that the vocalic dorsal gesture has a strong similarity with the syllable nucleus and is, thus, attracted to it, whereas the consonantal apical gesture has a strong relation with the syllable margins and thus is attracted to them. Besides that, they say that the combination of the consonantal apical gesture preceding the vocalic one occurs in syllable-initial , whereas the opposite occurs in syllable-final . In summary, Sproat and Fujimura claim that for the

[2] RP – Received Pronunciation: accent spoken throughout England, mainly by the upper-middle and upper class.
[3] GA – General American: accent spoken throughout the USA, but which does not carry any regional characteristic.
[4] SSE – Scottish Standard E: accent spoken in Scotland.

realization of the clear first the tongue tip goes towards the palatal area, and then its dorsum is retracted and lowered, whereas for the realization of the dark , first the tongue dorsum is retracted and lowered, then the tongue tip goes towards the palatal area. But, the tongue-dorsum retraction is greater for the dark . Therefore, the relationship between the dorsal gesture and the coronal gesture seems to be a salient feature which may phonetically differentiate the clear from the dark . Although their findings are relevant to the study of laterals and are considered in recent studies (e.g., Johnson & Britain, 2003; Silva, 1996) as well as in the present one, the authors themselves agree that the data from four speakers of Midwestern American English and one speaker of British English was a limitation of their study. It is also important to highlight that Sproat and Fujimura's findings in terms of tongue-dorsum lowering go against the current literature (e.g., Ladefoged, 2001) which claims that the dark is characterized by velarization (raising the back of the tongue towards the velum).

The features of the phoneme in BP seem similar to that of English. According to Cristófaro Silva (2002), when the BP segment occurs in syllable onsets such as in *lata* – 'can', following a consonant such as in *placa* – 'plate', and in an intervocalic position such as in *sala* – 'room', it is characterized as voiced, lateral and coronal, varying from alveolar to dental articulation, depending on the dialect. Furthermore, when the BP segment occurs in syllable rhymes such as *sal* - 'salt' and *salta* - 'jumps', it may be articulated with a velar property.

Although these features of the BP phoneme are similar to those of English, Cristófaro Silva (2002) states that the particular property of velarization of in coda position is restricted to some dialects spoken in the extreme south of Brazil. Tasca (2002) analyses the result of the studies of Espiga (2001), Quednau (1993) and Tasca (1999) about the production of in coda position by people from the extreme South of Brazil, and summarizes that most people older than 50 keep the property of velarization and resist to vocalization, whereas younger people behave the opposite.

In the other regions of the country the velar property of the BP phoneme in coda position is totally absorbed by the process of vocalization. That means that the BP phoneme in coda position mostly often loses its consonantal gesture and is articulated with the vocalic quality of the back vowel or the glide (Cristófaro Silva, 2002; Lamprecht, 2004; Netto, 2001; Tasca, 2002). For example, the word *mel* – 'honey' is mostly often realized as all over Brazil. Althouth Lamprecht (2004) says that the following coronal consonant favors vocalization in BP, Koerich (2002) states that vocalization in BP is a stable fact that is not influenced by the following vowel or consonant. She exemplifies this by referring to the sequences *mel escuro* ˈ ʊ̯i ˈkurʊ – 'dark honey' and *mel claro* ˈ ʊ̯ˈklarʊ – 'light honey', and points out that the adverb *mal* – 'badly' and the adjective *mau* – 'bad' are homophonous – [ˈ aʊ̯] in BP.

Another relevant finding concerns labialization. Espiga (2003) investigated the realization of the post-vocalic phoneme in the southernmost part of Brazil. Based on

acoustic analysis, he found a hybrid realization of the phoneme with features of both the velarized allophone and the vocalization / , which he categorized as velarized and labialized . As a result of these findings the author proposes that the process of vocalization follows three steps: 1) the clear / evolves to dark due to the addition of the [+dorsal] feature; 2) the dark evolves to the velarized and labialized due to the addition of the [+labial] feature; and 3) the velarized and labialized evolves to the vocalized due to disconnection of the [+coronal] feature.

In summary, on one hand, both the English RP and GA accents, and the BP allophones of the phoneme are similarly realized when the segment is in onset position, which means that they share the similar phonetic features of the clear . On the other hand, when is in the syllable rhyme, whereas it is mostly realized with a dark quality in both RP and GA accents (although there is literature that confirms the process of vocalization in these accents, see Section 2.3); in BP it is generally realized with very little or no consonantal gesture at all.

2.3 The vocalization of : A natural phenomenon

The first point to be highlighted in this section is that scholars claim that vocalization is the result of both articulatory change (loss of the consonantal gesture) and misperception (final being perceived as). On the one hand, those who argue in favor of articulatory changes (e.g., Camara Jr., 1973; and Grammont, 1971;

Ohala & Kawasaki, 1984, cited in Recasens, 1996) state that vocalization would be favored by alveolar contact loss, that is, the dark is realized as / or the glide / due to the secondary apical consonantal gesture failure. On the other hand, the evolution from to / or would be the result of the dark being misperceived as / or due to their acoustic similarity (Ohala, 1974, 1981, 1985; von Essen, 1964, cited in Recasens, 1996).

Although it seems that both the articulatory and the perceptual arguments are consistent in explaining the phenomenon of vocalization from a phonetic point of view, Johnson and Britain (2003), based on the existing literature and data from Fenland[5], claim that vocalization is prone to appear as a natural phenomenon in languages which have the dichotomy between clear and dark . For example, they say that vocalization is a widespread process in the South-Eastern part of Britain and in many other dialects including American English, Australian English, New Zealand English and Falkland Island English. Furthermore, vocalization is also observed cross-linguistically, for example, in many dialects of Romance languages[6] (Recasens, 1996) and in old French (Gess, 1998, 2001, cited in Johnson & Britain, 2003). The authors argue that vocalization is due to the emergence of the unmarked and then should be expected. They state that "naturalness has been linked with universal unmarkedness which has been correlated with language change – language change is expected to proceed in the direction of the unmarked" (p. 31). Less marked sounds are

[5] The Fens are in the Northernmost part of South-East of England.
[6] Romance languages: the languages that descend from Latin (for example, French, Italian, Catalan, Spanish, Portuguese)

more natural in the human languages, and hence they are expected to be acquired earlier and more easily than more marked sounds. If the phenomenon of vocalization is unmarked, then it is expected to emerge in early child language and to appear in language change. Johnson and Britain point out that, historically, children acquiring English strongly tend to replace the dark by or even when no vocalization is apparent in the ambient dialect.

Jakobson (1968, cited in Johnson & Britain, 2003), states that those sounds which require less physiological effort are also less marked, and hence are the first to be acquired by children, and consequently they appear more frequently in the world's languages. Johnson and Britain make use of the words of Jakobson (1968) that "nearly all the mutilations of ordinary language made by children have a close parallel with the sound changes of different languages of the world" (p. 5). When children replace the dark by or , they are merely producing a physiologically less marked sound, whereas the adult language resists the articulatory change in order to keep or introduce greater contrast into its inventory (Stampe, 1969, 1972/1979, cited in Johnson & Britain, 2003). Nowadays, the vocalization resistance could be seen as a way of keeping contrast between different social classes.

In summary, Johnson and Britain's claim that vocalization is the arising of the unmarked is based on the following facts: (a) it emerges in language change; for example, the clear/dark dichotomy was rare in British English until the end the 19th century, but by the 1960s the dark had spread across the southern half of England whereas the other areas preserved the clear in syllable rhyme position. Nowadays, the process of vocalization is widespread throughout part of England, at least; (b) it

emerges in early child language even when no vocalization is apparent in the ambient dialect; and (c) it emerges cross-linguistically; for example, it appears in many dialects of Romance languages (Recasens, 1996). Besides that, Johnson and Britain argue that unmarked forms will tend to be phonetically more natural as well as structurally simpler. Therefore, vocalization would be considered less marked than the dark due to the fact that the latter is a complex segment which involves both dorsal and coronal gestures, whereas the former is realized with the loss of the coronal gesture; hence the vocalized would be considered a structurally and physiologically simpler segment and thus unmarked when compared to the dark . Consequently, it would better fit the less marked CV syllable pattern than the dark .

Johnson and Britain (2003) conclusions somehow corroborate those of Espiga (2003). The former authors demonstrate that vocalization is natural and expected to emerge in dialects with the clear/dark dichotomy. Also, they found that the dark may be developed in those dialects with only clear in all positions. The latter author proposes that would evolve to , then to partially vocalized and finally to vocalized .

2.4 Phonological environments that may favor and inhibit vocalization

According to Ladefoged (2001), a secondary articulation is an articulation that occurs at the same time as another (primary) articulation. Normally, the secondary articulation adds a vowel-like feature to the primary articulation. In order to illustrate this fact the author explains the phenomenon of palatalization, which is the addition of a

high front tongue position, like that in , to another articulation, and cites the example of the English in *key*, which is considered more palatalized than the in *car*, since the place of articulation of the former is nearer the palatal area. Conversely, the author states that velarization occurs when the secondary articulation involves the raising of the back of the tongue towards the velum, like that in , but without the addition of lip rounding. This is what happens in the velarized ( ). Therefore, due to the fact that the vowel quality seems to affect the realization of its neighboring sounds, it may be plausible to argue that the more anterior the vowel preceding the phoneme in coda position is, the less probability of vocalization, whereas the less anterior the vowel preceding the dark ( ) in coda position is, the greater the probability of vocalization. For example: the phoneme in the word "hill" would be less frequently vocalized than the phoneme in the word "bull". This supposition corroborates Labov, Cohen, Robins and Lewis (1968, cited in Durian, 2004) that vowel frontness is a better predictor of vocalization than vowel height. Furthermore, it also corroborates Wyn Johnson (2005, personal communication) when he said that "back vowels would be more likely to promote vocalization than the front ones, since back vowels are dorsal, hence having an affinity with the dorsal gesture of the dark , whereas front vowels have an affinity with the coronality of the clear ".

In terms of vowel quality, Sproat and Fujimura (1993) state that long vowels promote early and long dorsal gestures, whereas short vowels inhibit them. The longer (more salient) dorsal gesture would cause the coronal one to fail, giving room for vocalization. Wyn Johnson corroborates this idea by proposing that the "preceding

vowel length seems to be a factor in promoting vocalization" (2005, personal communication).

The discussion above concerns left to right coarticulation. However, Blandon and Al-Bamerni (1976) investigated coarticulation in RP English embedded in several phonological environments and concluded that coarticulation occurs freely from either direction. Hence, it seems reasonable to suppose that not only the syllable nucleus but also the following consonant may interact in favoring or inhibiting the vocalization of the dark , probably due to the coarticulation phenomenon.

The existing literature has shown distinct opinions supporting the view that the place of articulation of the following consonant seems to play a role in favoring/inhibiting dark vocalization. Recasens (1996), for example, brings to the literature traditional beliefs about the phonological environment which is supposed to favor dark vocalization and questions them due to the fact that those beliefs do not account for what happens in many Romance language dialects. Based on Straka (1968), Grammont (1971), Ohala and Kawasaki (1984), and Hartcastle and Barry (1985), Recasens points out that it is traditionally believed that the dark vocalization is the result of central alveolar contact loss, which would be more favored in prepausal position, as well as before velars and labials, than before apicals and palatals; at least this seems to be what happens among Slavic and Anglo-Saxon languages.

The scholars agree that in prepausal position there is a great acoustic and articulatory similarity between the dark and , thus vocalization would be favored. Furthermore, they advocate that the tongue configuration for velars (a high back closure and a lowered predorsum) would favor the loss of dark apical contact,

hence the tongue would adopt a like feature, and that for labials, the tongue is not involved; that is, there is no lingual activity, which would also favor the loss of dark apical contact.

In view of this literature, it seems reasonable to add that the labial segments have to do with the secondary articulation of the glide / (labial protuberance), which facilitate the dark vocalization, and that the other side of the coin shows that following apical and palatal consonants would inhibit the dark vocalization due to its tongue dorsum raising and fronting, which has to do with the consonantal gesture of the lateral. It also seems reasonable to raise the point that the beliefs mentioned above do not account for what happens in a considerable number of Romance language dialects, in which the dark vocalization is more frequent before coronals (dental and alveolar stops, fricatives, and affricates) than before labials, velars and pause (Recasens, 1996). In BP, for example, the following coronal consonant seems to favor the vocalization of the liquid in comparison to bilabial and dorsal consonants (Lamprecht, 2004).

In summary, since the scholars' articulatory and perceptual arguments fail to explain why vocalization occurs mostly before apicals in Romance languages, Recasens suggested that a dissimilatory perceptual mechanism plays its role, then listeners would assign the gravity percept of the dark to a following grave labial or velar consonant but not to a following apical alveolar consonant. Hence, the would be perceived as darker before the dental alveolar than before labials and velars. Listeners would cancel out the dark quality of dark before labials and velars due to

their similar spectral properties and thus fail to hear the lateral consonant as dark, preventing vocalization in these environments.

Regarding the preceding consonant, Johnson and Britain mention that coronal consonants inhibit vocalization of the syllabic (for example, in the words *medal* and *little*), whereas labial or dorsal consonants tend to favor it (for example, in the words *humble* and *ankle*).

As for the vocalization of before vowels (for example in sequences such as *all empty*), its inhibition seems to occur due to linking of the words, hence resyllabification is promoted and becomes part of the syllable onset. However, if the speaker makes a pause between the two words, vocalization seems to be favored.

All the studies mentioned are based on L1 dark production. However, Baptista (2001) states that one of the frequent pronunciation errors made by Brazilian learners of English concerns the realization of the English final as . The author also contributes saying that although the English final is not always realized with tongue-alveolar closure, the lip-rounding gesture is never present in its production.

Among the very few studies that have been conducted on the production of the English dark by BP EFL learners are those by Moore (2004) and Baratieri (2005). Moore conducted a pilot-study in which he analyzed the productions of five elementary and four intermediate Brazilian EFL learners and found that both groups produced some final s as , mainly when the nucleus was a back vowel. The elementary group surpassed the intermediate group in producing the final as . In terms of the following phonological environment, he found that final was more frequently

realized as when followed by a consonant, then when followed by pause, and then by a vowel. It must be noted that Moore's pilot study presented some limitations which may have influenced the results: (a) the number of tokens was very limited considering the scope of the study; (b) the following phonological environment in terms of vowel and consonant qualities was not under control; and hence (c) the effects of the following phonological environment and of the vowel in the syllable peak may have been circular due to coarticulation.

Baratieri (2005) was the pilot for the present study, and investigated the production of dark by EFL teachers. The results indicated that transfer of the native language sound was a strategy the participants frequently used to produce the dark . They also revealed that when the dark was followed by a voiceless consonant it was more frequently vocalized. Furthermore, vocalization was also more frequent when followed by a consonant within the word, then when followed by a pause, and then when followed by a consonant in onset position of the following word. Like Moore's study, Baratieri's also presented limitations which may have influenced the results. For example, neither the syllable peak quality nor the following vowel and consonant were controlled.

Although at first sight the present study seems similar to Moore (2004) and Baratieri (2005), it differs from them [illegible]

voicing, (b) place of articulation (bilabial, labial-dental, alveolar, post-alveolar and velar), and (c) manner of articulation (plosive, nasal and fricative). In order to ensure that only the following phonological environment would affect the , the syllable peak was kept under control. Moreover, this is also a pioneer study in investigating the acoustic properties of and the syllable peak and their relation to the articulatory properties of realizations of in English coda.

The theoretical issues discussed in this chapter will ground the hypotheses and enlighten the discussion of the results with the intention of contributing with the findings to the scarcity literature in the field.

The following chapter presents an overview of the acoustic theories concerning speech production and its visual representation. It also describes the acoustic properties of the lateral phoneme and some of its allophones.

CHAPTER 3

ACOUSTIC PROPERTIES OF THE PHONEME

3.1 Introduction

This chapter presents a general picture of the acoustic theories concerning speech production and its visual representation. It also describes the acoustic properties of the lateral phoneme and some of its allophones.

3.2 Source-filter theory of speech production – an overview

The speech chain formulated by Denes and Pinson (1993) begins with explorations at the linguistic level, in which the speaker plans the linguistic form and translates it into the physiological level, in which the muscles responsible for the breathing and manipulation of the vocal tract play their role. The result is a sound wave[7] which travels through the atmosphere to the listener's ear and is converted in nerve impulses that are interpreted by the brain (Figure 1).

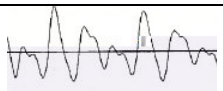
SPEAKER		ATMOSPHERE	LISTENER	
Linguistic level	Physiological level	Acoustic Level Sound wave	Physiological level	Linguistic level
Brain	The lungs + the vocal tract		Ear	Brain
→	→	→	→	→

Figure 1: The Speech Chain based on Denes and Pinson (1993)

The sound wave, which is located in the center of the speech chain, carries physical parameters of speech sounds directly related to the way the sound source was

[7] "A sound wave is a traveling pressure fluctuation that propagates through any medium that is elastic enough to allow molecules to crowd together and move apart" (Johnson, 2003, p. 4).

generated and filtered. According to Hayward (2000), the sound source is firstly generated by the airflow from the lungs to the glottis, in which the vocal cords function as a valve inhibiting or not its flow through the two main cavities: (a) oral (via the lips) and (b) nasal (via the nose). On the one hand, when the glottis is in an open position, the vocal cords do not vibrate; hence the sound source at the glottis is just turbulent air, also called white noise due to its aperiodic[8] feature, as the sound source of voiceless sounds. On the other hand, if the vocal cords are close together the air pressure causes them to vibrate; hence the sound source is modulated into a complex periodic[9] sound wave, as in voiced sounds. This complex periodic sound wave is the result of the vocal cords vibration action, whose movements cause a small variation of air pressure, which follows the same pattern as the vocal cords vibration. The vocal cords vibrate at a frequency, called fundamental frequency (F0)[10], which is equivalent to the number of vocal cords cycles (complete opening and closing movements the vocal cords make in a second). For example, if a sound has an F0 of 100 Hertz (Hz)[11] it means that the vocal cords make 100 complete movements of opening and closing in a second, hence this frequency of vibration makes the air pressure vary proportionally, resulting in a periodic sound wave with 100 cycles per second. This periodic sound wave is complex, which means that besides the fundamental frequency, it contains lots of other distinct periodic waves, called harmonics, whose frequencies are multiples of the fundamental frequency. Furthermore, the harmonics of the complex periodic sound wave are characterized by their amplitude, which is basically the amount of energy of the sound.

[8] Aperiodic sound waves are characterized by a non-repeating pattern, affecting the air particles at random (Johnson, 2003; Hayward, 2000).

[9] Periodic sound waves are characteristic of voiced sonorants. Their main feature is a repeating waveform pattern (cycle) which is the result of the vocal cords vibration. The frequency of repetition is called Fundamental Frequency (F0) (Hayward, 2000; Johnson, 2003).

[10] F0 changes according to the vocal cords mass and stiffness; the thinner and stiffer the vocal cords are, the more they vibrate and hence the higher the F0 is (Stevens, 1997). For these reasons children and women have higher F0 than men.

[11] Hertz (Hz): a unit of frequency. It stands for the number of cycles per second.

In more technical terms, the amplitude refers to the size of variation in the air pressure of the sound wave (Hayward, 2000; Johnson, 2003; Ladefoged, 2005; Stevens, 1997). However, the speech sound is not only generated at the glottis by the vocal cords' vibration or lack of it, but the glottis sound source may be filtered by the vocal tract[12] configuration due to the action of the articulators, resulting then in speech sound. Johnson (2003), based on the source-filter theory of speech production (Fant, 1960), explains that the vocal tract is an acoustic filter that acts as a resonating chamber and thus modifies the sound source. That is, when the sound source is filtered, some of its harmonics resonate and consequently their frequencies are amplified. These resonant frequencies are called formants[13], and sound formants are directly dependent on the shape of the airway between the glottis and the lips (Stevens, 1997). In summary, each different vocal tract configuration resonates differently reinforcing the sound source at particular frequencies, which are called formants.

Concerning the vocal tract configuration and its main effects on the sound source, on the one hand, when the sound source is just steady turbulent air, as in voiceless sounds, the action of articulators will either interrupt its flow, as in voiceless stops, or just narrow the airflow, hence the result will be hissing noise, as in voiceless fricatives, which are acoustically characterized mainly by the enhancement of the high frequencies. On the other hand, when the sound source is a complex periodic wave produced due to the vocal cords' vibration, as in sonorant sounds, the action of the active articulators[14] models the vocal tract in several different resonator chambers, thus particular frequencies (formants) that characterize each particular sound acoustically are enhanced.

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[12] The passages of the mouth, throat, and nose are collectively called the vocal tract (Ladefoged, 2001).
[13] The natural resonant frequencies of the vocal tract (Johnson, 2003). The formants can be identified as the most prominent peaks of a sound spectrum.
[14] Active articulators: tongue, lips and uvula.

Concerning the action of the articulators, Stevens (1997) claims that, the tongue-body position reflects on the frequencies of the first and second formants (F1 and F2). The height affects the F1 frequency and the frontness affects the F2 frequency. The high or low tongue positions lead, respectively, to low or high F1 frequency, whereas front or back tongue positions lead, respectively, to high or low F2 frequency. That is, the higher the tongue-body position, the lower the F1 frequency will be, and the more anterior the tongue-body position, the higher the F2 frequency will be. Furthermore, the author explains that lip rounding affects the first three formants, causing their frequencies to decrease. Therefore, the first formant frequencies are the result of the action of the vocal tract shape on the sound source and thus good indicators of vowel and voiced approximants qualities (Ladefoged, 2001).

As seen in this section, the source-filter theory aims at describing the effect of the vocal tract configuration on the sound source. The next section deals with the visual representation of the invisible sound wave components.

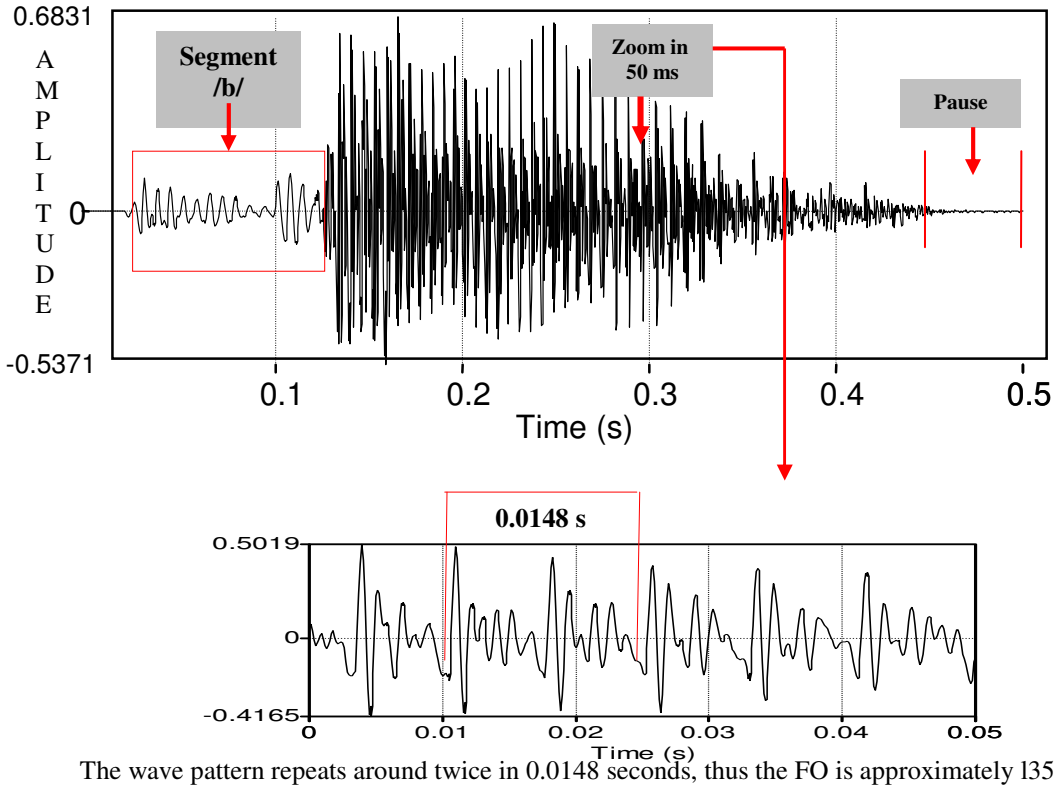
3.3. Visual representation of speech

According to Hayward (2000), a "sound of any kind is invisible and intangible" (p. 9) due to the fact that it is the result of very small and quick movements of air particles which can neither be seen with naked eye nor perceived as separate events. However, it is possible to represent sound by different diagrams in order to better depict and conceptualize it.

First, a sound can be described as a unified entity since it is the combination of several different sine[15] waves with particular frequencies and amplitudes, which results in only one complex periodic wave that is represented by a diagram known as

[15] Sine refers to the sinusoidal shape of the wave. That is, a periodic sound wave representation has a sine-like shape.

waveform. The analysis of the waveform shows basically duration and amplitude. For example, Figure 2 shows the representation of a sound wave of the utterance “bell” spoken by a male participant of the present study, and a zoom in of 5 milliseconds from the phoneme .



The wave pattern repeats around twice in 0.0148 seconds, thus the FO is approximately l35 Hz (f = 1/T → f = 2/0.0148 → **f = 135**)

Figure 2: The complex wave form of the utterance “bell” and a zoom in of 50 ms

By analyzing it, it is basically possible to see the sound behavior through time, that is, its amplitude variation and its pattern of cycle repetition during a period, which enable us to calculate duration of pauses, segments, and the FO (the harmonic with the lowest frequency).

However, the waveform graph does not provide enough information about the individual components of the sound, such as frequency and relative amplitude of its

harmonics, which would facilitate comparisons. In order to have an overview of the individual components of a sound, a two-dimensional diagram known as power spectrum has to be produced. Basically, the power spectrum is the result of Fourier analysis, which consists of decomposing the complex waveform into an arbitrary set of sine waves that may be the composition of the sound, in order to derive their individual frequencies and relative amplitudes (Johnson, 2003).

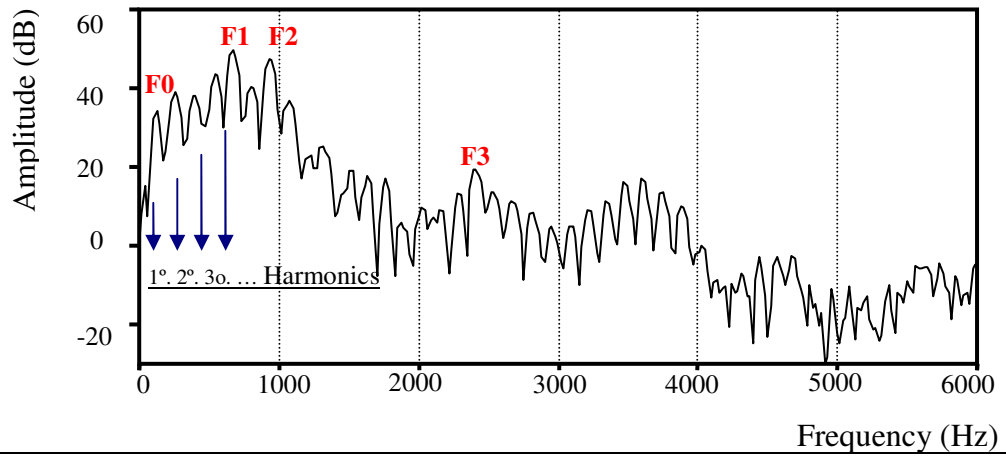


Figure 3: Power spectrum from the phoneme of the utterance “bell”

Figure 3 shows the spectrum of a waveform window[16] of the phoneme of the utterance “bell” spoken by a male participant of the present study. The horizontal axis represents the frequency and the vertical axis represents the relative amplitude of each harmonic that may have constituted the complex sound wave. In summary, the complex sound wave generated by the vocal cords vibration resonates differently according to each vocal tract configuration; hence the amplitudes of some of its harmonics are amplified, whereas some are attenuated. The first harmonic refers to the F0 and the

[16] A segment or a chunk of a waveform that has been windowed (Johnson, 2003).

formants are characterized by the most prominent peaks. In other words, the formants are the harmonics with greater energy.

However, sometimes the formants are not easy to be tracked by analyzing the power spectrum, and then studies make use of the Linear Predictive Coding (LPC) analysis in order to measure the formant frequencies of sonorant sounds. In summary, the LPC analysis separates the sound source (the harmonics) and the filter components of the complex sound wave and the result is a smoothed spectrum that shows the resonance peaks of the frequencies and bandwidth[17], which are necessary for formant tracking (Harrington & Cassidy, 1999).

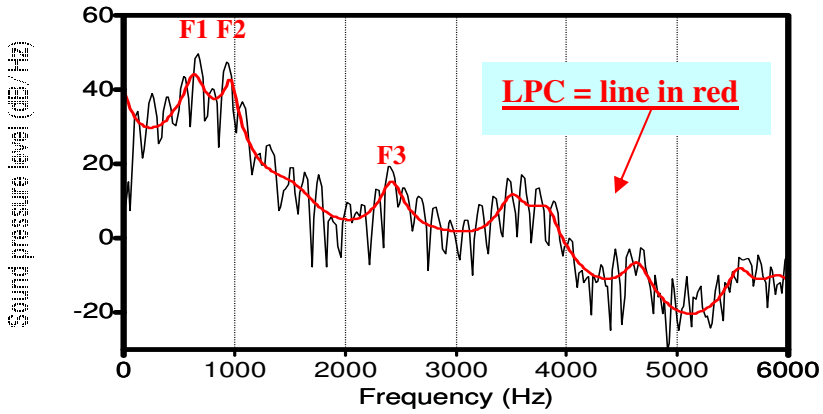


Figure 4: Power spectrum and the LPC from the phoneme of the utterance “bell”

Figure 4 above, shows both the power spectrum and the LPC of the waveform window of the phoneme from the utterance “bell” spoken by a male participant of the present study. As can be seen, both spectra are two-dimensional diagrams that specify the frequency and relative amplitude of the sound wave, but their main

[17] Bandwidth refers to the width (in Hz) of the resonance peak (Johnson, 2003).

difference is the absence of individual harmonic components in the LPC spectrum. Thus, the formants are easier to be tracked since they are identified by the broad peaks.

However, one of the problems in analyzing sound waves using spectra is that time is not represented. That is, spectra only provide information of windowed sound waves, but they do not show how the sound wave components behave through time. According to Johnson (2003), "the power spectrum is more like a snapshot than a movie" (p. 42), thus it is only possible to get an accurate idea of the frequency components of a sound wave at a particular moment in time. In order to see how the sound components behave through time, a diagram called spectrogram may be used. A spectrogram is a diagram that illustrates spectral changes over time; the frequency of the components (harmonics) is shown on the vertical axis, the time is shown on the horizontal axis, and the intensity (proportional to the amplitude) of each component is shown by the band darkness (the darker the band the greater the intensity) (Ladefoged, 2001).

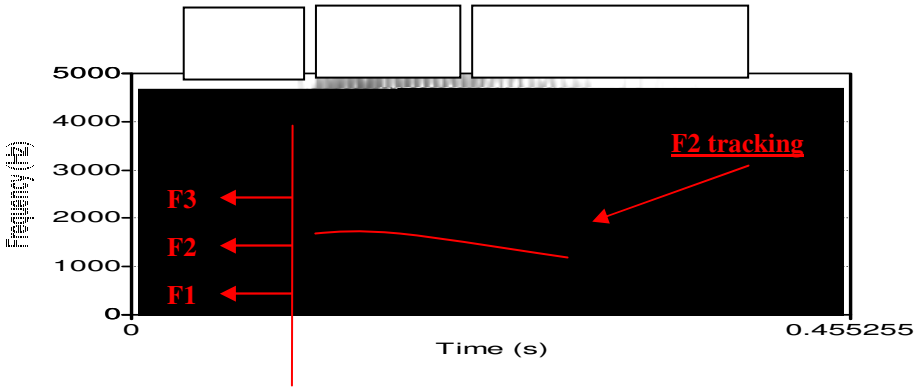


Figure 5: Spectrogram of the utterance "bell"

Figure 5 shows a spectrogram of the utterance "bell" spoken by a male participant of the present study. Taking into consideration that formants are the resonant frequencies that have the greatest intensity, it is possible to track them and see their

behavior through time by looking at the band darkness in the spectrogra

that the supralingual cavity and the presence of two lateral channels (the multiple airflow paths produced by the articulators) result in pole-zero clusters[19] around the F3 and above (2 – 5 kHz); consequently, the F3 – F4 frequency region is weakened, resulting in a fairly flat spectrum between 1600 and 3400 Hz. Furthermore, although details differ, this scenario holds true for both clear and dark allophones of (Lehman & Swartz, 2000). Also, most of the energy of the laterals is concentrated below 5 kHz, with low-frequency behavior greatly influenced by the back cavity (Narayanan, Alwan & Haker, 1997). Besides that, from the point of view of the source-filter theory, the acoustic of laterals is very similar to that of nasals due to the fact that the side branch introduces an anti-formant between F2 and F3, causing the amplitude of the higher formants to be reduced (Hayward, 2000; Johnson, 2003).

As for the formant frequencies, Ladefoged and Maddieson (1996) state that "voiced lateral approximants are characterized acoustically by well-defined formant-like resonances", with an F1 lower than 400 Hz; an F2 that varies between 1650 Hz and 2350 Hz depending on the adjacent segments; and a relatively high F3, between 2850 Hz and 3300 Hz. These measurements refer to the lateral in the onset position produced by a male voice and may vary according to its different points of articulation. For example, the measurements for the apical alveolar lateral are around 386 Hz, 1.677 Hz and 3.162 Hz for F1, F2 and F3, respectively.

Concerning the acoustic relationship between allophones of the phoneme , the dark is characterized by a relatively lower F2 and higher F1 when compared to the F2 and F1 frequencies of clear (Lehiste, 1964). The frequency of the F2 will be lower the narrower the back constriction becomes, hence F2 frequency is lower for dark

[19] Pole-zero clusters: great downward tilts of frequencies.

than for clear ; The F1 frequency tracks the opposite direction, being higher for dark than for clear . Therefore, the difference between F2 – F1 is lower for velarized than for clear (Ladefoged & Maddieson, 1996) and the closer the F1 and F2 are together, the more back the sound is (Ladefoged, 2001).

More specifically concerning the acoustic properties of the phoneme in syllable coda, Hayward (2000) says that "The addition of velarization gives the dark a more u-like character and this reflects in a lower F2". However, variation in the degree of darkness reflects in considerable variation in F2 frequency. Delattre (1951, cited in Llisterri & Daudén, 1990) argues that there is a direct relation between the tongue back-and-up and second formant frequency lowering. That means that low F2 denotes tongue backing and dorsal rising which is one of the features of the dark realization. The study conducted by Llisterri and Daudén (1990), about the production of the French in coda position spoken both by native Spanish and Catalan presents an F2 frequency mean of 1579 Hz, whereas the velarized Catalan F2 frequency varies between 874 Hz and 1039 Hz. Therefore, when was produced with a velar property (Catalan dark), the F2 frequency was much lower than when it was produced without it (French clear). Besides that, Ladefoged and Maddieson (1996) also state that the F2 frequency of the velarized varies between 900 and 1000 Hz, depending on the dialect and language, due to the constriction made by the retraction of tongue-body towards the velum.

Concerning the acoustic relationship between and , Dalston (1975) demonstrated that they are distinguishable on the basis of their temporal and spectral acoustic characteristics. His findings show that has longer steady-state duration than , and he claims that whereas the tongue is in resting position for , there is contact between it and the alveolar ridge for , resulting in gesture delay. Thus, it is hypothesized that the duration of the phoneme will vary according to its realization. The more marked the production in terms of articulatory gestures, the longer the duration will be. Thus, the vocalized production would have a shorter duration than the non-vocalized production, since the former is produced with a single lingual gesture, whereas the latter is the result of two gestures.

Concerning formant frequencies, the same author claims that the F2 may differentiate the phoneme from the phoneme / due to the fact that the former has a higher F2 frequency than the latter (1179 Hz vs. 732 Hz for males, 1340 Hz vs. 799 Hz for females). However, it is important to highlight that these results only refer to the phoneme in onset position. Moreover, Dalston takes into account Peterson's (1961) suggestion that equivalent vowels produced by different speakers tend to lie along lines of constant frequency ratio; then, in order to normalize individual differences, the phonemes and were rationalized by dividing the second and the third formant frequency values by the frequency value of the first formant. The ratios obtained for both male and female phonemes and are displayed in Table 1 below:

Table 1

Ratios of formant frequency means based on Dalston's (1975) data

	male	male	female	female
F2/F1*	2.17	3.42	2.37	3.67
F3/F1*	6.81	7.33	8.21	8.04

*Its important to highlight that the results refer to the phonemes in syllable onset position

Besides that, in an analysis of data from several American English speakers, Ladefoged and Maddieson (1996) found that the dark and the have similar formant frequencies, as can be seen in Table 2:

Table 2

Formant frequencies of the dark and the

	Contexts "aw" and "al"		Contexts "ow" and "ol"	
F1	545	510	410	405
F2	850	870	740	770
Ratio F2/F1	1.55	1.70	1.80	1.90

In a study about the phonetic-acoustic properties of the BP liquids, Silva (1997) analyzed the final productions of a male informant and concluded that he produced a phone which could be characterized as between velarized and vocalized, with the vocalic gesture, but without the consonantal one. As for the formant frequencies, the results showed an F1 frequency mean of 340 Hz and an F2 frequency mean of 829 Hz. Consequently, if the F2/F1 ratio were calculated, the result would be 2.44. Furthermore, according to the information displayed on the Macquarie University homepage, (http://www.ling.mq.edu.au/speech/acoustic/consonants/approxweb.html), the F1 frequency for the glide varies between 250 and 450 Hz and its F2 frequency varies

between 600 and 850 Hz. Hence, if the ratio between F2:F1 mean were calculated, the result would be 2.07 (F1 mean: 350 Hz, F2 mean: 725 Hz). Besides that, the same homepage brings information about the first formant frequencies of the dark . If the same strategy above were used, then the ratio F2:F1 of the dark / would be 1.67 (F1 mean: 450 Hz, F2 mean: 750 Hz).

Concerning the effects of the realization of the phoneme in coda position on its syllable peak, Lehiste (1964) claims that the darker its quality is, the lower the syllable peak F2 frequency will be. Lehiste also states that the labialization of the following consonant causes a decrease in the first formant frequencies of its syllable peak. Therefore, the acoustic behavior of the syllable peak would indicate the degree of darkness and vocalization of the phoneme . Table 3 shows the first formant frequencies of the vowel from both English (Ladefoged, 2001) and BP (Rauber, 2006). Thus, it will be possible to compare them with the acoustic behavior of the syllable peak of the present study.

Table 3

English and Brazilian formant frequencies for

	F1	F2	F3	F2:F1	F3:F1
English average	550	1770	2490	3.21	4.52
BP male	497	1888	2620	3.79	5.27
BP female					

mention that the formant frequencies of the phoneme / should be lower before labials and velars than before apicals and palatals (Recasens, 1996).

This review of the literature makes it possible to summarize that lingual height affects the frequency of the first formant, in that the higher its position, the lower the first formant frequency, and also that lingual retraction and dorsum rising affect the frequency of the second formant, in that the more retracted and raised the tongue, the lower the second formant frequency. Besides that, researchers agree that labialization causes a decrease in the frequency of the first three formants. Furthermore, the difference between F1 and F2 would be lower for the dark than for the clear . As for segment duration, the dark would be longer than the vocalized variety due to the fact that the former is more marked in terms of articulatory gestures. Finally, concerning the effects of different realizations of the phoneme on its syllable peak, the formant frequencies of the syllable peak would decrease proportionally to the degree of vocalization of the phoneme that follows it.

CHAPTER 4

METHOD

4.1 Introduction

This study was conducted in order to investigate (a) whether Brazilian EFL learners vocalize the in the English coda; (b) which contexts following favor or inhibit its vocalization; (c) whether the realization of different allophones of in the English coda reflects directly in their acoustic properties; and finally (d) whether the acoustic properties of the syllable peak are also affected by different allophones of . In order to achieve the objectives of this study, firstly participants were carefully selected aiming to control for possible intervening variables (e.g., length of instruction, age, and experience abroad). They were then asked to perform the directed speech production test, through which all the data was collected.

4.2 Participants

A group of 20 Brazilian EFL students, 15 females and 5 males, aged between 14 and 22, participated in this research. Thirteen students were enrolled in the 3rd level of the "To the Top"[20] (TT-3) English course, and 7 students had just completed the level. None of the participants had been abroad. Table 4 shows the participants' background.

[20] To the Top is a three-level Advanced English Course which consists of 57 hours of instruction per level. After completing the third level, students are advised to take the TOEFLl ITP test.

Table 4

Participants' background

Order	Gender	Age	English Course	Status	Length of instruction
01	Female	15	TT-3	enrolled	456 h
02	Female	18	TT-3	enrolled	456 h
03	Female	17	TT-3	enrolled	456 h
04	Female	14	TT-3	enrolled	456 h
05	Female	15	TT-3	enrolled	456 h
06	Female	17	TT-3	enrolled	456 h
07	Female	16	TT-3	enrolled	456 h
08	Female	20	TT-3	completed	513 h
09	Female	22	TT-3	completed	513 h
10	Female	17	TT-3	completed	513 h
11	Male	18	TT-3	completed	513 h
12	Male	18	TT-3	completed	513 h
13	Male	18	TT-3	completed	513 h
14	Male	20	TT-3	completed	513 h
15	Female	15	TT-3	enrolled	456 h
16	Female	15	TT-3	enrolled	456 h
17	Female	15	TT-3	enrolled	456 h
18	Male	16	TT-3	enrolled	456 h
19	Female	15	TT-3	enrolled	456 h
20	Female	15	TT-3	enrolled	456 h

Although the participants differed from one another in terms of length of instruction (7 participants had just completed the course and thus received 513 hours of instruction and 13 participants had received 456 hours of instruction), it was considered that this difference alone would not interfere in their pronunciation performance, since

factors such as different types and amount of input received out of class and the individual differences would work together affecting their pronunciation performance as a whole. In fact, the results showed that the participants' performance was not significantly influenced by length of instruction in all contexts under investigation ($p >$ .05). As regards the variable gender, although it directly affects some acoustic properties of , it was not under investigation in the present study due to the fact that the individual differences were normalized by the strategy of using the ratios of the formants F3/F1 and F2/F1 instead of using the raw formant frequencies, as suggested by Peterson (1961, in Dalston, 1975).

4.3 Material

The data was gathered through two instruments, a profile questionnaire and a directed speech production test.

4.3.1 Participants' Profile Questionnaire

The profile questionnaire (see Appendix A) was the basis for selecting the participants to take part in the data collection session. It consisted of questions about biographical information, and was written and answered in Portuguese. Twenty-three potential participants answered the questionnaire. Of these prospective participants, three were eliminated because they did not fulfill the following requisites: (a) participants should be aged between 15 and 25; (b) they should not have experience abroad; (c) they should only speak English as an L2; and (d) they should be enrolled in or have just completed the course "To the Top". Thus 20 participants fulfilled all the requisites above and then were selected as the data collection sample.

4.3.2 Directed Speech Production Test

The directed speech production test, which aimed at eliciting the production of within the phonological environments selected, consisted of the reading of a carrier sentence displayed on a computer screen in a sequence of slides. Each sentence appeared in one slide to prevent visual preparation for reading the following sentence and the skipping of sentences.

The directed speech production test was divided into three parts: (a) the instructions, (b) the training, and (c) the test itself (Appendix B). The instruction material had slides with instructions in Portuguese about the general task, such as: (a) what the participants would see in the slides and how long the slides would be on screen; (b) what their task would be during the time the slides were on the screen; and (c) information about the training material and the recording procedure.

The training material consisted of 8 slides which aimed at reinforcing understanding of the task as well as raising confidence for the data collection procedures. The first slide provided written instructions about (a) the use of the carrier sentence '*, I said *', and (b) what the participants should do when each slide appeared. It also showed four examples for the participants to practice. The second slide showed written instructions about the desired syllable peak pronunciation, and three examples for the participants to practice. The reason for giving instructions about the pronunciation of the syllable peak was to minimize mispronunciations, that is, the production of tokens which would be invalid for the study. Finally, slides 3 to 8 provided the training by modeling the data collection material and procedure. These slides appeared automatically every 4 seconds, and each showed one of the inputs: *felb, mels, melg, tell Gyna, selj* and *welsh* plotted in the center, and the carrier sentence **, I said ** plotted on the top left side of the slide. The words *mels, melg, tell Gyna, selj* were

chosen intentionally due to the fact that the sequences of phones in their rhymes were expected to trigger undesired pronunciation, which could then be worked out in the training session, so that the data collection would not be spoiled. For example, the expected pronunciation for the syllable rhyme of the word *mels* was , but it could be realized as ; the rhymes in the words *melg, Tell Gyna* and *selj* were expected to be pronounced as , and , respectively, but all of them could be realized as . By giving training on the pronunciation of theses words, participants who presented mispronunciations could rehearse and eventually produce the expected sound.

The testing material had 70 slides divided in two sets of 35. All the slides, except the 35th and the 70th, displayed the carrier sentence '*, I said *' on the top left side of the screen, and the target word plotted in the center. The 35th slide displayed the message *'Respire um pouco, aguarde alguns segundos...*' (relax and wait for a few seconds) and functioned as a break between the two sets of slides serving for the participants to relax while waiting a few seconds for the following set to begin. The 70th slide signaled the ending of the test with the message *'Thank you! Your contribution is relevant to the development of language research*'. In both sets, the first three slides served only as practice stimuli, that is, a warming up. For example, the three introductory slides for the first set brought the words 'bed', 'tell Gyna' and 'get', whereas the three introductory slides for the second set brought the words 'book', 'tell Joe', and 'dog'. The 64 valid slides displayed words with in the coda preceded by the phoneme and followed either by silence or by one of the following consonants:

or /. These sounds appeared either within the target word or in the onset position of the next word.

The words used in the test were (a) *bell*, *sell* and *shell* for followed by silence. In this condition, twelve tokens of final / / were produced by each participant (3 words repeated twice in the carrier sentence, each slide repeated twice); (b) *help*, *felb*, *helm*, *self*, *selv*, *melt*, *held*, *heln*, el*s*e, *mels*, *welsh*, *selj*, *belk* and *melg*, for followed by one of the consonants above within the word. Fifty-six tokens were produced in this condition (14 different contexts repeated twice through the carrier sentence which appeared in 2 slides); and (c) the sequences *tell Peter*, *tell Bob*, *tell Mary*, *tell Faby*, *tell Viny*, *tell Tom*, *tell Dan*, *tell Nan*, *tell Sam*, *tell Zak*, *tell Sharon*, *tell Gyna*, *tell Kate* and *tell Garry*, for followed by one of the consonants above in the onset of the following word. Another fifty-six tokens were produced by each participant in this condition (14 different contexts repeated twice through the carrier sentence, which appeared in 2 slides). The order of presentation of the words on the slides was counterbalanced across the two sets of slides (Appendix B).

As it was mentioned above, the study involved some non-words. It was necessary to make up words in order to cover the phonological contexts under investigation. The words *heln, mels, selv, selj, felb, belk and melg* included in this study are not found in major dictionaries of English, and so, are not part of the language lexicon; however, they do not go against the phonotactic rules of the English rhyme, which allows nasals, fricatives and stops following , hence they might be English words.

It seems reasonable to say that the carrier sentence '*, I said *.' was a sensible choice due to the fact that the punctuation mark inserted just after the target words would stimulate pauses, one of the phonological contexts of study, avoiding, or at least, minimizing undesired phenomena such as coarticulation, assimilation and linking.

Concerning the choice for as the syllable peak, it was due to the fact that it is the most frequent syllable nucleus found in monosyllabic English words with the coda cluster as can be checked in major dictionaries. Secondly, it was necessary to maintain the syllable nucleus stable to control for the effect of the preceding context on , and study the effect of the following context with the desired accuracy.

The following context was studied in terms of the effect of the consonantal phonemes and / in favoring vocalization of . This effect was analyzed in terms of voicing, place and manner of articulation of the consonantal phoneme. As for place of articulation, the consonantal phonemes studied were the bilabials ( ), labialdentals (, alveolars (/), postalveolars ( ), and velars ( ). The interdentals (were not included in this study due to the fact that they do not exist in BP and are often difficult for BP learners of English, who realize them as or and as or respectively (Baptista, 2001; Koerich, 2002; Xavier, 1989). Concerning manner of articulation, the consonantal phonemes were contrasted in terms of plosives ( ), nasals (/), and fricatives ( ). The affricates ( ) were not included in this study, although they can follow the phoneme in English coda clusters. The reason for leaving the affricates out was agreement with Ladefoged

[21] C stands for the consonants or /

(2005) who considers them as resulting from combinations of a stop followed by a fricative. Since this study already covered the alveolar stops and , it was considered that the affricates would affect the preceding in a similar way the alveolar stops would do. Besides that, the rhymes and are hardly found in English monosyllabic words.

4.4 Procedures

Concerning the participants who were enrolled in the English course and volunteered to take part in the experiment, the data was collected at the language school during their regular classes. As regards the participants who had just completed the course, individual meetings were scheduled at the language school they had studied. The data was collected in individual sessions, in a silent classroom in order to prevent background noise interference on the recordings.

4.4.1 Data collection session

First, each participant answered the profile questionnaire in Portuguese and handed it in to the researcher (Appendix A). Following that, the participant was invited to sit comfortably in front of a compact personal computer in order to take the directed speech production test (Appendix B).

The slide containing the instructions material was read aloud and explained by the researcher. Basically, the participant was told that a slide containing a word or a sequence of two words and the sentence '**, I said **' would appear on the computer screen every 4 seconds. The participant was also told that the location of the word or

group of two words would be about the slide's center, and the carrier sentence would be located on top left side of the slide.

The first slide of the training material was then shown and the details about it were explained by the researcher in Portuguese. During the presentation of the four examples in the slide the participant was told that the task consisted of inserting the word or the phrase (two words) in the asterisk spot in the sentence, and reading it as naturally as possible as if it was part of informal conversation. Following the presentation of the first slide, the participant was given the opportunity to practice. Once the basic task had been understood, the second slide was shown, and the participant was told that the pronunciation of the vowel in the syllable peak of the word or phrase (two words) would be , in all words, and the words were practiced through the three examples in the slide. Once the task was understood, the participant was told that the subsequent six slides would run automatically and that this presentation would be a model of the test. The third slide was then shown and every 4 seconds a different slide appeared and the participant said the carrier sentence inserting the word or phrase (two words) in the asterisk spot. Whenever the participant was judged by the researcher to have produced an undesired pronunciation in terms of the consonant that followed , s/he was told about the expected sound and had the chance to practice by repeating slides 3 to 8.

After finishing the training session, the test was run without interruption, and the productions were digitally recorded at a sampling frequency of 44 kHz on a Sony Minidisc MZ – R 700. The choice of this specific sampling frequency for recording was due to the fact that it is a sufficient frequency to conduct a consistent acoustical analysis of any speech sound. In fact, just half of it would be adequate since the main components of speech sounds lie under 10 kHz (Johnson, 2003).

4.4.2 Data analysis

The participants profile questionnaire provided information to guarantee the homogeneity of the group, except for the variable gender. However, the participant's gender was not a variable under investigation in the present study although the formant frequencies are proportionally affected according to the individual differences in the vocal tract. The reason for not considering gender as a variable of effect is due to the fact that the individual differences in the vocal tract were minimized by the strategy of using the ratios of the formants F3/F1 and F2/F1. The procedures of the acoustic analysis are described in Section 4.2.2.

The directed speech production test provided the information that was used to investigate the influence of the following context on the production of different realizations of in the English coda. Besides that, once different realizations of in the English coda were produced by the participants, the main acoustic properties characterizing them were investigated.

In order to make the necessary analysis, the data had to be specially treated. First, each participant's recording was downloaded to a file of the type '.wav'. Each file was labeled with characters that identified the participant's number and the gender. Then, each file was open using the software Praat[22] version 4.4.12. After that, the Praat function 'annotate to TextGrid' was run and the TextGrid[23] was set with 4 tiers and saved with the same name of the '.wav' file, but with an extension '.TextGrid'. Finally, both the '.wav' and the '.TextGrid' files were selected and edited. Figure 6 shows a participant's Praat window with the TextGrid segmented and labeled.

[22] PRAAT – doing phonetics by computer, by Paul Boersma & David Weening, free download from www.praat.org. It is basically a program to carry out acoustic analysis.
[23] TextGrid is a Praat tool that consists of a number of tiers which can be used for annotation (segmentation and labeling).

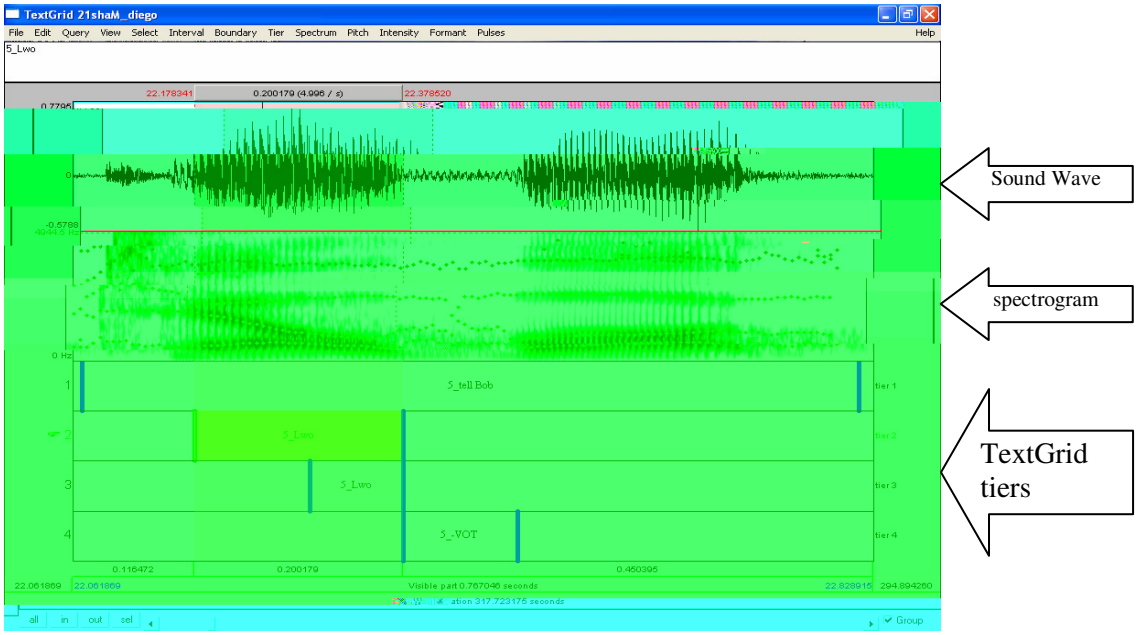


Figure 6: Praat window

The window shows the sound wave, the spectrogram and the TextGrid of the utterance ‘tell Bob’ produced by a participant. The sound wave shows the wave form properties such as duration, the glottal pulses, and the intensity, which is the contour of the wave form. The spectrogram was set to show the frequencies that lie within the first 5 kHz, thus it was possible to analyze the main acoustic properties of the phonological contexts under investigation. It also shows the first 5 formant contours (red dots) and their intensity (the darkest is the formant contour, the highest is their intensity). The TextGrid contains 4 tiers. Boundaries were inserted and manually labeled in each tier. The boundary locations were determined visually with the aid of the spectrogram and sound wave.

As for the first tier, boundaries were inserted to segment the sound wave in order to keep the target sound (the word or words under investigation) within them. Then the segments were labeled with a number referring to a code of the context under investigation plus the target word(s). Concerning the second tier, the boundaries were inserted in order to mark the beginning of the peak , and the end of the phone .

Then, they were also labeled with a number referring to the code of the context under investigation plus a symbol which is a code that refers to the allophone of produced. For example, in the label '5_Lw', the number 5 referred to the final followed by in onset position in '*tell Bob*', and the code Lw identified the realization of as a labialized (w) lateral (L). As for the third tier, it was labeled exactly the same way as the second tier but the boundaries segmented the sound wave in order to keep only the steady state of the phoneme within them. Finally, the last tier boundaries were labeled with any relevant information about the production. In Figure 5, for example, the fourth tier label is "5_-VOT", referring to the negative Voice Onset Time of that occurred within that period in the sequence '*tell Bob'*.

4.4.2.1 Participants' productions assessment

In order to make a well-balanced judgment of the participants' productions of in the English coda, and thus label the tiers 2 to 4, the researcher took the following steps: (a) listening to the stretch of the sound wave which encompassed the target word or the group of target words repeatedly in order to decide what sound was produced for the in the English coda. This stretch of the sound wave was kept within the boundaries in tier number 1 of the TextGrid; (b) listening to the stretch of the sound wave which encompassed the beginning of the syllable peak plus the end of the in order to confirm the decision made in step (a). This stretch of the sound wave was kept within the boundaries in tier number 2 of the TextGrid; (c) checking out the acoustic properties of the participants' production of the in the English coda in order to

reinforce the decisions made in steps (a) and (b), by analyzing the spectrogram and spectrum extracted from the stretch of sound wave which encompassed the steady state of the phoneme . This stretch of sound wave was kept within the boundaries in tier number 3 of the TextGrid; and finally, (d) labeling tiers 2 to 4 with a symbol that expressed the final decision about the phone produced for the in the English coda.

The acoustic analysis (step (c), above), which helped the researcher to decide which sound the participants produced for in the English coda, focused on the acoustic clues that would indicate: (a) the presence or absence of lip rounding, which would indicate vocalization; (b) the presence or absence of a consonantal gesture, which would indicate that the phoneme carried a feature belonging to liquids; and (c) the presence or absence of nasal formants, which would denote nasalization..

As for the focus on lip rounding clues, first an acoustic pattern was drawn for each allophone of the participant produced by analyzing the spectrograms and first formants frequencies[24]. This acoustic pattern was drawn for each participant individually due to the individual differences that may reflect in the acoustic properties. Then, the first three formants frequencies of each realization of in the coda were compared with the acoustic pattern drawn for that participant. Then, in the light of the pertinent literature, which states that a decrease in the first formant frequencies would denote lip rounding (Stevens, 1997), those productions of whose first formant frequencies were lower than the pattern drawn were assessed as having lip-rounding and consequently vocalization was identified.

[24] The strategies used to measure the formants are described in 4.4.2.2.1 – Extraction of acoustic features.

Concerning the focus on the acoustic clues that would denounce consonantal gesture, the spectrogram was also visually checked in order to verify the amplitude behavior[25] around the third formant area. The existence of a consonantal gesture would be responsible for an amplitude decrease due to the greater obstruction a consonantal gesture causes in the vocal tract when compared to a glide or back vowel (Stevens, 1997). Besides the visual checking of the spectrogram, the spectrum slice[26] from a period within which the coda lies was also analyzed. The analysis of the spectrum would facilitate tracking the formants in terms of amplitude and frequency. For example, Figure 7, below compares the spectra of two different realizations of . Spectrum 'A' refers to the judged to be realized with a consonantal gesture, but with the absence of lip rounding. Spectrum 'B' refers to the judged to be realized as a back vowel, with lip rounding.

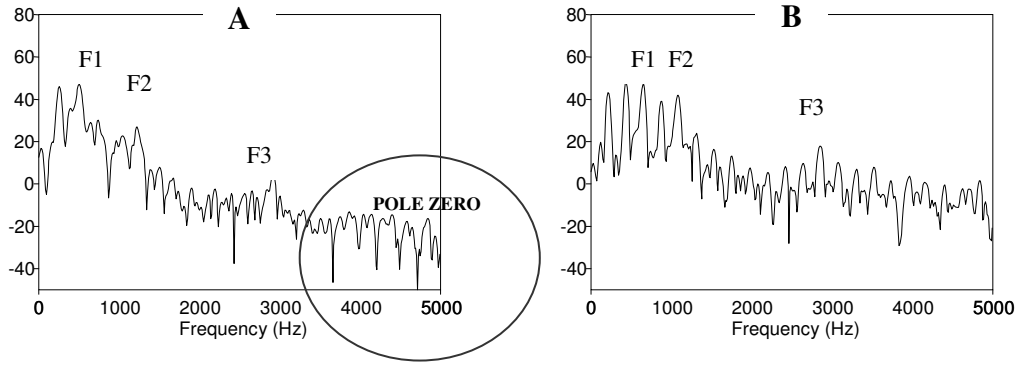


Figure 7: Spectra of realized as a liquid consonant (A) and as a back vowel (B)

Some features in spectrum 'A' when compared to spectrum 'B' would reveal characteristics that belong to the consonantal gesture of the lateral . First, spectrum

[25] The darker is the spectrogram's shade the higher is the amplitude.
[26] Information extracted from the spectrogram in a certain time which shows the amplitude versus frequencies.

'A' is rather flatter around the third formant area, that is, the array of resonance is not well defined. Second, the amplitude is lower; and third, there are some irregular pole-zeros[27] at high frequencies (4000 to 5000 Hz). According to the literature, these features are due to the presence of the consonantal gesture of liquids, which constricts the airflow causing a decrease in amplitude and creates multiple acoustic paths around the constriction causing pole-zeros (Stevens, 1997; Zhang & Espy-Wilson, 2004).

Moreover, in the researcher's auditory judgment of the participants' productions of in the English coda it was concluded that most of the productions were nasalized when was followed by a nasal segment, maybe due to coarticulation. Thus, in order to confirm this judgment the spectrogram and the spectrum extracted from the stretch of sound wave which encompassed the steady state of the phoneme were analyzed aiming to check the presence of a nasal formant[28] which would denote nasalization.

However, sometimes the decision taken according to the procedure in one step was refuted by the following one. In such cases, the researcher asked for a second opinion from a listener with experience in phonetic transcription. This person was not aware of the researcher's decision, and assessed the production through the listening of the sound wave stretch encompassing the target word or the group of target words, which was kept within the boundaries in tier number 1. In case of agreement with the researcher's decision made in step (a), that was accepted. In case of disagreement, the second listener was told about the researcher's decision and then both listeners listened repeatedly to the stretch of the sound wave in question, kept within the boundaries in tier number 1, with special attention to (a) the presence of a consonantal gesture, which would be denounced by the characteristic sound produced by the tongue contact with

[27] A great downward tilt at high frequencies.
[28] An extra low frequency formant around 300 Hz which is the result of addition the nasal tube to the oral one.

the alveolar ridge area during the realization of laterals; (b) the presence of lip rounding, which would be denounced by the characteristic sound produced by lip rounding during back vowels realization; and (c) the presence of the nasal feature, which would also be denounced by its characteristic sound. Both judges highlighted the articulatory clues present in the stretch of sound in question to support their judgment and together decided whether the production would be valid or treated as a missing value.

After the judgment decision, the TextGrid's tiers 2 to 4 were labeled with the following codes, which represented the participant production for the in the English coda: (a) "L", when the most salient gesture was consonantal whereas the lip rounding gesture was absent, which means that the production was not considered to be vocalized; (b) "Lwo" or "Lw"[29], when there was indication of the presence of both the consonantal gesture and of the lip rounding gesture, which means that the production was considered to be partially vocalized; (c) "W" or "Wo"[30], when the most salient gesture was lip rounding whereas the consonantal gesture was absent, which means that the production was considered to be completely vocalized; and (d) "N", when was classified as having nasal features. Furthermore, when the decision considered the production as having any other features than the ones above, the tiers were labeled with other codes (see Appendix C for the complete list of codes) and those tokens were considered as missing values in the result analysis.

4.4.2.2 Acoustic procedures

This section describes the strategies used to treat the data in order to extract the acoustic features used to investigate the hypotheses related to the research question 7,

[29] The difference between the symbols is due to different vowel quality in terms of height. "wo" is more similar to or and "w" is more similar to or .
[30] See note 10.

which was concerned with the acoustic features of duration and the first three formant frequencies mean.

4.4.2.2.1 – Extraction of acoustic features

Figure 8 displays a Praat window with the waveform, the spectrogram and the labeled TextGrid referring to the segment '*tell Bob*' produced by one of the participants. It is important to highlight that the acoustic analyses were conducted on the speech signal interval lying within the labeled boundaries in tier 2, which encompasses the very beginning of the peak ( ) and the very end of the phoneme (Figure 8, see total-interval). In order to define the location of these boundaries, and hence the start point of the peak ( ) and the end point of the phoneme (total-interval), both the waveform and spectrogram were considered, with special focus on amplitude and formants steady state.

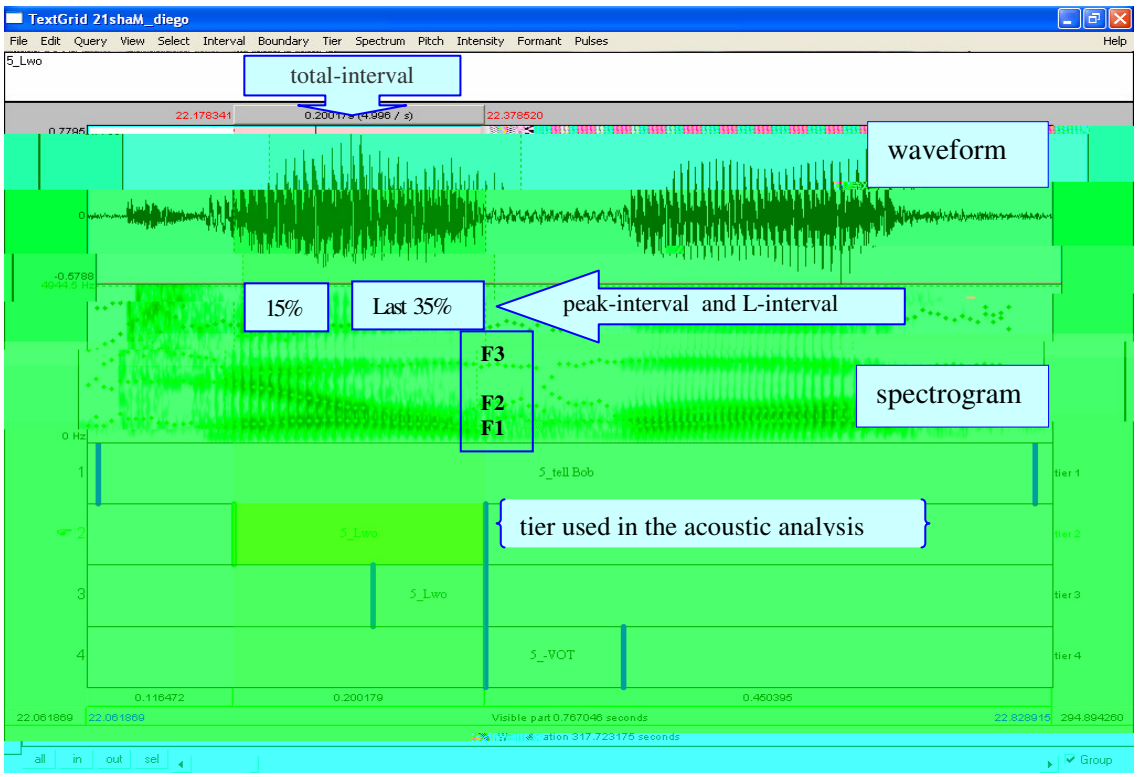


Figure 8: Praat window

For example, the end point of the total-interval in Figure 7 was set at the end of the amplitude decrease of the waveform as well as at the end of the formants steady state in the spectrogram. On the other hand, the start point was set at the beginning of the formants steady state in the spectrogram, around the beginning of the increase of the waveform amplitude.

However, the information extracted from the total-interval only enabled me to test the hypothesis related to the duration of the syllable peak and the phoneme , which stated that the mean of the duration measured from the syllable peak beginning to the end would be significantly different according to each realization of . In order to test the hypotheses concerning the F3/F1 and F2/F1 ratios of the peak and the phoneme , two individual intervals had to be established within the total interval: (a) the peak-interval and (b) the L-interval. In order to accomplish that, it was decided to divide the total-interval in 100 equal points, and it was established that the peak-interval duration would be equal to 15 points (15/100), the 5th point being its start point and the 20th point its end point and the L-interval would be equal to 35 points (35/100), the 65th point being its start point and the 100th point its end point. In other words, the peak-interval duration would lie within the first 20% of the total-duration, leaving out the first 5%, in order to minimize the onset effect on the peak and the L-interval duration would lie within the last 35% of the total-duration. This strategy minimized the individual differences in terms of speech speed, that is, the longer the total-interval duration was, the longer the peak-interval and the L-interval durations would be.

Furthermore, it is also necessary to clarify that the choice for these specific proportions for the peak-interval and for the L-interval in relation to the total-interval was made after analyzing a great number of the participants' spectrograms at random. It

was observed that both the syllable peak and the formants steady state lay within 15% and 35%, respectively.

After setting the peak-interval and the L-interval, the first three formants means were measured by applying the Burg algorithm (Anderson, 1978) built into Praat to calculate the LPC spectra. The number of formants per frame was set as 5 and the maximum frequency of the signal was defined as 5 kHz for male and 5.5 kHz for female speakers due to the differences in their vocal tract shapes. That is, the calculation would consider the five most prominent frequencies lying within the maximum frequency of the signal. Also, the window length was set at 0.025 seconds, and an inverted low-pass filter with a slope of +6 dB per octave from 50 Hz was applied in order to enhance the frequencies in 6 dB per octave counting from 50 Hz.

4.4.2.3 Operationalization of variables and statistical treatment

The variables under investigation were extracted from Praat by running a script written specifically for this research (Appendix L). Basically, the script extracted all the nominal independent variables, transforming them into numbers, in order to facilitate the statistical analysis. For the dependent variables, the script did all the necessary calculations, and extracted the intended values. However, due to the fact that the aim of this research was not to investigate accuracy, but vocalization of considering the effect of the following phonological context, the decision was made to grade the participants' productions according to the degree of vocalization of . Thus, the nominal variable, "participants' production of the phoneme " with several levels concerning to the phones participants produced for , served as the basis for the creation of a new interval variable. The strategies used to create it were the following:

(a) the productions which were analyzed as having only lip-rounding with no consonantal gesture (labeled as W or Wo) were considered as totally vocalized and were attributed grade 10 (ten); (b) the productions which were analyzed as having both a consonantal gesture and lip-rounding (labeled as Lw and Lwo) were classified as partially-vocalized and attributed grade 5 (five); (c) the productions analyzed as having only the typical lateral consonantal gesture (labeled as L) were classified as not-vocalized and attributed grade 0 (zero); and (d) all the other productions were considered as missing values. The difference between the labels W or w and Wo or wo, refers to the vowel-like quality of the vocalization, the label W or w being more like a

and the label Wo or wo more like a . That is, the productions that were assigned those labels were analyzed as being vocalized, either totally or partially, but the quality of vocalization was different according to the label. However, vocalization quality was not the aim of the present study and hence it was not considered. The strategy of attributing grades to the productions according to their degree of vocalization enabled the analysis of the effect of the following phonological context in favoring vocalization.

It is important to highlight that the productions which were analyzed as having a nasal feature (identified by an N added to the regular label) were acknowledged during the analysis of the results despite being treated as missing value.

For more details on the operationalization of the variables, see the list of dependent and independent variables in Appendix D.

As for the statistical treatment, the techniques used to address the research questions and hypotheses of the study were performed using the software SPSS for Windows 10.0. Due to the fact that the data was not well distributed, the statistical analyses were based on comparing ranks either by running (a) the Friedman test, (b) the

Wilcoxon signed-rank test; (c) the Kruskal-Wallis H test; or (d) the Mann-Whitney U test. The probability level of statistical significance (alpha level) was set at .05. Although it was decided to be conservative in choosing the statistical tests, if the data was analyzed by running Anova tests the results would be similar in terms of statistical significance, maybe due to the large scope of data.

CHAPTER 5

RESULTS AND DISCUSSION

5.1 Introduction

This chapter reports and discusses the results of the investigations on (1) How Brazilian EFL learners produce in the English coda; (2) the influence of the following phonological environment in favoring/inhibiting vocalization; and (3) the effect of different realizations of on the acoustic properties of the syllable rhyme.

5.2 How Brazilian EFL learners produce in the English coda

It seems useful to begin this section reinforcing the definitions adopted for consonantal and vocalic gestures since the results are discussed in terms of their presence or absence. In this study, the consonantal gesture refers to a gesture which involves the tongue tip or blade contact with the dental/alveolar area, as the most salient gesture of the clear in the onset of *lip* , whereas the vocalic gesture refers to a gesture which carries traces of tongue retraction and lip-rounding, as the glide in the coda of the Brazilian word *mel* – 'honey'.

The results displayed in Table 5 confirm the hypothesis that Brazilian EFL learners present different realizations for in the English coda. Five realizations of were identified: 'L', 'Lwo', 'Lw', 'Wo' and 'W'.

Table 5

/l/ realizations by Brazilian EFL learners

Realizations	Frequency	Valid Rate	Recoding	Frequency	Valid Rate
'L'	57	2.7 %	'L'	57	2.7 %
'Lwo'	819	38.4 %	'Lw'	1319	61.8 %
'Lw'	500	23.4 %			
'Wo'	571	26.8 %	'W'	758	35.5 %
'W'	187	8.8 %			
Total	2134	100.0 %		2,134	100.0 %
Missing values	346				
Total	2480				

The participants' performance in the '*direct speech production test'* resulted in 2,134 valid productions encompassing 5 distinct realizations of : 'L', 'Lwo', 'Lw', 'Wo' and W. The least frequent occurrence was the realization of encoded as 'L' (57 – 2.7%). This realization was characterized by the presence of the consonantal gesture only, thus realizations of this type were considered non-vocalized productions. Although this production is the one which most approximates the dark , it is important to highlight that realizations of this type do not necessarily characterize English native-like productions, since this study did not apply such judgment. Thus, the realizations of coded as 'L' refer to non-vocalized productions, which are mainly characterized by the presence of the consonantal gesture and the absence of lip-rounding. There was a low rate of occurrence of this type of realization (about 3%).

A second type of realization encompasses the realizations of classified as partially vocalized, which means they are characterized by the presence of both the consonantal and the vocalic gestures. These realizations of were encoded either as

‘Lwo’, when the vocalic gesture carried a similar quality of an , or ‘Lw’, when the vocalic gesture carried a similar quality of an , the former being the one with greater frequency of occurrence. However, it was decided to unify these realizations by recoding them as ‘Lw’ due to the fact that the vocalic quality of vocalization was not in question in the analysis. Thus, the unification of the results showed that the participants partially vocalized the in the English coda in about 60% of the productions (1319 out of 2134).

A third type of the realization of concerns the productions with traces of the vocalic gesture exclusively. These realizations were classified as completely vocalized productions and were encoded either as ‘Wo’ or ‘W’, according to their vocalic quality. However, as it occurred with the partially vocalized productions, the re-codification, grouping the two realizations together resulted in 758 productions classified as ‘W’, which represents about one-third of the total productions (35.5%).

5.2.1 The results in light of the literature

According to the arrangement of the data described above, the participants of this study produced the in the English coda in three main distinct ways: (a) completely vocalized (‘W’); (b) partially vocalized (‘Lw’); and (c) non-vocalized (‘L’) at all.

As figure 9 shows, the productions were more frequently partially vocalized (Lw) than completely vocalized (W); whereas the rate of occurrence of non-vocalized productions (L) was really low.

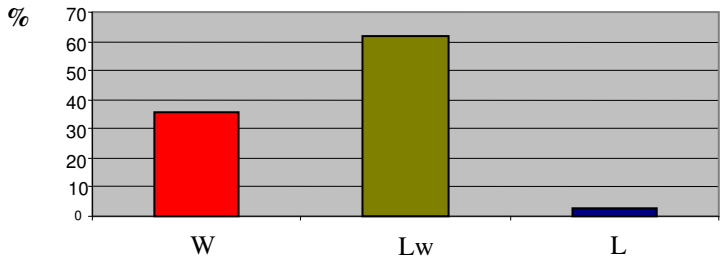


Figure 9: Different productions of in the English coda

At first sight, it may be argued that the participants of the present study transferred the BP to produce the / in the English coda since both vocalized and partially vocalized / occurs in BP. As mentioned in section 2.2, the BP / in coda position is most frequently realized with the vocalic quality of a back vowel or the glide (Lamprecht, 2004; Netto, 2001; Tasca, 2002), and in the extreme south, on the border of Brazil and Uruguay, it is sometimes realized with the hybrid features of velarization and labialization (Espiga, 2003). The results also corroborate Moore (2004) and Baratieri (2005) whose studies indicated that the transferring of the BP sound seems to be the strategy the English learners use to produce the English final / .

However, as mentioned in section 2.3, the phenomenon of / vocalization that occurred in BP (Cristófaro Silva, 2002; Espiga, 2003; Lamprecht, 2004; Netto, 2001; Tasca, 2002) as well as in many Romance Languages (Recasens, 1996), and in some dialects of English (Johnson & Britain, 2003), seems to be a change in the direction of the less marked. That is, the clear / evolves to the dark which evolves to the partially vocalized which, finally, evolves to the vocalized variety .

From this picture, it seems tempting to presume that the participants of this research are tracking the opposite direction, from the less marked (/) to the more market ( ). This supposition is grounded on the results which show that more than half of the productions were partially vocalized (‘Lw’), which, in my point of view, may

opposite direction the participants of this research are tracking. The query that may be raised concerns the reasons why the participants of this research are tracking in direction of the more marked sound rather than transferring the less marked native language sound. I would assume that the fact they received a great length of instruction by means of the audio-visual method in which most of the input they received consisted of Standard English has triggered the arising of the consonantal gesture of the dark / .

5.3 The influence of the following phonological environment

One of the motivations to carry out this study was the scarcity of literature on the effects of the phonological environment following the in the English coda. This section presents the results of this investigation in order to verify whether different phonological environments affect the productions of . Each phonological environment and the hypotheses related to the investigation of its effect are discussed separately in the following sub-sections.

5.3.1 Pause, consonant within the word and consonant across the word

The research question concerning the effect of different phonological environments was: 'does the following phonological environment in terms of (a) a pause, (b) a consonant within the word, or (c) a consonant across the word influence the vocalization of in the English coda?' It was hypothesized that the degree of vocalization of would vary according to the following phonological environment. Table 6 presents the results of this investigation.

Table 6

vocalization in the phonological environments: a pause, a consonant within the word and a consonant across the word

Partici-pants	Realizations of /l/ in different phonological environments														
	Followed by a pause					Followed by a consonant within the word					Followed by a consonant across the word				
	N	'L'	'Lw'	'W'	G[31]	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G
1	12	--	12		5.00	53	--	48	5	5.47	56	--	35	21	6.88
2	8	1	3	4	6.88	42	--	23	19	7.26	44	--	24	20	7.27
3	12	4	7	1	3.75	45	5	33	7	5.22	53	1	47	5	5.38
4	12	--	11	1	5.42	48	--	40	8	5.83	54	--	29		

The Friedman statistical test showed that the difference between the phonological environments was significant (X^2 (2, N = 20) = 6.100, $p < .05$). Thus, the Wilcoxon Signed Ranks Test was run in order to verify whether the differences between the pairs of phonological environments were significant. The test yielded the following results: (a) for the pair 'pause' vs. 'consonant across the word' the difference was not significant (Z = -.448, p > .05); (b) for the pair 'pause' vs. 'consonant within the word' the difference was significant (Z = -2.464, p < .05); and (c) for the pair 'consonant within the word' vs. 'consonant across the word' the difference was also significant (Z = -2.352, p < .05).

Thus, the hypothesis that the degree of vocalization of would vary according to the following phonological environment was only partially supported due to the following: (a) although the degree of vocalization in the phonological environment 'pause' was higher than in the phonological environment 'consonant across the word', the difference between them was not significant; (b) the degree of vocalization in the phonological environment 'consonant within the word' was significantly lower than in the phonological environments 'pause', and in 'consonant across the word', which means that both ´pause´ and 'consonant across the word' triggered significantly more vocalization than the phonological environment 'consonant within the word'.

5.3.1.1 The results in light of the literature

The findings of the present study seem to give support to Baptista's (2001) observation that Brazilians tend to vocalize the English final . Furthermore, they corroborate the traditional belief that vocalization is favored in prepausal position

(Straka, 1968; Grammont, 1971; Ohala & Kawasaki, 1984; Hartcastle & Barry, 1985, all cited in Recasens, 1996), as mentioned in section 2.4. However, the results do not account for what happens in a considerable number of Romance dialects, in which dark vocalization is more frequent before coronals (dental and alveolar stops, fricatives, and affricates) than before labials, velars and pause (Recasens, 1996).

Concerning English vocalization by BP learners of English, the results of the present investigation do not corroborate the tendencies found in previous studies (Baratieri, 2005; Moore, 2004). In Moore's study, vocalization was more frequently favored when was followed by a consonant across the word than by a pause, and in Baratieri's study it was more frequently favored when the following consonant was within the word than across the word. It seems important to note that the present study accounted for some limitations of the previous ones, such as (a) the small number of tokens, (b) the lack of statistical tests, and (c) the lack of control of the previous and following phonological environments, that may have affected the results in those studies. In both studies the number of tokens was very limited and hence generalizations should be seen with caution. In the present study the number of tokens is much higher and it accounted for the control of the syllable peak, avoiding the circular effects of coarticulation. Finally, the results of the present study were analyzed through statistical tests giving more power to generalizations.

Another issue to be discussed regards the non-significant difference between the degree of vocalization in the phonological environments 'pause' and 'consonant across the word'. It seems to be the case that the process of coarticulation between the final and the consonant across the word was absent or at least hindered, hence was not differently affected by the phonological environments 'pause' and 'consonant

across the word', although there was a tendency for higher vocalization in the former environment.

In summary, the results of the present study corroborate traditional assumptions about vocalization and about the effect of the phonological environment. The next sections analyze in depth the effects of the quality of the following consonant on the participants' realization of the in the English coda.

5.3.2 Voicing of the following consonant

Does voicing of the following consonant influence the vocalization of in the English coda? It was hypothesized that the degree of vocalization of would be influenced by voicing of the following consonant. Table 7 presents the results.

Table 7

vocalization in the phonological environments: voiced and voiceless consonants

Phonological environments	Different realizations of /l/ followed by a consonant											
	Within the word				Across the word				Both phonological environments			
	N	Grade Median	Grade min	Grade max	N	Grade Median	Grade min	Grade max	N	Grade Median	Grade min	Grade max
Voiced	419	5.65	4.71	8.24	560	6.87	2.60	8.48	979	6.38	3.45	8.00
voiceless	465	6.61	5.00	8.75	457	7.16	2.71	9.32	922	6.88	4.04	8.48
N total	884				1017				1901			

The source data is found in Appendix E

The was mostly vocalized when the following consonant was 'voiceless', both 'within the word' and 'across the word' (Median = 5.65 vs. 6.61 and 6.87 vs. 7.16, respectively). Considering both phonological environments together, the medians

presented the degrees of vocalization of 6.38 for voiced consonant and 6.88 for voiceless consonant.

The Friedman statistical test yielded that the difference between voiced and voiceless consonants was significant (X^2 (5, N = 20) = 30.952, $p < .05$). Thus, Wilcoxon tests were run in order to verify whether the pairs voiced vs. voiceless were significantly different for all phonological environments. The results yielded that the degree of vocalization of was significantly higher before voiceless consonants than voiced consonants for all phonological environments: (a) 'consonant within the word': $Z = -3.260$, $p < .05$; (b) 'consonant across the word': $Z = -2.737$, $p < .05$; and (c) both contexts: $Z = -3.435$, $p < .05$.

In summary, the following voiceless consonants significantly triggered more vocalization than the following voiced consonants, both in the phonological environment 'within the word' and 'across the word', confirming the hypothesis that the degree of vocalization of would vary according to voicing of the following consonant.

These results corroborate Baratieri (2005), whose results revealed that when dark was followed by a voiceless consonant it was more frequently vocalized.

5.3.3 Place of articulation

Concerning the question: "Does place of articulation of the following consonant influence the vocalization of in the English coda?", it was hypothesized that the degree of vocalization of would be influenced by place of articulation of the following consonant.

Firstly, it is important to highlight that voiced and voiceless consonants were treated without distinction here; hence the results encompass both voiced and voiceless consonant as a single entity. This treatment was due to the fact that there was a high correlation between voiced and voiceless consonants in the phonological environments bilabial, labiodental, alveolar, post-alveolar and velar (See Appendix F.a), thus voicing quality would not significantly influence the results. Table 8 presents the results.

Table 8

vocalization in the phonological environments: bilabial, labiodental, alveolar, post-alveolar and velar

Contexts	Different realizations of /l/ followed by a consonant											
	Within the word				Across the word				Both phonological environments			
	N	Grade Median	Grade min	Grade max	N	Grade Median	Grade min	Grade max	N	Grade Median	Grade min	Grade max
Bilabial	162											

the word' (X^2 (4, N = 20) = 33.397, p < .05); and (c) both phonological environments together (X^2 (4, N = 20) = 47.222, p < .05).

Consequently, in order to verify whether the differences between different pairs of levels of place of articulation were significant between themselves, several Wilcoxon Signed Ranks Tests were run[32]. The results are displayed on Table 9.

Table 9

Difference significance between the levels of the variable place of articulation

	Place of articulation	Labiodental	Alveolar	Post-alveolar	Velar
Within word	Bilabial	Z = -2.680**	Z = -3.680**	Z = -2.701**	Z = -2.964**
	Labiodental		Z = -3.432**	Z = -.786	Z = -.263
	Alveolar			Z = -3.124**	Z = -3.260**
	Post-alveolar				Z = -.853
Across Word	Bilabial	Z = -2.939**	Z = -3.849**	Z = -3.181**	Z = -2.940**
	Labiodental		Z = -3.300**	Z = -1.658	Z = -.313
	Alveolar			Z = -2.343*	Z = -3.662**
	Post-alveolar				Z = -2.039*
Both contexts	Bilabial	Z = -3.510**	Z = -3.920**	Z = -3.621**	Z = -3.360**
	Labiodental		Z = -3.883**	Z = -1.952	Z = -.373
	Alveolar			Z = -3.680**	Z = -3.771**
	Post-alveolar				Z = -2.113*

* p < 0.05 - ** p < 0.01

The tests yielded that most of the differences were significant, except for the pairs labiodental vs. post-alveolar and labiodental vs. velar in all phonological environments, and post-alveolar vs. velar in the phonological environment consonant within the word. However, as can be seen in Figure 11, the vocalization of follows a 'V' pattern with a central point and two wings. The central point refers to the

[32] It is necessary to stress that running so many Wilcoxon tests increases the chances of statistical error. Thus, the results should be regarded with extreme caution.

vocalization of when followed by alveolar consonant. The left wing refers to the vocalization of when followed by bilabial and labiodental consonants, and the right wing refers to the vocalization of when followed by post-alveolar and velar consonants.

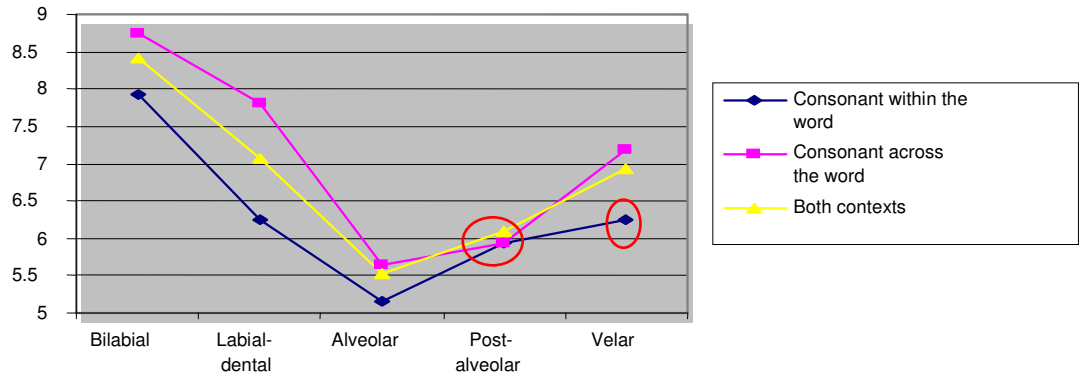


Figure 11: Degree of vocalization of according to place of articulation of the following consonant

Thus, the difference between the degrees of vocalization within the left wing was significant for each pair (bilabial – labiodental, bilabial – alveolar and labiodental – alveolar), the bilabial consonant being the phonological environment that most favored vocalization and the alveolar the phonological environment that less favored it. Also, the results within the right wing presented significant difference between all pairs, except for the pair post-alveolar - velar, in the context within the word, (Figure 11, red circles). However, it is at least possible to claim that there is a tendency concerning these two places of articulation, the velar one being the environment in which vocalization would more frequently occur. Furthermore, the left wing surpassed the right wing in triggering vocalization in all contexts.

Statistical significance apart, the results clearly show that the vocalization of was more hindered by the following alveolar consonant and the farther from the alveolar point was the place of articulation of the consonant that follows the , the greater was the degree of its vocalization, in both left and right wing. Therefore, the hypothesis that the degree of vocalization of would be influenced by place of articulation of the following consonant was confirmed since it varied from phonological environment to phonological environment.

5.3.3.1 The results in the light of literature

The finding of the present study corroborates scholars' traditional claims that vocalization is the result of central alveolar contact loss, which would be more favored before velars and labials, than before apicals and palatals. It is advocated that the tongue configuration for velars (a high back closure and a lowered predorsum) would favor the apical contact loss, hence the tongue would adopt a / like feature; for labials, it is advocated that there is no lingual activity, which would also favor the dark apical contact loss (Grammont, 1971; Hartcastle & Barry, 1985; Ohala & Kawasaki, 1984; Straka, 1968, all cited in Recasens, 1996;).

I would suggest that vocalization would be favored or inhibited by the homorganicity of gestures between the and the following consonant. That is, when the following consonant was a velar one, the vocalic gesture of the would be emphasized since it is homorganic of the most salient gesture of the velars, and when the following consonant was a coronal one, the consonantal gesture of the would

be emphasized since it is homorganic of the most salient gesture of the alveolars. I would also suggest that the labial segments have to do with the secondary articulation of the glide / (labial protuberance), which would facilitate the dark vocalization.

However, the scholars' claims do not account for what happens in a considerable number of Romance language dialects, in which the dark vocalization is more frequent before coronals (dental and alveolar stops, fricatives, and affricatives) than before labials, velars and pause (e.g., the following coronal consonant seems to favor the vocalization of the liquid in comparison to bilabial and dorsal consonants (Lamprecht, 2004)). Thus, taking into account that the participants of this research are Brazilian EFL learners, and that the results showed that the pattern of their vocalization corroborates traditional beliefs and not what occurs with the BP , it may be argued that rather than native language transfer, an interlanguage development process operates in the acquisition of the in the English coda. If native language transfer were operating exclusively vocalization would be more frequent before alveolar consonants, but in fact the results pointed to an opposite trend.

5.3.4 Manner of articulation

The question of the present research concerning manner of articulation read: "Does manner of articulation of the following consonant influence the vocalization of in the English coda?", and it was hypothesized that the degree of vocalization of would be influenced by manner of articulation of the following consonant. Table 10 presents the results of this investigation.

Table 10

vocalization in the phonological environments: plosive, nasal and fricatives

Phonological environments	Different realizations of /l/ followed by a consonant											
	Within the word				Across the word				Both phonological environments			
	N	Grade Median	Grade min	Grade max	N	Grade Median	Grade min	Grade max	N	Grade Median	Grade min	Grade max
Plosive	468	6.35	4.58	8.33	457	7.72	2.83	9.52	925	7.03	4.33	8.22
Nasal[1]	19	8.50	5.00	10.00	124	7.19	4.00	10.00	143	7.18	4.00	10.00
Fricative	397	6.08	4.17	8.82	436	6.36	2.14	8.13	833	6.22	3.08	7.84
	884				1017				1901			

The source data is found in Appendix G

[1] N total 160 – missed - within the word: 141 – across the word: 36

The first fact to be analyzed concerns the effects of the nasal consonants on the production. The results show that in the phonological environment ‘within the word’ most of the tokens were considered as missing tokens (141 out of 160) due to the fact that the following nasal mostly caused the nasalization of the productions. This fact corroborates the assumption that coarticulation occurred more frequently when the consonant was within the word than across the word. That is, nasalization of the production of mostly occurred when the nasal consonant was within the word (141 out of 160) than across the word (36 out of 160).

Nasalization apart, the analysis of the valid tokens detected that the behavior of followed by nasal consonant in relation to the following plosive consonants was not consistent between the phonological environments within and across the word. That is, whereas the degree of vocalization of in the phonological environment within the word was higher when followed by nasals than when followed by plosives (8.50 vs. 6.35), the opposite occurred in the phonological environment across the word

(7.19 vs. 7.72). Concerning the following fricatives, the results show that it was the environment which presented the lowest degree of vocalization of in both phonological environments.

In order to verify whether there were significant differences between the degrees of vocalization of according to each manner of articulation of the following consonant, Friedman tests were run for each phonological environment (within and across word) separately, due to the inconsistent behavior of the nasal consonants. The statistical tests revealed that the difference between the degrees of vocalization according to the manner of articulation of the following consonant was significant for both phonological environments: (a) 'consonant within the word' (X^2 (2, N = 6) = 7.000, $p < .05$); (b) 'consonant across the word' (X^2 (2, N = 20) = 16.219, $p < .05$).

Consequently, in order to verify whether the differences between different pairs of levels of manner of articulation were significant between themselves, several Wilcoxon Signed Ranks Tests were run. The results are displayed on Table 11.

Table 11
Difference significance between the levels of the variable manner of articulation

	Place of articulation	Nasal	Fricative
Within Word	Plosives	Z = -1.782	Z = -1.512
	Nasal		Z = -1.992*
Across Word	Plosives	Z = -.414	Z = -3.724**
	Nasal		Z = -2.417*

* $p < 0.05$ - ** $p < 0.01$

Due to the non-consistent effect of the nasal segment on the production in the phonological environments tested, any assumption would be just guessing. However, the statistical analysis showed that the difference between the degrees of

vocalization of when followed by nasal and when followed by plosive consonants were not significant in both phonological environment (within the word and across the word), thus, I would say that they affected the production of in a similar way.

Concerning the difference between the degrees of vocalization of when followed by plosive and when followed by fricative consonants, the results show significance for the phonological environment across the word, but non-significance for the phonological environment within the word. Taking into account that coarticulation mostly occurred in the phonological environment within the word, then, if any assumption about the effects of the following consonant on the production is to be raised, it should be raised taking into consideration the phonological environment 'within the word' only. Thus, the degree of vocalization of when followed by plosive and fricative consonants was not significantly different.

In summary, the results point to the assumption that manner of articulation of the consonant that follows the is not the decisive factor that causes its vocalization, although there is a tendency for plosives and nasals to surpass the fricatives in triggering the vocalization of . This tendency seems to be coherent since the place of articulation of fricatives is closer to the alveolar point than the place of articulation of plosives and nasals are, and as seen in section 5.3.3, the closer to the alveolar point was the place of articulation of the following consonant, the lower the degree of vocalization. However, the statistical analyses fail to confirm the hypothesis that the degree of vocalization of would be influenced by manner of articulation of the following consonant.

It is important to comment that the findings of the present study concerning the effects of manner of articulation of the following consonant on vocalization may be considered just the tip of iceberg since it is a pioneering work.

5.3.5 Place vs. manner of articulation

Which is the decisive factor in influencing the vocalization of in the English coda: place of articulation or manner of articulation of the following consonant? It was hypothesized that place of articulation of the following consonant would surpass manner of articulation of the following consonant in determining the degrees of vocalization of . Table 12 presents the results:

Table 12
Degree of vocalization (mean) – Place vs. Manner of articulation

	Manner of Articulation	Places of articulation				
		Bilabial	Labiodental	alveolar	Post-alveolar	velar
Within Word	plosive	7.68		4.94		6.52
	nasal	8.18		8.13		
	fricative		6.52	5.22	6.22	
Across Word	plosive	9.01		5.84		7.35
	nasal	7.50		6.36		
	fricative		7.42	5.23	6.32	
Both Phonological environments	plosive	8.24		5.32		6.85
	nasal	7.50		7.28		
	fricative		6.98	5.28	6.27	

The source data is found in Appendix H

The results seem to confirm the assumption that was raised in the previous section that the manner of articulation of the consonant that followed would not be the decisive factor in affecting its vocalization. The degree of vocalization of behaved similarly for both phonological environments ‘within the word’ and ‘across

the word', the place of articulation being the factor which guided vocalization of . That is, no matter the manner of articulation of the consonant that followed the , its vocalization was directed by the place of articulation of the consonant that followed it.

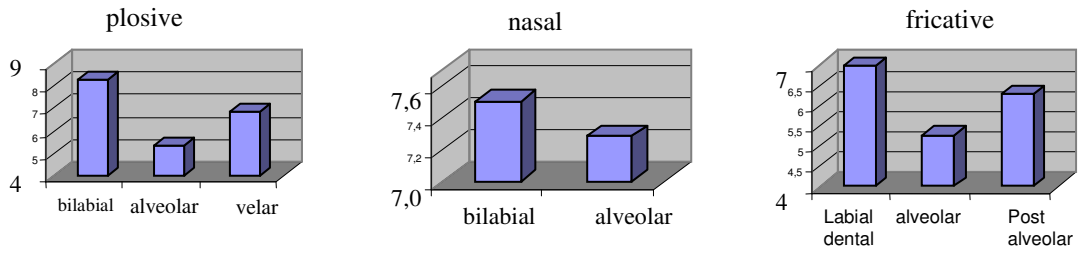


Figure 12: Degree of vocalization – manner vs. place of articulation

Figure 12 displays the behavior of vocalization in face of different manners and places of articulation. As can be grasped, vocalization occurred less frequently before alveolar consonants, either for plosives, nasals and fricatives. Furthermore, the farther the place of articulation of the consonant that followed the from the alveolar place, the greater was the degree of vocalization of .

Therefore, the hypothesis that place of articulation of the consonant that follows in the English coda would be the decisive factor in influencing its vocalization was confirmed.

5.4 Acoustic behavior of the different realizations of

Do different realizations of in the English coda affect the acoustic properties of the syllable rhyme? Hypotheses were raised concerning the syllable peak formant

frequencies, the formant frequencies, and the duration. The results regarding each hypothesis are reported in the following sub-sections and a spreadsheet with the raw acoustic values is found in Appendix K.

5.4.1 The syllable peak formant frequencies

It was hypothesized that the F3/F1 and F2/F1 ratios of the vowel in the syllable peak would vary according to the realization of . That is, different realizations of / would cause changes in the syllable peak formant frequencies. Table 13 presents the results:

Table 13

Syllable peak acoustical behavior in face of different productions of /l/

Sex	Prod:	N	Mean F1 Peak	Mean F2 Peak	Mean F3 Peak	Ratio F3/F1 mean	S.D	Ratio F2/F1 mean	S.D
male	L	1	525	1526	2493	4.74	--	2.90	--
	Lw	115	523	1636	2408	4.62	.49	3.14	.34
	W	127	515	1588	2456	4.79	.47	3.09	.32
female	L	25	660	1880	2828	4.28	.39	2.84	.51
	Lw	468	640	1900	2761	4.34	.60	2.98	.48
	W	281	615	1932	2844	4.68	.69	3.17	.49
Grand Mean	L	26	655	1866	2815	4.30	.39	2.84	.50
	Lw	583	617	1848	2692	4.39	.59	3.01	.46
	W	408	584	1825	2723	4.71	.63	3.15	.45
		1017							

The dataset treatment was the first strategy carried in order to check the hypothesis. Only the syllable peaks of the word ‘tell’ from the phonological environment followed by a consonant across the word were analyzed, thus the effect of the onset would be similar to all productions and hence the peak would be influenced mainly by different realizations of the . This strategy resulted in 1017

valid tokens which comprised three different productions of : 'L' (non-vocalized), 'Lw' (partially vocalized) and 'W' (vocalized). The overall results show that the F3/F1 and F2/F1 ratios of the vowel in the syllable peak varied according to the realization of : the more vocalized the was, the higher the ratios were ('W' > 'Lw' > 'L').

The Kruskal-Wallis test revealed that both F3/F1 and F2/F1 ratios mean differed significantly as a function of different productions of ($X^2 = 69.394$, df = 2, $p < .01$ and $X^2 = 21.041$, df = 2, $p < .01$, respectively). Thus, the Mann-Whitney Test was run for both F3/F1 and F2/F1 ratios in order to check whether the difference was significant for each pair of different productions of . The test results are displayed on table 14:

Table 14

Mann-Whitney test – ratios of the peak

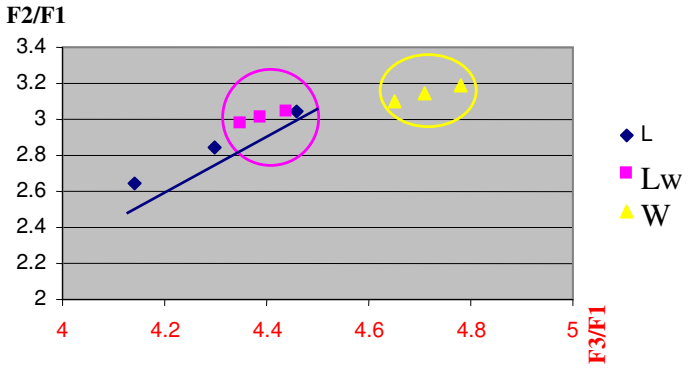
	F3/F1			F2/F1	
	'Lw'	'W'		'Lw'	'W'
'L'	Z= -.924	Z= -3.785**	'L'	Z= -1.339	Z= -2.701**
'Lw'		Z= -8.027**	'Lw'		Z= -4.158**

* $p < 0.05$ - ** $p < 0.01$

As can be inferred, the Mann-Whitney Tests yielded that the difference between both F3/F1 and F2/F1 ratios of the syllable peak was not significant when the was realized as 'L' and as 'Lw'. Thus, although there is a tendency for these ratios to be higher for the realization of as 'Lw' (F3/F1: 4.39 and F2/F1: 3.01) than as 'L' (F3/F1: 4.30 and F2/F1: 2.84), any assumption about which production of was made just by looking at the F3/F1 and F2/F1 ratios of the peak would be imprecise. However, when the / was realized as 'W', the F3/F1 and F2/F1 ratios of the peak were both

significantly higher than when the / was realized as ‘L’ and ‘Lw’. Thus, there would be a great possibility of identifying the / realization as ‘W’ by looking at the formant frequencies of the syllable peak.

As displayed in Figure 13, the statistical test showed with confidence of 95% that the syllable peak formant frequencies behavior could denote at least the complete vocalization of the phoneme / (W) produced by the participants of the present study. Also, those productions of the / in which its syllable peak F3/F1 and F2/F1 were lower than 4.30 and 2.84 respectively could probably be classified as non-vocalized (L) at all.



Ratios		L	Lw	W
F3/F1	Min	4.14	4.35	4.65
	Mean	4.30	4.39	4.71
	Max	4.46	4.44	4.78
F2/F1	Min	2.64	2.98	3.10
	Mean	2.84	3.01	3.15
	Max	3.04	3.05	3.19

Figure 13. F3/F1 vs. F2/F1 ratios of the syllable peak – 95% confidence interval

Thus, the hypothesis that the F3/F1 and F2/F1 ratios of the vowel in the syllable peak would vary according to the realization of was partially supported. There were significant difference between the realizations of as ‘W’ and as ‘L’ and as ‘W’ and as ‘Lw’, but the difference was not significant between the realizations of as ‘L’ and as ‘Lw’.

5.4.1.1 The results in the light of Literature

The literature basically claims that the first formant frequencies of the syllable peak decrease proportionally to the degree of vocalization of the phoneme that follows it. Lehiste (1964) claims that the darker the quality of , the lower the syllable peak F2 frequency will be. Lehiste also states that the labialization of the following consonant causes a decrease in the first formant frequencies of its syllable peak. The results of the present study seem to corroborate Lehiste's since the vocalization of the caused a decrease in the first English and second formant frequencies of the syllable peak, at least.

However, although it seems true that vocalization of the causes the first formants of the syllable peak to decrease; the degree of decreasing seems to be particular for each formant and may vary according to individual differences. This study showed that the difference between the formant frequencies (ratios of F3/F1 and F2/F1) of the syllable peak seems to be a better predictor of vocalization. That is, the greater the difference between F3 – F1 and F2 – F1 frequencies, the higher the degree of vocalization. It is important to highlight that the present study only tested the vowel in the peak position, thus any generalization concerning the frequency behavior of any other vowel in the syllable peak would be inadequate.

A last remark regards the comparison between the first three formant frequencies of the syllable peak produced by the participants of the present study with the pattern of the first three formant frequencies of the English and BP vowel . Table 15 displays the frequencies and the ratios.

Table 15

English and Brazilian formant frequencies for

	N	F1	F2	F3	F3/F1	F2/F1
English average (Ladefoged, 2001)	--	550	1770	2490	4.52	3.21
BP male (Rauber, 2006)	--	497	1888	2620	5.27	3.79
BP female (Rauber, 2006)	--	611	2283	2969	4.85	3.73
Present study – male – grand mean	243	519	1609	2421	4.69	3.11
Present study – female – grand mean	774	632	1908	2796	4.47	3.04
Present study – average	1017	575	1758	2608	4.53	3.05

The most relevant fact is that the formants average of the present study was similar to those of the English, except for the third formant frequency which presented some discrepancy. However, due to the fact that the F1 and F2 frequencies are related to both vowel height and frontness respectively (Stevens, 1997) I would say that the participants of this study are producing the / in a similar articulatory way the English average. Concerning the comparison between the present study first formant frequencies of the / with the BP / , the F1 frequency mean of the present study was a little higher than the F1 frequency mean of BP whereas the F2 and F3 frequency mean of the present study were lower than the F2 and F3 frequency mean of BP.

The fact that the participants of the present study produced the / acoustically more similarly to the English / than to the BP / may be seen as evidence that their interlanguage is evolving and hence they are overcoming the strategy of L1 transfer.

5.4.2 The formant frequencies of different productions of

It was hypothesized that the F3/F1 and F2/F1 ratios of would vary according to its realization. That is, different realizations of / would cause changes in its formant frequencies.

Table 16 shows that the means of both F3/F1 and F2/F1 ratios of the varied according to its realization, being higher when the was partially vocalized (Lw) than when the was totally-vocalized (W), which was higher than when the was non-vocalized (L) – ('Lw' > 'W' > 'L').

Table 16
Acoustical behavior of different productions of /l/

Sex	Productions	N	Mean F1	Mean F2	Mean F3	Ratio F3/F1 mean	S.D	Ratio F2/F1 mean	S.D
Male	L	9	512	1042	2276	4.56	.99	2.10	.55
	Lw	273	497	1015	2371	4.84	.72	2.07	.34
	W	239	501	1010	2307	4.69	.72	2.05	.37
Female	L	48	571	1234	2736	4.95	1.07	2.22	.43
	Lw	1046	530	1229	2787	5.36	.86	2.37	.50
	W	519	529	1204	2661	5.17	.98	2.34	.63
Average Male Female	L	57	562	1204	2663	4.89	1.02	2.20	.45
	Lw	1319	523	1185	2701	5.25	.86	2.30	.48
	W	758	520	1143	2549	5.02	.93	2.25	.58
		2134							

The Kruskal-Wallis test revealed that both F3/F1 and F2/F1 ratios mean differed significantly as a function of different productions of ($X^2 = 55.866$, df = 2, $p < .05$ and $X^2 = 21.654$, df = 2, $p < .05$, respectively). Thus, the Mann-Whitney Tests were run for both F3/F1 and F2/F1 ratios in order to check whether the differences were

significant for each pair of different productions of . The results are displayed in table 17:

Table 17

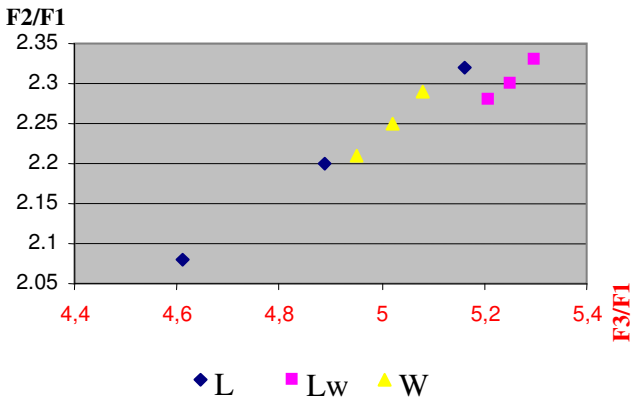
Mann-Whitney test – ratios of the peak

	F3/F1			F2/F1	
	'Lw'	'W'		'Lw'	'W'
'L'	Z= 2.732**	Z= .797	'L'	Z= 1.316	Z= .109
'Lw'		Z= 2.230**	'Lw'		Z= 4.593**

* $p < 0.05$ - ** $p < 0.01$

Concerning the F3/F1 ratios, there was no significant difference between the realizations of / as 'L' and as 'W', but the ratio of 'Lw' was significantly higher than the ratio of 'L' and the ratio of 'W'. Concerning the F2/F1 ratios, the Mann-Whitney Tests showed that only the ratio of the realizations of / as 'Lw' was significantly higher than the realizations of / as 'W'.

Figure 14 presents a scatterplot with F3/F1 and F2/F1 ratio means within the confidence interval of 95%.



Means

Ratio		L	Lw	W
F3/F1	Min	4,61	5,21	4,95
	Mean	4,89	5,25	5,02
	Max	5,16	5,30	5,08
F2/F1	Min	2,08	2,28	2,21
	Mean	2,20	2,30	2,25
	Max	2,32	2,33	2,29

Figure 14: F3/F1 vs. F2/F1 ratios of the realizations of /l/ – 95% confidence interval

As can be inferred, the ratios of the realizations of / as 'L' and as 'W' surpass one another in both F3/F2 and F2/F1, thus the difference between them are not significant. The only realization which differs from the other two is the 'Lw', at least in relation to F3/F1 ratio.

Thus, although the ratio varied according to the realizations of / , the hypothesis raised was only partially supported due to the fact that the F3/F1 and F2/F1 ratios were only significantly higher for the / realized as 'Lw' than the realizations of / as 'L' and as 'W'. Thus any attempt to link the ratios value to the / realization would fail, except for 'Lw'. However, statistical significance apart, it is important to highlight that the result concerning the realizations of / as 'Lw' is somehow unexpected and odd under the light of literature, as discussed in the section below.

5.4.2.1 The results in the light of literature

The pertinent literature traditionally describes the acoustic properties of the realizations of focusing on their two allophones: 'clear' and 'dark'. However, the present study did not describe the realizations of in terms of 'dark' or 'clear', but in terms of presence or absence of consonantal and vocalic gestures. The productions labeled as 'L' comprise the realizations of with only the consonantal gesture (tongue – alveolar); the productions labeled as 'W' comprise the realizations of with only the vocalic gesture (tongue retraction and lip-rounding); and the productions labeled as 'Lw' comprise both realizations of . Thus, in order to make a parallel with the literature, I would link the realization of as 'L' as having the lowest

degree of darkness and the realization of as 'W' as having the highest degree of darkness and labialization; the realization of as 'Lw' would lie in between them.

In order to situate the reader and enhance understanding, the means of the formant frequencies and ratios of the present study are displayed in table 18. Furthermore, with the aim of assisting further studies, figures of spectrograms and spectra of each realization of are displayed in Appendix J.

Table 18

Formant frequencies and ratios of different realizations of

Production	N	F1	F2	F3	F3/F1	S.D	F2/F1	S.D
L	57	562	1204	2663	4.89	1.02	2.20	.45
Lw	1319	523	1185	2701	5.25	.86	2.30	.48
W	758	520	1143	2549	5.02	.93	2.25	.58

Concerning F2, the results seems to agree with the literature since the more vocalized and darker the realizations of were, the lower the frequency was. For example, Hayward (2000) and Llisterri and Daudén (1990) claim that the second formant frequency of the is lower for the dark than for the clear , and there is even a greater frequency reduction when vocalization takes place. That is, the darker the the lower its F2 would be.

As regard F1, the results show an opposite tendency from the literature since the darker and more vocalized the realizations of were, the greater the tongue retraction and consequently the higher the F1 would be. For example, Lehiste (1964) states, that the dark has a higher F1 frequency than the clear . Although the

behavior of the F1 is mostly influenced by tongue height, concerning realizations, I believe that the darker the production is, the lower and more retracted the tongue will be, increasing F1 frequency. The tongue would be lower due to weakness or absence of a consonantal gesture. This articulatory behavior corroborates Sproat and Fujimura's (l993) claim that tongue retraction and dorsum lowering are present in dark realizations.

Taking both F1 and F2 into consideration, the closer the F1 and F2 are together the darker the is. Ladefoged (2001) contributes with this idea by proposing that the closer the F1 and F2 are together, the more back the sound is. Thus, the results also do not contribute since the ratio F2/F1 showed odd behavior, being higher for the realizations of as 'Lw' and lower for the realizations of as 'L', whereas the realizations of as 'W' presented F2/F1 ratio in between them.

Concerning the F3, the highest frequency for the realization of as 'Lw' was also unexpected. Taking into consideration that F3 is not significantly affected by lingual activity, but by labial protuberance, which would cause its decrease (Lehilse, 1964; Stevens, 1997), then the F3 would be higher for the realizations of as 'L' then as 'Lw', which would have a higher F3 than the realizations of as 'W'.

The odd and unexpected behavior of the first and third formants of may be due to the effect of the following environment on their frequencies. For example, each particular realization of could have presented different acoustical behavior due to the action of the following environment. However, to conduct such an investigation, the realization of should be stable in order to minimize circular effects.

5.4.2.2 A comparison between the formant frequencies and ratios of

The present study analyzed 57 productions of as 'L', 1.319 as 'Lw' and 758 as 'W'. Table 19 presents their first three formants frequencies, ratios, as well as the formant frequencies and ratios of the dark / and in coda position gathered from the literature.

Table 19

Formant frequencies of and

Production		F1	F2	F3	F3/F1	F2/F1
The present study	L	562	1204	2663	4.89	2.20
The present study	Lw	523	1185	2701	5.25	2.30
The present study	W	520	1143	2549	5.02	2.25
Llisterri and Daudén (1990)	Catalan dark /l/	--	874 -	1039	--	--
Ladefoged and Maddieson (1996)	General dark /l/	--	900 -	1000	--	--
Dalston (1975)	E male /l/ onset	--	1179	--	--	--
Dalston (1975)	E female /l/ onset	--	1340	--	--	--
Dalston (1975)	E male /w/ onset	--	732	--	--	--
Dalston (1975)	E male /w/ onset	--	799	--	--	--
Ladefoged and Maddieson (1996)	E dark /l/	510	870	--	--	1.70
Ladefoged and Maddieson (1996)	E /w/	545	850	--	--	1.55
Silva (1997)	BP vocalized /l/	340	829	--	--	2.44
Macquarie University homepage	/w/	250 - 450	600 -	850	--	-- 2.07
Macquarie University homepage	dark /l/	450	750	--	--	1.67

Concerning the F1 frequencies, all realizations of of this study present similar frequencies to those of the English dark and presented by Ladefoged and Maddieson (1996). However, the frequency of the production of as 'W' was much higher than the vocalized BP presented by Silva (1997). Thus, generalizations apart, it seems that the participants of the present study realized the much more similarly to the English and than to the BP in terms of F1 frequency.

As regards the F2 frequency, the findings of the present study most approximate the frequencies found by Dalston (1975) and Llisterri and Daudén (1990) in relation to the phoneme , but were far from the English F2 frequencies proposed by Ladefoged and Maddieson (1996) and Macquarie University homepage (http://www.ling.mq.edu.au/speech/acoustic/consonants/approxweb.html). Concerning the glide , all the literature set its frequency around 800 Hz; however the realizations of as 'W' in the present study presented a much higher frequency.

Due to the discrepancy between the results of the present study and the literature, any generalization about linking the formant frequencies with the realizations of would have to be done with caution.

Therefore, although the F3/F1 and F2/F1 ratios were significantly higher for the realizations of as 'Lw' than for the realizations of / as 'L' and as 'W', partially supporting the hypothesis that the ratios would vary according the realization of / , I would have the consciousness of saying that any generalization on this issue could be seen just as guessing.

5.4.2.3 Alternative proposal

It is claimed that the F2 would differentiate the clear , the dark and the , being lower for the latter and higher for the former, due to the degree of tongue retraction (Delattre,1951, cited in Llisterri & Daudén, 1990; Lehiste, 1964).

However, in an analysis of data from several American English speakers, Ladefoged and Maddieson (1996) found that the dark and the in coda position

have similar formant frequencies (→ F1: 510, F2: 870 and → F1: 545, F2: 850). In the present study the productions of as 'L', 'Lw' and 'W' also presented similar formants (F1→ 562-523-520, F2 → 1204-1185-1143). In spite of the differences in the F2 values across the studies, the formant frequencies between the different phone realizations were consistently similar within the studies, which hindered the link between formant frequencies and phone realizations.

Thus, based on Ladefoged and Maddieson (1996) and on the findings of the present study, I propose that the formant frequency differences would be insufficient to assure whether the realizations of were vocalized or not due to the fact they lay too close together.

I would argue that the articulators' gestures, which would be responsible for determining the first formant frequencies, do not reach their full target when the is in coda position due to the weakness of the segment in this position, thus their effect on the first formant frequencies would be minimized. Consequently, the different realizations of in the English coda would present similar F1, F2 and F3 which would at least blur their distinction in terms of formant frequencies.

Sproat and Fujimura (1993) commented that consonants are more weakly articulated in syllable-final than in syllable initial position, thus no matter the realizations of in coda position, I suppose they would be weakly articulated and hence their first formants would not vary enough to discriminate one realization from another in terms of frequencies.

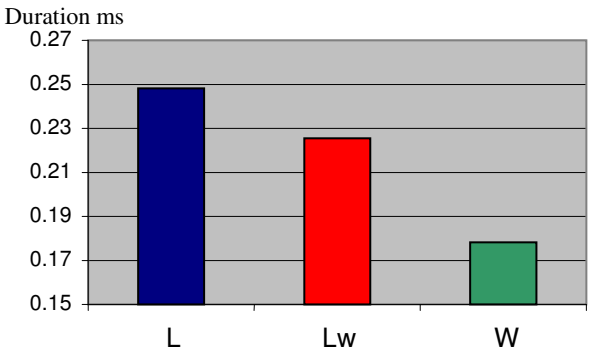
It is important to highlight that the pertinent literature claims that other acoustic features, such as first formants bandwidth, amplitude and pole-zeros at high frequencies

could differentiate one realization of from another. These features were not investigated in the present study, though.

5.4.3 Duration

It was hypothesized that the mean of duration of the period which encompasses the vowel and would vary according to different realizations of in the English coda. Table 20 presents the results:

Table 20
Duration of different productions of /l/

Sex	Prod.	N	Mean Duration (s)	Graph
male	L	9	.23164	
	Lw	273	.21297	
	W	239	.16836	
female	L	48	.25597	
	Lw	1046	.22671	
	W	519	.19032	
Median Male Female	L	57	.24840	
	Lw	1319	.22540	
	W	758	.17815	

The duration of the period which encompasses the vowel and showed consistency for both male and female participants, being higher for the realization of as 'L' than as 'Lw', which presented a higher duration than 'W', thus the statistical tests were run without distinction between participants' gender.

The Kruskal-Wallis test revealed that the duration differed significantly as a function of different realizations of (X^2 = 309.333, df = 2, $p < .05$). Thus, the Mann-Whitney Tests were run in order to check whether the differences were

significant for each pair of different productions of . The results are displayed in Table 21:

Table 21

Mann-Whitney test – duration from the peak beginning to the end

	'Lw'	'W'
'L'	Z= -4.197*	Z= -8.873*
'Lw'		Z= -16.594*

* $p < 0.001$

As can be seen, the statistical test showed that the duration measured from the peak beginning to the end was significantly higher for the realization of as 'L' (.24840 s.) than as 'Lw' (.22540 s.) – (Z= -4.197); and the realization of / as 'Lw' had a significantly higher duration than the realization of / as 'W' (.22540 s. vs. .17815 s.) – (Z= -16.594).

Thus, it could be claimed that the duration which encompasses the peak and the is a good predictor of the realization of as 'L', 'Lw' and 'W', supporting the hypothesis that the duration of the period which encompasses the vowel and would vary according to different realizations of in the English coda.

5.4.3.1 The results in the light of literature

Dalston (1975) demonstrated that the has longer steady-state duration than , and claims that whereas the tongue is in resting position for , there is a

contact between it and the alveolar ridge for , resulting in gesture delay. The present study at least confirmed that the duration of the syllable peak plus the phoneme in coda position varies according to the realization of . Taking into consideration that the syllable peak was the same vowel for all productions of the present study, I would claim that the differences in duration would be caused mostly by the different productions of the . I would propose that the more marked the production of / in terms of articulatory gestures, the longer the duration would be.

However, in order to accept the assumption that the more marked the production of / in terms of articulatory gestures, the longer the duration, it is necessary to show that the non-vocalized production (L) would be more marked than the partially-vocalized one (Lw), which would be more marked than the vocalized one (W).

Thus, I would claim that the present study production of classified as 'L' mostly approximates Sproat and Fujimura (1993) definition of the dark - the combination of the vocalic gesture of tongue retraction followed by the consonantal gesture of tongue touching the dental/alveolar area – that is, the production of classified as 'L' would be mainly characterized by two lingual gestures, its retraction followed by its tip raising. Hence, it would be appropriate to presume that the production of classified as 'L' would be more marked than the productions of classified as 'W' due to the fact the latter is realized with only the single vocalic gesture. As regards the production of classified as 'Lw', I would assume that it would be more marked than the production of classified as 'W', due to the presence of both vocalic and consonantal gesture, but less marked than the production of

classified as ‘L’, due to the fact that the consonantal gesture of ‘Lw’ would be weaker than the consonantal gesture of ‘L’. Consequently, the duration of ‘L’ would be greater than ‘Lw’, which would be greater than ‘W’, confirming the findings of the present study.

However, the realizations of of the present study were classified perceptually by the judges, with the aid of acoustic clues, but without any device which could measure the actual articulators’ gestures. Hence, an analysis taking into account only the presence or absence of the most salient gestures of the realizations of would be more appropriate, since that was the perceptual strategy used by the judges to classify the productions. That is, the realization of as ‘L’ was mainly characterized by the presence of the consonantal gesture, whereas the realization of as ‘W’ was mainly characterized by the absence of it and by the presence of lip-rounding. The realization of as ‘Lw’ was characterized by the presence of both consonantal gesture and lip-rounding. The consonantal gesture has to do with lingual movement, thus present in the realization of as ‘L’ whereas the tongue is in resting position in the realization of as ‘W’. Thus, the presence of an active lingual gesture would cause an increase in the duration of the segment. Hence, the duration of the realization of as ‘L’ would be greater than the duration of the realization of as ‘W’. The duration of the realization of as ‘Lw’ would be intermediate between the realization of as ‘L’ and as ‘W’ due to the fact that the consonantal gesture would be present but weaker than for the realization of as ‘L’.

In summary, I would argue that the presence of the consonantal gesture would increase the duration of , which would vary proportionally according to the intensity of the consonantal gesture. That is, the more intense the consonantal gesture, the longer the duration of .

CHAPTER 6

CONCLUSIONS

6.1. Final remarks

The main objectives of the present study were to investigate: (1) How Brazilian EFL learners produce in the English coda; (2) the influence of the following phonological environment on the production of concerning: (a) a pause, a consonant within the word and a consonant across the word; (b) voicing; (c) place of articulation; and (d) manner of articulation; and (3) the effect of different realizations of on the acoustic properties of the syllable rhyme concerning: (a) the F3/F1 and F2/F1 ratios of the syllable peak; (b) the F3/F1 and F2/F1 ratios of the phoneme ; and (c) the duration of the vowel in the peak plus .

The main findings of this investigation and the assumptions raised are summarized below.

Finding 1: The participants of the present research produced the in the English coda in three main different ways: (a) partially vocalized – 'Lw' (61.8%); (b) vocalized – 'W' (35.5%); and (c) non-vocalized – 'L' (2.7%). On the one hand, the vocalized realizations of may indicate that L1 transfer played a role in shaping the participants' interlanguage. On the other hand, the high occurrence of partially vocalized productions may indicate that an interlanguage developmental process was operating in the acquisition of traces of the English dark .

Finding 2: The phonological environments ‘pause’ and ‘consonant across the word’ following significantly triggered more vocalization than the phonological environment ‘consonant within the word’. The difference in the degrees of vocalization of ‘pause’ and ‘consonant across the word’ were not significant, though. The results do not corroborate the tendencies found in Baratieri (2005), and Moore (2004), but corroborate traditional beliefs that vocalization is more favored in prepausal position, as well as before velars and labials, than before apicals and palatals (Straka, 1968; Grammont, 1971; Ohala & Kawasaki, 1984; Hartcastle & Barry, 1985, all cited in Recasens, 1996). The non-significant difference between the phonological environments ‘pause’ and ‘consonant across the word’ may be due to the absence of the process of coarticulation in these cases, or at least to its avoidance to a certain degree. Thus, if the absence of coarticulation favors vocalization, then its presence would inhibit it, which was confirmed by the lower degree of vocalization before the phonological environment ‘consonant with the word’.

Finding 3: A following voiceless consonant significantly triggered more vocalization than a following voiced one. This result corroborates Baratieri (2005).

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Finding 4: The results showed that the farther the place of articulation of the following consonant from the alveolar point the greater the degree of vocalization was. The results corroborate the traditional beliefs that vocalization is more favored before velars and labials, than before apicals and palatals (Straka, 1968; Grammont, 1971; Ohala & Kawasaki, 1984; Hartcastle & Barry, 1985, all cited in Recasens, 1996); and

cannot be related to L1 transfer, since vocalization of BP is more favored before apicals and palatals than before velars and labials (Recasens, 1996; Lampretch, 2004). The results seem to signal that vocalization is favored or inhibited by the homorganicity of gestures between and the following consonant. That is, in the realization of the gesture homorganic with the following consonant is emphasized. The results also suggest that labial segments facilitate vocalization due to labial protuberance. In summary, the results indicated that rather than L1 transfer, an interlanguage developmental process is operating in the acquisition of in the English coda by the participants of this research, since vocalization was not favored before alveolar consonants, as occurs with BP . In fact, the results, pointed to an opposite direction, that is, vocalization was inhibited before alveolar consonants and favored before labials and velars, as occurs with some varieties of English in coda position.

Finding 5: The results indicated a tendency for to be more frequently vocalized when followed by a plosive or a nasal consonant than when followed by a fricative. However, the statistical analyses failed to confirm the hypothesis that the degree of vocalization would be influenced by manner of articulation of the following consonant. Considering that place of articulation is the decisive factor that influences vocalization, the alveolar consonants being the ones which inhibit it, and the farther the place of articulation of the following consonant from the alveolar point, the greater the degree of vocalization, then the tendency found in relation to manner of articulation seems to be coherent; that is, fricatives would cause less vocalization than plosives

and nasals due to the fact that their place of articulation are closer to the alveolar point than plosives and nasals are.

Finding 6: The results showed that the place of articulation of the following consonant was the decisive factor of influence on vocalization. That is, vocalization occurred less frequently before alveolar consonants and the farther the place of articulation from the alveolar place, the greater the degree of vocalization. This fact was consistent also for plosives, nasals and fricatives.

Finding 7: The overall results showed that the F3/F1 and F2/F1 ratios of the vowel in the syllable peak were higher the more vocalized the was ('W' > 'Lw' > 'L'). However, they were only significantly higher for the realizations of as 'W', whereas for the realizations of as 'Lw' and 'L', they did not differ significantly. That is, it was statistically possible to identify only the realizations of as 'W' by looking at the formant frequencies of its syllable peak. Moreover, taking into account the confidence interval of 95%, the realizations of whose F3/F1 and F2/F1 ratios of the vowel in the syllable peak were lower than 4.30 and 2.84, respectively, could be identified as 'L'. The results seem to corroborate the literature in terms of the behavior of the syllable peak formants in face of vocalization effects: the darker and more labialized the is, the lower the syllable peak formant frequencies are (Lehilse, 1964). However, since raw formant frequencies vary greatly according to individual vocal tract differences, it can be suggested that the difference between the first formant frequencies seems to be a

better predictor of vocalization, thus it can be proposed that the greater the F3/F1 and F2/F1 ratios of the syllable peak, the higher is the degree of vocalization.

Finding 8: The results showed that the ratio F3/F1 of / for 'Lw' was significantly higher than for 'W' and 'L'; whereas the ratio F2/F1 of / for 'Lw' was only significantly higher than for 'W'. Thus, it was statistically possible to identify the realizations of as 'Lw' by looking at the F3/F1 only. However, the fact that the realizations of / as 'Lw' presented the highest ratios, whereas the ratios of / as 'W' and 'L' surpassed one another can be seen as an unexpected result since it was assumed that the ratios of 'Lw' would lie in between the ratios of 'L' and 'W'. Moreover, only the results concerning F2 corroborate the values found in the literature (Dalston, 1975; Llisterri and Daudén,1990). Besides that, the literature mostly approach the realizations of as clear and dark, whereas the realizations / in the present study are not approached in such terms, but in terms of presence or absence of consonantal and vocalic gestures. Thus, any link between the previous literature and the results of the present study must be seen with caution.

In spite of these facts, and based on the results of the present study and on Ladefoged and Maddieson (1986), it is proposed that the first formants frequency seems to be insufficient to confidently differentiate one realization of from another, since they lay too close together due to the fact that the articulators involved in the production of these segments do not reach the target completely.

Finding 9: The duration of the realizations of / as 'L' was significantly greater than those of / as 'Lw' which, in turn, were significantly greater than the realizations of / as 'W'. Therefore, it seems possible to identify the realization of / by looking at its duration, since, the more vocalized the / the shorter the duration. This fact may be explained by the fact that 'L' seems to have a more marked lingual activity than 'W' resulting in gesture delay. The 'Lw' would lie in between 'L' and 'W'.

6.2 Pedagogical implications

I begin this section referring to the discussion in Baptista (1995) who advocates that the earlier the learner's awareness of the differences between L1 and L2 sound systems arises, the greater the chances of minimizing fossilization at the phonological level.

I further argue that foreign language teachers should be aware of the differences between L1 and L2 sound systems in order to be able to assist learners in overcoming L1 transfer.

Besides that, I also advocate that both teachers and material writers should consider the research on interlanguage phonology in order to produce materials for the teaching of EFL. Pedagogical materials should focus on L1 and L2 sound system differences and bring specific pronunciation activities for enhancing the development of interlanguage and avoid negative transfer.

The present study contributes to the field, more specifically to the area of English pronunciation acquisition by Brazilians with the following results and suggestions:

1. The BP speakers, learners of English who participated in the present study, vocalized or partially vocalized the / in the English coda. That means that they fully transferred the BP / or / or that they transferred, at least, the feature of labialization. Thus, teaching the differences between the English and BP / at the very beginning stages of instruction could minimize negative transfer and hence fossilization. However, the teachers as well as the material writers should be attentive to language change processes, and include up-to-date information in the materials and in their teaching practice. For example, Johnson and Britain (2003) indicate that / vocalization in coda position is spreading over English speaking countries, especially in informal rapid speech, thus this phenomenon should be accounted in EFL materials and approached in classes. However, it must be highlighted that although English / may be vocalized in some dialects, its vocalization does not have the same features of BP vocalization. In the former, vocalization means suppressing the apical/alveolar gesture exclusively, and in the latter vocalization means both the suppression of the apical/alveolar gesture and the addition of lip-rounding. Thus, treating the BP and English / in coda as the same entity would enhance negative transfer of labialization and probably consequent fossilization of a wrong feature.

2. The results of the present study indicate that the degree of / vocalization was higher before a ‘pause’ than before a ‘consonant within the word’. Besides that, the following voiceless consonants triggered higher degrees of / vocalization than the voiced ones. Moreover, the degree of vocalization in terms of place of articulation followed a decreasing order from bilabials, to labiodentals, velars, post-alveolars, and then to alveolars. Thus, awareness of these facts might facilitate

teaching and learning of the English final / since possible problems may be accounted for. Moreover, considering that communication does not occur by words in isolation, and that coarticulation shapes the production of sounds, teaching words in connected speech seems to be much more productive and authentic than dealing with words in isolation.

3. The results concerning experimental phonetics enlighten the field of acoustic phonetics with valuable data which may be used by researchers, electronic engineers and speech synthesis technicians in order to enhance electronic communication. For example, by analyzing the first formant frequencies and the duration of the first segment in coda position it was possible to identify whether / was vocalized, partially vocalized, or non-vocalized. Consequently, these data could be used to produce these phones electronically in a more natural form.

6.3 Limitations and suggestions for further research

Besides the unbalanced number of participants in terms of gender, only 5 out of 20 being male, a study including more participants would provide a greater number of valid tokens and hence generalizations would gain more power.

The present study only accounted for the vowel / in the syllable peak, thus further studies testing other vowels in this environment would add to the findings of the present study. Also, it would be useful to conduct research in order to analyze the effects of the syllable peak on the realization of the English final / . That would clarify which syllabic environment as a whole favors or inhibits its vocalization. Besides that, studies accounting for the realization of the syllabic / would add to the field as well.

Although the use of a carrier sentence in slides may have hindered reading, and hence given the test a more free-speech-like feature, real free speech could have triggered different rates of / vocalization. However, it would be very difficult to gather tokens of the contexts covered in the present study in real free speech collection procedure.

Considering that some scholars agree that / vocalization is the result of articulatory change due to affinity of the gestures (e.g., Camara Jr., 1973; and Grammont, 1971; Ohala & Kawasaki, 1984, cited in Recasens, 1996) and others agree that it is the result of misperception due to acoustic similarity (Ohala, 1974, 1981, 1985; von Essen, 1964, cited in Recasens, 1996), studies on the relationship between perception and production would enlighten the field.

Concerning acoustic phonetics, the present study did not analyze / in terms of amplitude and bandwidth. Besides that, the effects of the following consonant on the acoustic properties of each realization of / were not investigated. The pertinent literature claims that there is a clear link between them. Thus, future research in this sense is greatly advisable.

Finally, it is clear from this modest study that the scope of issues on acoustic and articulatory phonetics and their relationship is vast and hence much needs to be accounted for. Hopefully the findings of the present study will contribute for the enrichment of the field and the gaps left here will encourage further studies.

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APPENDICES

APPENDIX A

Universidade Federal de Santa Catarina
Curso de Pós-Graduação em Inglês English Literaturas Correspondentes
Aluno: Jacir Paulo Baratieri
Orientadora: Drª Rosana Denise Koerich

QUESTIONÁRIO SOBRE O PERFIL DOS PARTICIPANTES

Por favor, responda às perguntas abaixo. Este questionário visa somente obter informações que serão utilizadas para direcionar a análise dos dados da pesquisa conduzida pelo aluno acima citado. Em nenhuma hipótese os nomes dos participantes serão divulgados, pois se trata de uma pesquisa quantitativa. Solicito informar nome, telefone English e-mail somente para, no caso de necessitar alguma informação adicional, poder entrar em contato com você posteriormente.

1. NOME: _____ 2. DATA: _____

3. IDADE: _____ 4. SEXO: FEM / MASC 5. TEL: ( ) -_____

Responda às perguntas abaixo tendo em mente que o objetivo é traçar um perfil de seu contato com a língua inglesa. Tente ser o mais específico/a possível. Faça qualquer tipo de comentário que julgar interessante para dar uma visão fiel deste contato.

6. Estudou Inglês no colégio? SIM / NÃO

7. Desde que série? _____

8. Qual sua idade na época? _____

9. As aulas exploravam comunicação escrita English oral?

_____

_____

10. Fez curso de inglês? SIM / NÃO

11. Quais cursos/escolas?

CURSOS						ESCOLAS	QUANTOS SEMESTRES?	QUANTAS HORAS?	
C	A	B	I	A	OUTRO			SEMANA	SEMESTRE
C=crianças A=adolescentes B=básico I=intermediário A=avançado									

12. Faz algum curso de inglês no momento? SIM / NÃO

13. Qual nível/semestre/fase que freqüenta no momento? _____

14. Quantas horas semanais tem este curso? _____

15. Quantas horas por semana, além do curso, você dedica ao estudo da língua inglesa / a atividades para aperfeiçoar seu inglês?

_____

16. Tem vivência em país de língua inglesa? (mais de 1 mês) SIM / NÃO

17. Por quanto tempo? _____ Qual sua idade na época? _____

18. Freqüentou escola naquele país? SIM / NÃO

19. Que tipo de escola/ curso?

_____

20. Conversa com freqüência em inglês com outros brasileiros? SIM / NÃO

21. Conversa com freqüência em inglês com falantes nativos? SIM / NÃO

22. Assiste filmes sem dublagem com freqüência? SIM / NÃO

23. Ouve música em inglês com freqüência? SIM / NÃO

28. Canta em inglês? SIM / NÃO

24. Transcreve (tira) letras de músicas em inglês? SIM / NÃO

25. Estuda, estudou, ou tem contato com outra língua estrangeira? SIM / NÃO

26. Em que contexto? (escola, na família...) _____

27. Qual língua? _____

28. Em que cidade foi criado/a? _____

29. Qual seu sotaque no português? (por exemplo: norte/ nordeste/sul do país, do estado)

Paranaense	Catarinense	Gaúcho	Carioca	Paulista	Outro

Universidade Federal de Santa Catarina
Curso de Pós-Graduação em Inglês English Literaturas Correspondentes
Aluno: Jacir Paulo Baratieri
Orientadora: Drª Rosana Denise Koerich

PARTICIPANTS PROFILE QUESTIONNAIRE

Please answer the questions below. This questionnaire aims only at gathering information that will help in the analysis of the research data. Under no circumstances will the names of the participants be revealed, as this research is strictly quantitative. I request your name and phone number only for the purpose of contacting you later in case more information is needed.

1. NAME: _____ 2. DATE: _____

3. AGE: _____ 4. SEX: FEM / MALE 5. PHONE: ( ) -

Please, answer the questions below, bearing in mind that they will help to characterize your contact with English. Be as specific as possible. Add any comment that may be important to give a complete and accurate view of this contact.

6. Did you study English at school? YES / NO

7. When did you start? _____

8. How old were you at the time? _____

9. Did the classes develop both written and oral expression?

_____

_____

10. Have you taken a language course? YES / NO

11. What course/language school?

Courses						SCHOOLS	HOW MANY SEMESTERS?	HOW MANY HOURS?	
C	A	B	I	A	OTHER			WEEK	SEMESTER
C=Child A=adolescents B=basic I=intermediate A=advanced									

12. Do you study English currently? YES / NO

13. Which level/semester/ are you enrolled currently? _____

14. How many class hours a week are devoted to the course? _____

15.

APPENDIX B

DIRECTED SPEECH PRODUCTION TEST SLIDES

Instruction material

Slide 1:	Click F5
Slide 2:	Welcome
Slide 3:	Instruções
Slide 4: I read and explained the slide.	1. Uma palavra aparecerá na tela do computador English permanecerá por 4 segundos; 2. Nesse tempo você falará uma sentença na qual você inserirá a palavra que está na tela do computador. 3. Procure falar a sentença normalmente, como se estivesse conversando com um amigo. 4. Após os 4 segundos, uma nova palavra aparecerá na tela English você segue os mesmos procedimentos anteriores. 5. Você poderá praticar antes de começar a gravação; 6. As primeiras 3 gravações não serão consideradas;

Training material

Slide 1: I read and explained the slide.	Aparecerá na tela	Você fala:
	bed	Bed, I said bed.
	get	Get, I said get.
	tell John	Tell John, I said tell John.
	well	Well, I said well.
Slide 2: I explained the syllable peak pronunciation and the participants practiced with help, belk and tell Paul	**Help**, I said **help**	a vogal será sempre **help** **belk** **tell Paul**
Slide 3:	*, I said *	felb
Slide 4:	*, I said *	mels
Slide 5:	*, I said *	melg
Slide 6:	*, I said *	Tell Gyna
Slide 7:	*, I said *	selj
Slide 8:	*, I said *	welsh

The carrier sentence was plotted on the top left side of each slide;
The target word(s) was/were plotted in the slide center;
The words in the slides 3 to 8 were used during the performing session too. They were chosen deliberately for the training session due to the fact that they could cause pronunciation problems in relation to the consonantal phoneme that follows /

Performing material

Slide 1:	*, I said *	bed
Slide 2:	*, I said *	Tell Gyna
Slide 3:	*, I said *	get
Slides 4 to 34	*, I said *	bell, help, tell Peter, felb, tell Bob, helm, tell Mary, melt, sell, tell Tom, held, tell Dan, heln, tell Nan, else, tell Sam, mels, tell Zak, belk, tell Kate, melg, tell Garry, shell, self, tell Faby, selv, tell Viny, welsh, tell Sharon, selj, tell Gyna
Slide 35:	Respire um pouco, aguarde alguns segundos...	
Slide 36:	*, I said *	book
Slide 37:	*, I said *	Tell Joe
Slide 38:	*, I said *	dog
Slides 39 to 69	*, I said *	help, bell, selj, tell Faby, welsh, tell Mary, selv, tell Gyna, self, tell Garry, shell, tell Viny, felb, tell Tom, held, tell Nan, mels, tell Sharon, else, tell Peter, heln, tell Sam, sell, tell Zak, belk, tell Dan, helm, tell Bob, melg, tell Kate, melt

The carrier sentence was plotted on the top left side of each slide;
The target word(s) was/were plotted in the slide center;
The words in the slides 1 to 3 and 36 to 38 were used as training stimuli and not considered in the study.

APPENDIX C

LIST OF CODES USED TO LABEL THE PARTICIPANTS' PRODUCTIONS

Codes[33]	Description	Considered missing value[34]
L	Production with the presence of the typical lateral consonantal gesture only – considered not vocalized at all.	No
Lwo or Lw	Production with the presence of the consonantal and the vocalic gestures (lip rounding) – considered partially vocalized - The difference between them is in vowel like quality: 'wo' more similar to /o/ and 'w' more similar to /u/.	No
Wo or W	Production with the presence of the vocalic gesture only (tongue retraction plus lip rounding) – considered completely vocalized - The difference between them is in vowel like quality: 'wo' more similar to /o/ and 'w' more similar to /u/.	No
N[35]	Nasalization	Yes
BP	Problem in identifying the boundary	Yes
MS	Murmured sound	Yes
NM	Nasal murmur	Yes
M	Mispronunciation	Yes
CV	Creaky voice	Yes
BF	Bad formants formation	Yes
NL	No link between the two words	Yes
TF	Too fast production	Yes
NI	Background noise interference	Yes
BI	Bad intonation	Yes

[33] These codes refer to the judgment of the "participants' production of the phoneme "
[34] The missing values refer to the productions that were not considered in the results.
[35] It was added N to the labels L, Lw, Lwo, Wo and W every time there was nasalized features.

APPENDIX D

VARIABLES OPERATIONALIZATION

SPSS – File 1[36]

Nominal Variables – Levels	
1. Participants	1 to 20
2. Instruction	1. 456 h 2. 513 h
3. Gender	3. male 4. female
2. Allophone produced	1. L 2. Lwo 3. Lw 4. Wo 5. W 99. missing value
3. Nasal feature	1. yes 2. no
4. Following context	1. /l/ 2. /lp/ 3. /l p/ 4. /lb/ 5. /l b/ 6. /lm/ 7. /l m/ 8. /lt/ 9. /l t/ 10. /ld/ 11. /l d/ 12. /ln/ 13. /l n/ 14. /ls/ 15. /l s/ 16. /lz/ 17. /l z/ 18. /lk/ 19. /l k/ 20. /lg/ 21. /lg/ 22. /lf/ 23. /l f/ 24. /lv/ 25. /l v/ 26. /l / 27. /l / 28. /l / 29. /l /
5. Following Context 1	1. final L 2. LConsonant 3. L _Consonant
6. Voicing	1. + voiced 2. – voiced 99. missing value
7. Manner of articulation	1. Plosive 2. nasal 3. fricative
8. Place of articulation	1. bilabial 2. labialdental 3. alveolar 4. postalveolar 5. velar

Dependent Variables – Scale
1. total duration
2. mean_F1 peak interval
3. mean_F2 peak interval
4. mean_F3 peak interval
5. ratio F3 peak /F1 peak
6. ratio F2 peak /F1 peak
7. mean_F1 L- interval
8. mean_F2 L- interval
9. mean_F3 L- interval
10. ratio F3 L / F1 L
11. ratio F2 L / F1 L
12. ratio F2 peak / F2 L-interval
13. Degree of vocalization – grade (calculated by computing the dependent variable "2. allophone produced". The allophone L was graded as 0 (zero); the allophones Lwo and Lw were graded as 5 (five) and the allophones Wo and W were graded as 10 (ten)).

[36] This file contains a spreadsheet with 2480 lines. Each line corresponds to one token. This spreadsheet was made automatically by running a 'Praat' script created specially for this study (Appendix E).

SPSS file 2	
Lines:	20 lines - Participants (1 to 20)
Columns:	Dependent variables – grades[37]
Contexts:	1. final L 2. L + Cww (consonant within the word) 3. L + Caw (consonant across the word)
Voicing:	4. +vd Cww 5. +vd Caw 6. +vd total 7. –vd Cww 8. –vd Caw 9. –vd total
Place of articulation	10. bilabial total 11. labial-dental total 12. alveolar total 13. post-alveolar total 14. velar total 15. bilabial Cww 16. labial-dental Cww 17. alveolar Cww 18. post-alveolar Cww 19. velar Cww 20. bilabial Caw 21. labial-dental Caw 22. alveolar Caw 23. post-alveolar Caw 24. velar Caw
Manner of articulation	25. plosive total 26. nasal total 27. fricative total 28. plosive Cww 29. nasal Cww 30. fricative Cww 31. plosive Caw 32. nasal Caw 33. fircative Caw

[37] L = 0, Lw = 5, W = 10 --- Grade: sum up all the grades of each participant for each specific context and divide it by the valid N of each specific context. The result means the degree of vocalization.

APPENDIX E

COMPLETE TABLES OF REALIZATIONS OF /l/ TAKING INTO ACCOUNT THE FOLLOWING CONTEXT IN TERMS OF VOICING

/l/ followed by voiced consonant

Partici-pants	Different realizations of /l/ followed by a voiced consonant														
	Within the word					Across the word					Both contexts				
	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G
1	29	--	26	3	5.52	32	--	20	12	6.88	61	--	46	15	6.23
2	22	--	11	11	7.50	27	--	15	12	7.22	49	--	26	23	7.35
3	21	2	17	2	5.00	30	--	28	2	5.33	51	2	45	4	5.20
4	25	--	25	--	5.00	30	--	15	15	7.50	55	--	40	15	6.36
5	22	--	14	8	6.82	32	--	22	10	6.56	54	--	36	18	6.67
6	22	--	15	7	6.59	26	--	9	17	8.27	48	--	24	24	7.50
7	17	2	14	1	4.71	25	12	13	--	2.60	42	14	27	1	3.45
8	21	--	21	--	5.00	30	--	24	6	6.00	51	--	45	6	5.59
9	17	1	15	1	5.00	28	--	28	--	5.00	45	1	43	1	5.00
10	22	--	14	8	6.82	32	--	25	7	6.09	54	--	39	15	6.39
11	23	--	18	5	6.09	22	1	15	6	6.14	45	1	33	11	6.11
12	16	--	16	--	5.00	26	--	22	4	5.77	42	--	38	4	5.48
13	17	--	15	2	5.59	23	--	7	16	8.48	40	--	22	18	7.25
14	28	3	18	7	5.71	32	--	12	20	8.13	60	3	30	27	7.00
15	17	--	6	11	8.24	28	--	12	16	7.86	45	--	18	27	8.00
16	20	--	20	--	5.00	29	--	26	3	5.52	49	--	46	3	5.31
17	24	--	19	5	6.04	29	--	13	16	7.76	53	--	32	21	6.98
18	16	--	12	4	6.25	26	--	10	16	8.08	42	--	22	20	7.38
19	18	--	17	1	5.28	25	--	17	8	6.60	44	--	35	9	6.02
20	22	--	18	4	5.91	28	--	15	13	7.32	49	--	32	17	6.73
Total	419	8	331	80		560	13	348	199		979	21	679	279	
%	100	1.9	79.0	19.1		100	2.3	62.1	35.5		100	2.1	69.4	28.5	
			Grade Median		5.65					6.87					6.38
			Grade Minimum		4.71					2.60					3.45
			Grade Maximum		8.24					8.48					8.00

Grade (L=0, Lw=5 and W=10) - - Number of production (NP)

G = (NP 'L' * grade 'L') + (NP 'Lw' * grade 'Lw') + (NP 'W' * grade 'W') / N

/l/ followed by voiceless consonant															
Partici-pants	Different realizations of /l/ followed by a voiceless consonant														
	Within the word					Across the word					Both contexts				
	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G
1	24	--	22	2	5.42	24	--	15	9	6.88	48	--	37	11	6.15
2	20	--	12	8	7.00	17	--	9	8	7.22	37	--	21	16	7.16
3	24	3	16	5	5.42	23	1	19	3	5.33	47	4	35	8	5.43
4	23	--	15	8	6.74	24	--	14	10	7.50	47	--	29	18	6.91
5	22	--	12	10	7.27	24	--	13	11	6.56	46	--	25	21	7.28
6	24	--	14	10	7.08	22	--	3	19	8.27	46	--	17	29	8.15
7	23	3	15	5	5.43	24	11	13	--	2.60	47	14	28	5	4.04
8	23	3	17	3	5.00	23	--	16	7	6.00	46	3	33	10	5.76
9	24	--	21	3	5.63	24	--	20	4	5.00	48	--	41	7	5.73
10	24	--	13	11	7.29	24	1	14	9	6.09	48	1	27	20	6.98
11	24	2	16	6	5.83	21	--	17	4	6.14	45	2	33	10	5.89
12	24	1	11	12	7.29	24	--	13	11	5.77	48	1	24	23	7.29
13	24	--	14	10	7.08	24	--	8	16	8.48	48	--	22	26	7.71
14	23	--	10	13	7.83	23	--	4	19	8.13	46	--	14	32	8.48
15	24	--	6	18	8.75	24	--	12	12	7.86	48	--	18	30	8.13
16	21	--	20	1	5.24	23	--	16	7	5.52	44	--	36	8	5.91
17	24	--	12	12	7.50	23	--	7	16	7.76	47	--	19	28	7.98
18	23	--	9	14	8.04	22	--	7	15	8.08	45	--	16	29	8.22
19	23	--	17	6	6.30	22	--	4	18	6.60	45	--	21	24	7.67
20	24	--	19	5	6.04	22	--	11	11	7.32	46	--	30	16	6.74
Total	465	12	291	162		457	13	235	209		922	25	526	371	
%	100	2.6	62.6	34.8		100	2.8	51.4	45.7		100	2.7	57.0	40.2	
			Grade Median		6.61					7.16					6.88
			Grade Minimum		5.00					2.71					4.04
			Grade Maximum		8.75					9.32					8.48

Grade (L=0, Lw=5 and W=10) - - Number of production (NP)

G = (NP 'L' * grade 'L') + (NP 'Lw' * grade 'Lw') + (NP 'W' * grade 'W') / N

APPENDIX F

COMPLETE TABLES OF REALIZATIONS OF /l/ TAKING INTO ACCOUNT THE FOLLOWING CONTEXT IN TERMS OF PLACE OF ARTICULATION

BILABIAL

Partici-pants	Different realizations of /l/ followed by a bilabial consonant														
	Within the word					Across the word					Both contexts				
	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G
1	11	--	6	5	7.27	12	--	2	10	9.17	23	--	8	15	8.26
2	8	--	7	1	5.63	12	--	1	11	9.58	19	--	2	17	9.47
3	7	--	1	6	9.29	11	--	8	3	6.36	19	--	15	4	6.05
4	9	--	6	3	6.67	12	--	2	10	9.17	21	--	8	13	8.10
5	8	--	--	8	10.00	12	--	4	8	8.33	20	--	4	16	9.00
6	8	--	2	6	8.75	9	--	--	9	10.00	17	--	2	15	9.41
7	8	--	6	2	6.25	12	6	6	--	2.50	20	6	12	2	4.00
8	5	--	3	2	7.00	12	--	3	9	8.75	17	--	6	11	8.24
9	8	--	8	--	5.00	11	--	10	1	5.45	19	--	18	1	5.26
10	8	--	2	6	8.75	12	--	3	9	8.75	20	--	5	15	8.75
11	10	--	5	5	7.50	12	--	3	9	8.75	22	--	8	14	8.18
12	8	--	4	4	7.50	12	--	6	6	7.50	20	--	10	10	7.50
13	7	--	3	4	7.86	11	--	--	11	10.00	18	--	3	15	9.17
14	11	--	3	8	8.64	12	--	1	11	9.58	23	--	4	19	9.13
15	8	--	--	8	10.00	12	--	--	12	10.00	20	--	--	20	10.00
16	6	--	6	--	5.00	11	--	7	4	6.82	17	--	13	4	6.18
17	10	--	4	6	8.00	12	--	3	9	8.75	22	--	7	15	8.41
18	6	--	2	4	8.33	11	--	2	9	9.09	17	--	4	13	8.82
19	8	--	3	5	8.13	11	--	3	8	8.64	19	--	6	13	8.42
20	8	--	3	5	8.13	12	--	1	11	9.58	20	--	4	16	9.00
Total	162	0	74	88		231	6	65	160		393	6	139	248	
%	100.0	0.0	45.7	54.3		100.0	2.6	28.1	69.3		100.0	1.5	35.4	63.1	
			Grade median		7.68					8.34					8.07
			Grade Minimum		5.00					2.50					4.00
			Grade Maximum		10.00					10.00					10.00

LABIAL-DENTAL

Partici-pants	Different realizations of /l/ followed by a labialdental consonant														
	Within the word					Across the word					Both contexts				
	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G
1	8	--	8	--	5.00	8	--		8	10.00	16	--	8	8	7.50
2	6	--	2	4	8.33	7	--	6	1	5.71	13	--	8	5	6.92
3	6	--	3	3	7.50	8	--	7	1	5.63	14	--	10	4	6.43
4	8	--	8	--	5.00	8	--	2	6	8.75	16	--	10	6	6.88
5	8	--	5	3	6.88	8	--	4	4	7.50	16	--	9	7	7.19
6	8	--	6	2	6.25	8	--	3	5	8.13	16	--	9	7	7.19
7	8	--	8	--	5.00	8	6	2	--	1.25	16	6	10	--	3.13
8	7	--	7	--	5.00	7	--	4	3	7.14	14	--	11	3	6.07
9	8	--	6	2	6.25	8	--	7	1	5.63	16	--	13	3	5.94

10	6	--	1	5	9.17	8	--	6	2	6.25	14	--	7	7	7.50
11	8	--	6	2	6.25	6	--	6	--	5.00	14	--	12	2	5.71
12	8	--	7	1	5.63	8	--	5	3	6.88	16	--	12	4	6.25
13	7	--	2	5	8.57	8	--	--	8	10.00	15	--	2	13	9.33
14	8	--	5	3	6.88	8	--	--	8	10.00	16	--	5	11	8.44
15	8	--	--	8	10.00	8	--	1	7	9.38	16	--	1	15	9.69
16	7	--	7	--	5.00	8	--	6	2	6.25	15	--	13	2	5.67
17	8	--	5	3	6.88	8	--	1	7	9.38	16	--	6	10	8.13
18	6	--	4	2	6.67	8	--	3	5	8.13	14	--	7	7	7.50
19	7	--	7	--	5.00	8	--	3	5	8.13	15	--	10	5	6.67
20	8	--	6	2	6.25	7	--	2	5	8.57	15	--	8	7	7.33
Total	148	0	103	45		155	6	68	81		303	6	171	126	
%	100.0	0.0	69.6	30.4		100.0	3.9	43.9	52.3		100.0	2.0	56.4	41.6	
			Grade median		6.57					7.38					6.97
			Grade Minimum		5.00					1.25					3.13
			Grade Maximum		10.00					10.00					9.69

ALVEOLAR

Partici-pants	Different realizations of /l/ followed by a alveolar consonant														
	Within the word					Across the word					Both contexts				
	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G
1	18	--	18	--	5.00	20	--	19	1	5.25	38	--	37	1	5.13
2	13	--	11	2	5.77	14	--	11	3	6.07	27	--	22	5	5.93
3	15	2	13	--	4.33	18	1	17	0	4.72	33	3	30	--	4.55
4	15	--	13	2	5.67	18	--	14	4	6.11	33	--	27	6	5.91
5	12	--	12	--	5.00	20	--	16	4	6.00	32	--	28	4	5.63
6	14	--	11	3	6.07	16	--	7	9	7.81	30	--	18	12	7.00
7	14	5	9	--	3.21	16	6	10	--	3.13	30	11	19	--	3.17
8	16	2	14	--	4.38	18	--	18	--	5.00	34	2	32	--	4.71
9	13	--	13	--	5.00	17	--	16	1	5.29	30	--	29	1	5.17
10	16	--	13	3	5.94	20	1	18	1	5.00	36	1	31	4	5.42
11	17	1	14	2	5.29	15	1	13	1	5.00	32	2	27	3	5.16
12	12	1	9	2	5.42	18	--	17	1	5.28	30	1	26	3	5.33
13	11	--	10	1	5.45	16	--	12	4	6.25	27	--	22	5	5.93
14	16	3	11	2	4.69	20	--	8	12	8.00	36	3	19	14	6.53
15	13	--	11	2	5.77	19	--	15	4	6.05	32	--	26	6	5.94
16	14	--	14	--	5.00	17	--	17	--	5.00	31	--	31	--	5.00
17	14	--	14	--	5.00	20	--	12	8	7.00	34	--	26	8	6.18
18	12	--	10	2	5.83	17	--	12	5	6.47	29	--	22	7	6.21
19	13	--	13	--	5.00	17	--	13	4	6.18	30	--	26	4	5.67
20	13	--	12	1	5.38	16	--	16	--	5.00	29	--	28	1	5.17
Total	281	14	245	22		352	9	281	62		633	23	526	84	
%	100.0	5.0	87.2	7.8		100.0	2.6	79.8	17.6		100.0	3.6	83.1	13.3	
			Grade median		5.16					5.73					5.48
			Grade Minimum		3.21					3.13					3.17
			Grade Maximum		6.07					8.00					7.00

POST-ALVEOLAR

Partici-pants	Different realizations of /l/ followed by a post-alveolar consonant														
	Within the word					Across the word					Both contexts				
	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G
1	8	--	8		5.00	8	--	7	1	5.63	16	--	15	1	5.31
2	8	--	2	6	8.75	5	--	2	3	8.00	13	--	4	9	8.46
3	8	1	5	2	5.63	8	--	7	1	5.63	16	1	12	3	5.63
4	8	--	7	1	5.63	8	--	6	2	6.25	16	--	13	3	5.94
5	8	--	7	1	5.63	8	--	7	1	5.63	16	--	14	2	5.63
6	8	--	6	2	6.25	7	--	2	5	8.57	15	--	8	7	7.33
7	4	--	2	2	7.50	6	2	4	--	3.33	10	2	6	2	5.00
8	8	1	7	--	4.38	8	--	8	--	5.00	16	1	15	--	4.69
9	4	--	4	--	5.00	8	--	7	1	5.63	12	--	11	1	5.42
10	8	--	7	1	5.63	8	--	7	1	5.63	16	--	14	2	5.63
11	4	1	1	2	6.25	4	--	4		5.00	8	1	5	2	5.63
12	4	--	3	1	6.25	4	--	2	2	7.50	8	--	5	3	6.88
13	8	--	6	2	6.25	5	--	3	2	7.00	13	--	9	4	6.54
14	8	--	5	3	6.88	8	--	5	3	6.88	16	--	10	6	6.88
15	4	--	--	4	10.00	5	--	5	--	5.00	9	--	5	4	7.22
16	6	--	6	--	5.00	8	--	8	--	5.00	14	--	14	--	5.00
17	8	--	5	3	6.88	5	--	2	3	8.00	13	--	7	6	7.31
18	7	--	2	5	8.57	5	--	--	5	10.00	12	--	2	10	9.17
19	6	--	6	--	5.00	3	--	--	3	10.00	9	--	6	3	6.67
20	8	--	7	1	5.63	8	--	5	3	6.88	16	--	12	4	6.25
Total	135	3	96	36		129	2	91	36		264	5	187	72	
%	100.0	2.2	71.1	26.7		100.0	1.6	70.5	27.9		100.0	1.9	70.8	27.3	
			Grade median		6.30					6.53					6.33
			Grade Minimum		4.38					3.33					4.69
			Grade Maximum		10.00					10.00					9.17

VELAR

Partici-pants	Different realizations of /l/ followed by a velar consonant														
	Within the word					Across the word					Both contexts				
	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G
1	8	--	8	--	5.00	8	--	7	1	5.63	16	--	15	1	5.31
2	8	--	7	1	5.63	6	--	4	2	6.67	14	--	11	3	6.07
3	8	2	5	1	4.38	8	--	8		5.00	16	2	13	1	4.69
4	8	--	6	2	6.25	8	--	5	3	6.88	16	--	11	5	6.56
5	8	--	2	6	8.75	8	--	4	4	7.50	16	--	6	10	8.13
6	8	--	4	4	7.50	8	--	--	8	10.00	16	--	4	12	8.75
7	6	--	4	2	6.67	7	3	4	--	2.86	13	3	8	2	4.62
8	8	--	7	1	5.63	8	--	7	1	5.63	16	--	14	2	5.63
9	8	1	5	2	5.63	8	--	8	--	5.00	16	1	13	2	5.31
10	8	--	4	4	7.50	8	--	5	3	6.88	16	--	9	7	7.19
11	8	--	8	--	5.00	6	--	6	--	5.00	14	--	14	--	5.00
12	8	--	4	4	7.50	8	--	5	3	6.88	16	--	9	7	7.19
13	8	--	8	--	5.00	7	--	--	--	10.00	15	--	8	7	7.33

14	8	--	4	4	7.50	7	--	2	5	8.57	15	--	6	9	8.00
15	8	--	1	7	9.38	8	--	3	5	8.13	16	--	4	12	8.75
16	8	--	7	1	5.63	8	--	4	4	7.50	16	--	11	5	6.56
17	8	--	3	5	8.13	7	--	2	5	8.57	15	--	5	10	8.33
18	8	--	3	5	8.13	7	--	--	7	10.00	15	--	3	12	9.00
19	8	--	6	2	6.25	8	--	2	6	8.75	16	--	8	8	7.50
20	8	--	8	--	5.00	7	--	2	5	8.57	15	--	10	5	6.67
Total	158	3	104	51		150	3	78	69		308	6	182	120	
%	100.0	1.9	65.8	32.3		100.0	2.0	52.0	46.0		100.0	1.9	59.1	39.0	
			Grade median		6.52					7.20					6.83
			Grade Minimum		4.38					2.86					4.62
			Grade Maximum		9.38					10.00					9.00

Grade (L=0, Lw=5 and W=10) - - Number of production (NP)
G = (NP 'L' * grade 'L') + (NP 'Lw' * grade 'Lw') + (NP 'W' * grade 'W') / N

APPENDIX F.a

PEARSON CORRELATION BETWEEN VOICED vs. VOICELESS AND PLACE OF ARTICULATION

Correlations			VOICED				
			bilabial	labiodental	alveolar	post-alveolar	velar
VOICELESS	bilabial	Pearson Correlation	.853(**)				
		Sig. (1-tailed)	0				
		N	20				
	labiodental	Pearson Correlation		.747(**)			
		Sig. (1-tailed)		0			
		N		20			
	alveolar	Pearson Correlation			.770(**)		
		Sig. (1-tailed)			0		
		N			20		
	post-alveolar	Pearson Correlation				.470(*)	
		Sig. (1-tailed)				0.018	
		N				20	
	velar	Pearson Correlation					.674(**)
		Sig. (1-tailed)					0.001
		N					20

** Correlation is significant at the 0.01 level (1-tailed).
* Correlation is significant at the 0.05 level (1-tailed).

APPENDIX G

COMPLETE TABLES OF REALIZATIONS OF /l/ TAKING INTO ACCOUNT THE FOLLOWING CONTEXT IN TERMS OF MANNER OF ARTICULATION

PLOSIVE

Partici-pants	Different realizations of /l/ followed by a plosive consonant														
	Within the word					Across the word					Both contexts				
	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G
1	24	--	21	3	5.63	24	--	15	9	6.88	48	--	36	12	6.25
2	23	--	15	8	6.74	20	--	8	12	8.00	43	--	23	20	7.33
3	24	4	18	2	4.58	22	--	20	2	5.45	46	4	38	4	5.00
4	24	--	19	5	6.04	24	--	10	14	7.92	48	--	29	19	6.98
5	24	--	10	14	7.92	24	--	11	13	7.71	48	--	21	27	7.81
6	24	--	14	10	7.08	21	--	2	19	9.52	45	--	16	29	8.22
7	22	--	18	4	5.91	23	10	13	--	2.83	45	10	31	4	4.33
8	21	2	16	3	5.24	24	--	16	8	6.67	45	2	32	11	6.00
9	24	1	21	2	5.21	24	--	22	2	5.42	48	1	43	4	5.31
10	24	--	14	10	7.08	24	--	14	10	7.08	48	--	28	20	7.08
11	24	--	19	5	6.04	20	1	13	6	6.25	44	1	32	11	6.14
12	24	1	15	8	6.46	24	--	15	9	6.88	48	1	30	17	6.67
13	22	--	17	5	6.14	22	--	4	18	9.09	44	--	21	23	7.61
14	24	1	14	9	6.67	23	--	7	16	8.48	47	1	21	25	7.55
15	24	--	8	16	8.33	24	--	10	14	7.92	48	--	18	30	8.13
16	22	--	21	1	5.23	23	--	15	8	6.74	45	--	36	9	6.00
17	24	--	15	9	6.88	23	--	8	15	8.26	47	--	23	24	7.55
18	22	--	12	10	7.27	22	--	7	15	8.41	44	--	19	25	7.84
19	24	--	17	7	6.46	24	--	9	15	8.13	48	--	26	22	7.29
20	24	--	19	5	6.04	22	--	10	12	7.73	46	--	29	17	6.85
Total	468	9	323	136		457	11	229	217		925	20	552	353	
%	100.0	1.9	69.0	29.1		100.0	2.4	50.1	47.5		100.0	2.2	59.7	38.2	
			Grade median		6.35					7.27					6.80
			Grade Minimum		4.58					2.83					4.33
			Grade Maximum		8.33					9.52					8.22

NASAL

Partici-pants	Different realizations of /l/ followed by a nasal consonant														
	Within the word					Across the word					Both contexts				
	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G	N	'L'	'Lw'	'W'	G
1	5	--	3	2	7.00	8	--	5	3	6.88	13	--	8	5	6.92
2	--	--	--	--	no	4	--	1	3	8.75	4	--	1	3	8.75
3	--	--	--	--	no	8	--	7	1	5.63	8	--	7	1	5.63
4	1	--	1	--	5.00	6	--	3	3	7.50	7	--	4	3	7.14
5	--	--	--	--	no	8	--	6	2	6.25	8	--	6	2	6.25
6	--	--	--	--	no	4	--	--	4	10.00	4	--	--	4	10.00
7	--	--	--	--	no	5	1	4		4.00	5	1	4	--	4.00
8	--	--	--	--	no	6	--	4	2	6.67	6	--	4	2	6.67
9	--	--	--	--	no	4	--	4		5.00	4	--	4	--	5.00
10	1	--	--	1	10.00	8	--	5	3	6.88	9	--	5	4	7.22

11	5	--	3	2	7.00	7	--	3	4	7.86	12	--	6	6	7.50
12	--	--	--	--	no	6	--	5	1	5.83	6	--	5	1	5.83
13	--	--	--	--	no	4	--	--	4	10.00	4	--	--	4	10.00
14	5	--	--	5	10.00	8	--	--	8	10.00	13	--	--	13	10.00
15	--	--	--	--	no	8	--	2	6	8.75	8	--	2	6	8.75
16	--	--	--	--	no	6	--	6	--	5.00	6	--	6	--	5.00
17	2	--	--	2	10.00	8	--	3	5	8.13	10	--	3	7	8.50
18	--	--	--	--	no	7	--	2	5	8.57	7	--	2	5	8.57
19	--	--	--	--	no	4	--	4	--	5.00	4	--	4	--	5.00
20	--	--	--	--	no	5	--	1	4	9.00	5	--	1	4	9.00
Total															

APPENDIX H

REALIZATIONS OF /l/ TAKING INTO ACCOUNT: MANNER vs. PLACE OF ARTICULATION

Contexts				Places of articulation					Total
				bilabial	Labial-dental	alveolar	Post-alveolar	velar	
WITHIN THE WORDS	L	Manner	plosive	--	--	6	--	3	9
			nasal	--	--	--	--	--	--
			fricative	--	--	8	3	--	11
			Total	--	--	14	3	3	20
	Lw	Manner	plosive	70	--	149	--	104	323
			nasal	4	--	3	--	--	7
			fricative	--	103	93	96	--	292
			Total	74	103	245	96	104	622
	W	Manner	plosive	81	--	4	--	51	136
			nasal	7	--	5	--	--	12
			fricative	--	45	13	36	--	94
			Total	88	45	22	36	51	242
ACROSS THE WORDS	L	Manner	plosive	5	--	3	--	3	11
			nasal	1	--	--	--	--	1
			fricative	--	6	6	2	--	14
			Total	6	6	9	2	3	26
	Lw	Manner	plosive	28	--	123	--	78	229
			nasal	37	--	28	--	--	65
			fricative	--	68	130	91	--	289
			Total	65	68	281	91	78	583
	W	Manner	plosive	123	--	25	--	69	217
			nasal	37	--	21	--	--	58
			fricative	--	81	16	36	--	133
			Total	160	81	62	36	69	408

MEAN of /l/ VOCALIZATION

	Manner of Articulation	Places of articulation				
		Bilabial	Labial-dental	alveolar	Post-alveolar	velar
Within Word	plosive	7,68	--	4,94	--	6,52
	nasal	8,18	--	8,13	--	--
	fricative	--	6,52	5,22	6,22	--
Across Word	plosive	9,01	--	5,84	--	7,35
	nasal	7,50	--	6,36	--	--
	fricative	--	7,42	5,23	6,32	--
Both Contexts	plosive	8,24	--	5,32	--	6,85
	nasal	7,50	--	7,28	--	--
	fricative	--	6,98	5,28	6,27	--

Mean calculation: ((N of Lw * 5)+(N of W *10) / (N of L + N of Lw + N of W))

APPENDIX I

DIFFERENT REALIZATIONS OF BY PARTICIPANTS AND BY CONTEXTS

		Participants																				Total
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	
L	**Final L**		1	4				3	1			1							1			11
	l p							3														3
	l b							2														2
	l m							1														1
	lt			2					2				1									5
	ld														1							1
	l d							2				1										3
	ls							3				1										4
	l s			1				3			1											5
	lz							2							2							4
	l z							1														1
	l k							2														2
	lg			2						1												3
	lg							1														1
	l f							3														3
	l v							3														3
	lsh			1					1			1										3
	l j							2														2
Total			1	10				31	4	1	1	4	1		3				1			57
	Final L	9	3	7	7	5	2	6	9	10		4	6	3	4		6	1	2	7	3	94

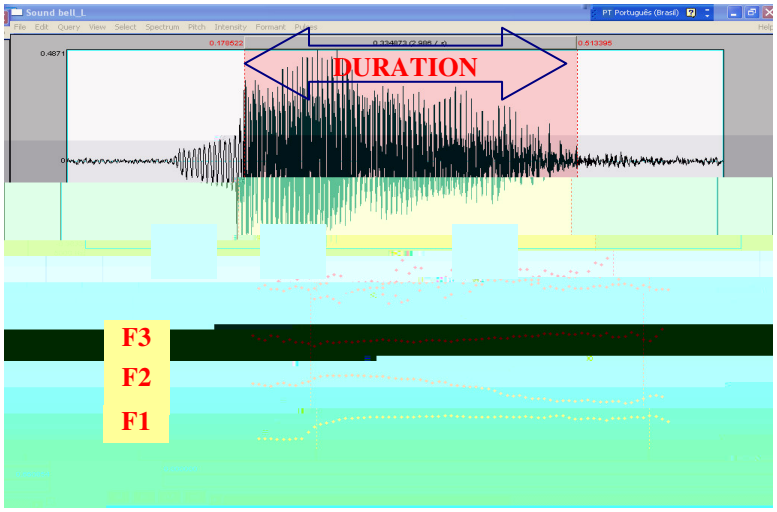
l sh	3	4	2	2	3	3	1	3	2	2	2	1

	lg					1				1						2		1				5
	lg					2								3	1	2		1		2	2	13
	lf		1	1		2				2	3	2	1	4	2	2		3	1		1	25
	l f	3		1	3	4			2	1	2		3	3	4	2	1	4	3	3	4	43
	lv			2		1					2			1	1	2					1	10
	l v	3			1				1					3	2	3	1	3			1	18
	lsh			2	1						1	2	1	2	1			2	2			14
	l sh					1				1			2	2	2			1		1		10
	lj		1																2		1	4
	l j														1						2	3
	Total	22	12	12	15	40	15	7	15	10	43	28	33	44	55	47	13	56	37	29	38	571
W	**final L**		1		1											3						5
	lp		2		1	1									1	1			1			7
	l p	1	3		2		3		1					2						1		13
	lb		2				1									2						5
	l b		2		1		3							1	1	1			2	2		13
	lm														1			1				2
	l m		2		1		1															4
	l t		2				1							1					1			5
	l d				2		1															3
	ln														2							2
	l n					1	1									1			1			4
	ls				2		2									1						5
	l s						2												1			3
	lz		1				1															2
	l z		1				1															2
	lk		1		2		2									2	1					8
	l k		1		1		4				2			3	2				2	1	1	17
	lg					2					1					1			1			5
	lg		1		2		4								1				3			11
	lf		1				1									2			1			5
	l f	1					3							1		1				1		7
	lv		2				1									2						5
	l v	1	1		2		2							1	2	1			2	1		13
	lsh		2			1		1							2	4			1			11
	l sh		1		2		4												4	1		12
	lj		3				2	1										1				7
	l j	1	2	1			1				1							2	1	1	1	11
Total		4	31	1	19	5	41	2	1		4			9	12	22	1	4	21	8	2	187
																						2134

APPENDIX J

SPECTROGRAMS AND SPECTRA OF REALIZATIONS OF AS 'L' AND 'W'

Spectrogram and sound wave of production of of the word 'bell' as 'L' by a female participant



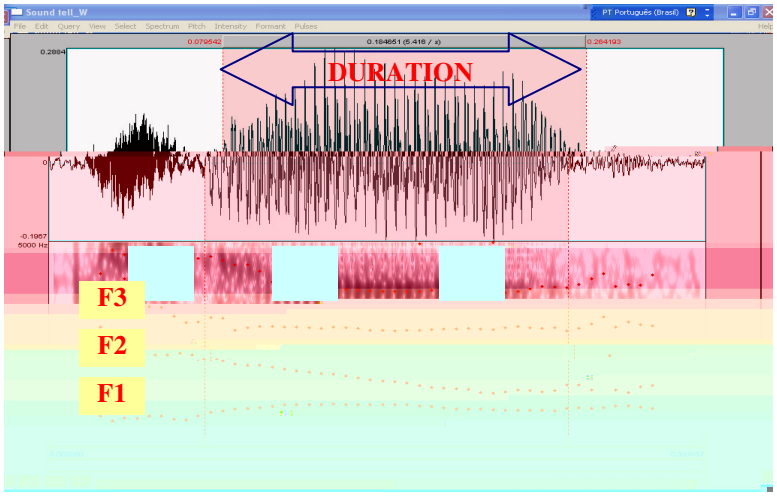
1. The most salient gesture is consonantal;
2. Duration: 33 ms
3. Syllable peak

Formants	Ratios
F1 - 760 F2 - 1809 F3 – 2676	F3/F1: 3.52 F2/F1: 2.38

as 'L'

Formants	Ratios
F1 - 757 F2 - 1188 F3 - 2844	F3/F1: 3.75 F2/F1: 1.56

Spectrogram and sound wave of production of of the word 'tell' as 'W' by a female participant



1. The most salient gesture is consonantal;
2. Duration: 18 ms
3. Syllable peak

Formants	Ratios
F1 - 738 F2 - 1670 F3 – 2765	F3/F1: 3.74 F2/F1: 2.26

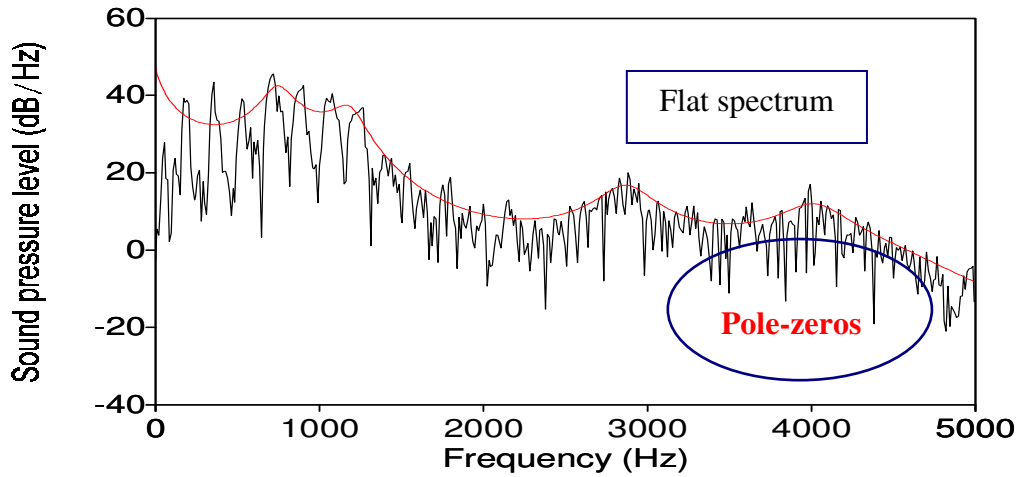
as 'W'

Formants	Ratios
F1 - 629 F2 - 1103 F3 - 2739	F3/F1: 4.35 F2/F1: 1.75

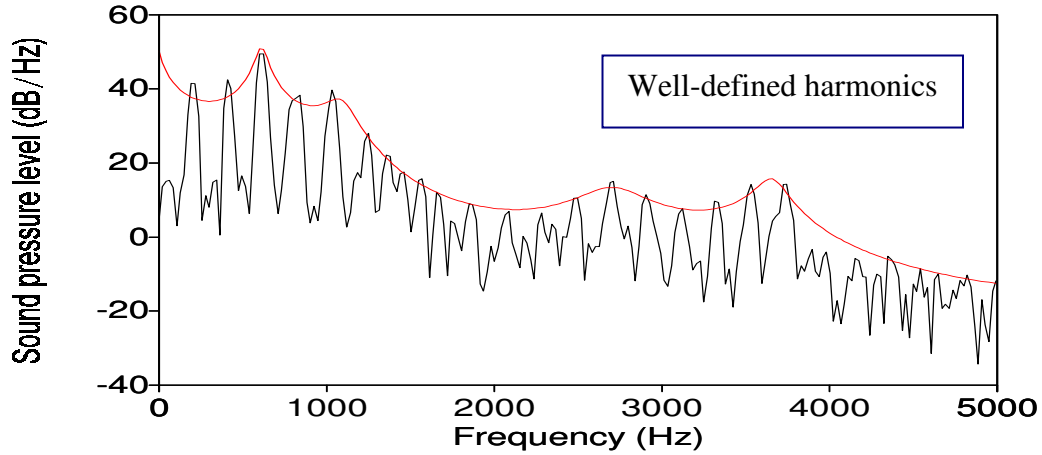
ANALYSIS

1. Duration is a good predictor of realizations; the longer the duration is the lower the degree of vocalization will be. That is, the more vocalized the , the shorter the duration of the segment;
2. The results of the present study showed that the ratios F3/F1 and F2/F1 of the syllable peak would be higher the more vocalized the was. The examples above confirm this fact in relation to ratio F3/F1, at least;
3. Concerning the realizations of as 'L' and as 'W', the spectrograms show that the formant frequencies behaviour are too similar that makes it hard to state which realization is made by analyzing the formant frequencies only, although there is a tendency for the ratios being higher the more vocalized the realization is.

Spectrum a stretch of sound from the production of as 'L' by a female participant



Spectrum a stretch of sound from the production of as 'W' by a female participant



ANALYSIS

1. The presence of consonantal gesture causes pole-zero clusters (great downward tilts of frequencies) at high frequencies;
2. The presence of pole-zero clusters also weaken the frequencies, resulting in a fairly flat spectrum between 1600 and 3400 Hz;
3. When there is less obstruction in the vocal tract, like during the production of vowels or the vocalized , the harmonics are better defined.

APPENDIX K

ACOUSTIC PROPERTIES OF DIFFERENT REALIZATIONS OF

LEGEND

Context

1, 9 and 23 /l/	2. /lp/	3. /l p/	4. /lb	5. /l b/
6. /lm/	7. /l m/	8. /lt/	9. /l t/	10. /ld/
11. /l d/	12. /ln/	13. /l n/	14. /ls/	15. /l s/
16. /lz/	17. /l z/	18. /lk/	19. /l k/	20. /lg/
21. /lg/	24. /lf/	25. /l f/	26. /lv/	27. /l v/
28. /l	29. /l	30. /lʒ/	31. /l ʒ/	

P	Context + /l/ prod.	Duration	Peak F1	Peak F2	Peak F3	/l/ F1	/l/ F2	/l/ F1
1	1_Lwo	0,3265	515	2323	3013	566	1184	2733
1	1_Lwo	0,287	608	2276	2989	552	1344	2738
1	2_Wo	0,2336	713	2174	2909	568	1181	2704
1	2_Wo	0,2221	635	1932	2886	583	1164	2588
1	3_Wo	0,1829	617	2138	3065	499	1090	2694
1	3_W	0,1235	642	1934	2869	471	1111	2384
1	4_Lwo	0,2498	634	1668	2759	614	1186	2783
1	4_Wo	0,2317	660	2037	2765	558	1123	2588
1	5_Wo	0,1725	667	2047	2999	529	1046	2853
1	5_Wo	0,1288	647	1984	2915	573	1025	2715
1	6_WN	0,2148	829	2278	3069	706	1237	2625
1	6_Lw	0,2061	577	1613	2690	500	1026	2553
1	7_Lwo	0,23	637	2295	2957	523	1075	2623
1	7_Wo	0,1065	650	1861	2966	576	1099	2836
1	8_Lwo	0,2886	557	1893	3009	596	1333	2752
1	8_Lwo	0,2936	679	2494	3274	515	1239	2601
1	9_Lwo	0,3442	644	2173	2986	532	1067	2661
1	9_Lw	0,2253	664	2083	2841	555	1133	2335
1	10_Lw	0,2098	678	2056	2732	466	1161	2649
1	10_Lw	0,152	654	1914	2886	553	1279	2600
1	11_Lwo	0,2618	659	2268	2840	547	1291	2778
1	11_Lwo	0,2514	613	1165	2375	513	1350	2530
1	12_Lwo	0,293	663	2123	2878	468	1244	2928
1	12_Lwo	0,1835	572	1988	2875	521	1404	3062
1	13_Lwo	0,2202	658	2416	3187	617	1100	2689
1	13_Lw	0,2269	624	2234	3115	512	1145	2636
1	14_Lw	0,2954	573	2036	2992	475	1140	2876
1	14_Lwo	0,1579	644	1985	2997	614	1454	2763
1	15_Lwo	0,257	657	2136	2918	539	1319	2645
1	15_Lw	0,2736	629	2113	2988	456	1342	2695
1	16_Lwo	0,1749	659	2078	2851	527	1433	2941
1	16_Lwo	0,1307	656	1964	2734	592	1397	2933
1	17_Lwo	0,2584	689	2341	3145	570	1190	2689
1	17_Lw	0,254	735	2225	3012	544	1191	2737
1	18_Lw	0,2628	616	2232	3120	471	1280	3105
1	18_Lw	0,1799	639	1959	2856	501	1349	2946
1	19_Lwo	0,2589	632	2215	3012	553	1141	2574
1	19_Lw	0,2689	619	2092	2921	514	1175	2668
1	20_Lw	0,1811	653	2080	2856	517	1133	2628
1	20_Lw	0,1275	643	2005	2811	488	1104	2473
1	21_Lw	0,262	686	2263	3069	525	1219	2751
1	21_Lw	0,2636	617	2467	3101	490	1119	2648
1	22_Lw	0,2013	575	2186	2935	526	1379	2749
1	22_Lw	0,1421	638	1918	2847	484	1316	2817
1	23_Lwo	0,3038	642	2124	2843	531	954	2458
1	23_Lw	0,2426	613	2087	2713	499	1162	2600
1	24_Lwo	0,2284	654	2078	2868	521	1059	2486
1	24_Lwo	0,2378	654	2100	2818	508	1092	2552
1	25_W	0,1661	618	2111	3009	459	995	2747

P	Context + /l/ prod.	Duration	Peak F1	Peak F1	Peak F3	/l/ F1	/l/ F2	/l/ F3
11	1_Wo	0,2365	512	1614	2372	531	1037	2287
11	1_Wo	0,2421	541	1493	2187	519	1024	2229
11	2_Wo	0,1755	590	1511	2476	572	1034	2297
11	2_Wo	0,1826	607	1438	2308	487	970	2270
11	3_Wo	0,1612	510	1525	2302	480	877	2278
11	3_Wo	0,2277	505	1620	2416	515	985	2216
11	4_Wo	0,215	535	1416	2198	514	1037	2216
11	4_Wo	0,1915	521	1426	2201	477	985	2185
11	5_Wo	0,1814	437	1643	2557	499	952	2278
11	5_Wo	0,2564	522	1649	2510	479	917	2288
11	6_Lwo	0,2457	591	1359	2237	484	1017	2309
11	6_M	0,2173	556	1505	2363	485	1003	2300
11	7_Wo	0,1847	491	1606	2460	497	1007	2193
11	7_Wo	0,226	491	1672	2187	543	1107	2239
11	8_Lwo	0,2529	554	1502	2319	488	1037	2312
11	8_Lwo	0,2297	541	1587	2300	483	1088	2320
11	9_Wo	0,2645	482	1477	2404	534	1060	2230
11	9_Wo	0,23	467	1449	2359	527	1096	2229
11	10_Lwo	0,2385	462	1736	2612	476	1074	2356
11	10_NL	0,249	491	1727	2321	568	1181	2267
11	11_Lwo	0,2194	580	1532	2349	483	1073	2369
11	11_Lw	0,2541	599	1507	2351	433	1065	2445
11	12_Lw	0,1838	511	1466	2308	448	1024	2391
11	12_Lw	0,3254	493	1686	2373	473	1056	2234
11	13_Lwo	0,2317	581	1490	2279	488	1048	2288
11	13_WN	0,2063	565	1589	2349	505	1039	2304
11	14_Lwo	0,2084	474	1600	2526	491	1007	2356
11	14_Wo	0,2189	482	1649	2434	518	1066	2251
11	15_Lwo	0,2377	590	1560	2318	534	1119	2401
11	15_Lwo	0,2354	595	1507	2285	513	1045	2415
11	16_Lwo	0,1855	501	1513	2359	505	1061	2299
11	16_Lwo	0,2431	496	1598	2456	489	1035	2249
11	17_Lwo	0,2408	556	1520	2400	515	1014	2267
11	17_Lwo	0,2408	531	1621	2368	468	996	2179
11	18_Lwo	0,1937	534	1465	2304	469	1032	2346
11	18_NL	0,3134	499	1692	2327	520	1053	2265
11	19_Lwo	0,2697	508	1488	2266	525	1043	2301
11	19_Lwo	0,2447	514	1481	2231	500	1006	2221
11	20_Lwo	0,1918	452	1681	2481	491	1037	2231
11	20_NL	0,2797	458	1770	2472	506	1059	2168
11	21_Lwo	0,2728	497	1710	2373	508	1037	2196
11	21_Lwo	0,2589	484	1708	2360	480	1041	2207
11	22_Lwo	0,2302	494	1593	2405	480	1036	2344
11	22_Lwo	0,2482	484	1709	2471	554	1066	2185
11	23_Wo	0,2102	490	1640	2411	608	1105	2119
11	23_Wo	0,1626	492	1546	2320	625	1132	2183
11	24_Wo	0,1946	524	1447	2403	600	1010	2241
11	24_Lwo	0,1631	507	1381	2423	608	1099	2192
11	25_Lwo	0,219	509	1524	2415	496	985	2361

1	25_Wo	0,1249	638	2054	2915	516	1032	2345	11	25_Lwo	0,2695	491	1399	2143	528	1013	2237
1	26_Lwo	0,2347	661	2083	2879	547	1102	2779	11	26_Lwo	0,2859	526	1474	2380	456	1009	2329
1	26_Lwo	0,2417	622	2084	2930	499	1097	2608	11	26_Lwo	0,2963	479	1519	2363	447	971	2376
1	27_W	0,2038	626	2028	2968	456	1002	2815	11	27_Lwo	0,2119	500	1464	2470	466	966	2400
1	27_Wo	0,1643	640	1774	2900	425	944	2898	11	27_NL	0,3118	508	1625	2353	452	994	2303
1	28_Lwo	0,2881	645	2188	3040	506	1251	2858	11	28_Lwo	0,2183	581	1436	2146	524	1072	2097
1	28_Lw	0,2673	617	2126	2987	507	1191	2674	11	28_L	0,2393	538	1224	2156	508	1028	2231
1	29_Lw	0,1827	642	2043	2886	490	1353	2772	11	29_Lwo	0,1749	557	1491	2312	488	1089	2172
1	29_Lwo	0,1429	648	2017	2826	582	1459	2817	11	29_NL	0,2559	540	1542	2275	551	1065	2204
1	30_Lwo	0,2936	660	2047	2778	530	1544	2625	11	30_M	0,2788	567	1431	2389	463	1130	2408
1	30_Lw	0,3	642	2126	2878	499	1539	2709	11	30_M	0,2917	563	1444	2376	462	1124	2336
1	31_Lw	0,1702	653	1961	2842	489	1661	2797	11	31_M	0,2333	515	1510	2471	458	1120	2408
1	31_Lwo	0,18	642	1984	2872	532	1696	2781	11	31_NL	0,2391	547	1550	2173	519	1038	2235
1	2_Lwo	0,2338	711	2142	2848	555	1179	2643	11	2_Lwo	0,2407	622	1444	2291	546	1129	2391
1	2_Lwo	0,2026	665	2020	2752	558	1115	2452	11	2_Lwo	0,2333	603	1461	2262	460	1058	2280
1	1_Lwo	0,3097	635	2271	2914	536	1080	2682	11	1_L	0,2788	507	1582	2311	535	1059	2198
1	1_Lwo	0,2625	622	2163	2979	542	1158	2633	11	1_Lwo	0,2761	509	1621	2404	489	1034	2130
1	30_Lwo	0,2701	652	2198	2964	507	1488	2653	11	30_M	0,3193	544	1445	2473	465	1102	2300
1	30_Lwo	0,2782	668	2127	2825	512	1456	2727	11	30_M	0,2741	553	1452	2386	462	1128	2315
1	25_Wo	0,1873	662	2175	2959	506	1026	2598	11	25_Lwo	0,1751	574	1292	2184	498	1007	2301
1	25_Wo	0,143	646	2120	2905	496	1041	2665	11	25_Lwo	0,2196	512	1646	2419	516	1022	2300
1	28_Lwo	0,2255	647	2130	2932	576	1260	2718	11	28_Wo	0,2101	558	1312	2174	529	1151	2099
1	28_Lw	0,2732	645	2092	2901	489	1250	2668	11	28_Wo	0,2305	553	1341	2216	497	1117	2055
1	7_Lwo	0,1697	691	2053	2710	584	1192	2581	11	7_Wo	0,2108	503	1543	2442	535	981	2183
1	7_Wo	0,1341	653	2020	2989	521	1085	2763	11	7_Lwo	0,2163	509	1613	2378	513	958	2160
1	26_Lw	0,2508	698	2043	2900	505	1139	2764	11	26_Lwo	0,2662	521	1474	2406	541	1052	2115
1	26_Lwo	0,2537	670	2051	3002	516	1096	2739	11	26_Lwo	0,2402	490	1509	2376	502	1065	2137
1	31_W	0,1603	615	1893	2886	461	1728	2909	11	31_Lwo	0,2266	491	1519	2470	493	1037	2253
1	31_Lw	0,1656	638	1874	2924	479	1556	2891	11	31_NL	0,2239	499	1644	2347	560	1119	2190
1	24_Lwo	0,2302	688	2086	2896	533	1085	2659	11	24_Wo	0,1901	513	1457	2405	563	1052	2252
1	24_Lwo	0,2442	670	2059	2841	560	1122	2532	11	24_Lwo	0,2427	538	1443	2268	525	1011	2177
1	22_Lwo	0,2088	624	2089	2838	504	1286	2747	11	22_Lwo	0,2058	469	1613	2478	500	1096	2113
1	22_Lwo	0,1631	642	1929	2821	534	1477	2980	11	22_NL	0,2735	525	1638	2255	517	1022	2152
1	23_Lwo	0,2763	659	2100	2884	525	1024	2560	11	23_Lwo	0,2952	493	1583	2386	574	1037	2047
1	23_Lw	0,2796	628	1978	2555	491	1182	2503	11	23_Lwo	0,2059	493	1565	2372	592	1096	2161
1	27_Wo	0,1362	632	2000	2955	478	1297	2719	11	27_Lwo	0,2859	485	1582	2420	496	1003	2329
1	27_Wo	0,1138	649	1837	2788	541	1149	2851	11	27_NL	0,2877	528	1635	2392	491	1006	2321
1	4_Lwo	0,2188	676	1860	2784	539	1219	2658	11	4_Wo	0,219	575	1470	2244	550	1058	2205
1	4_Lwo	0,2243	663	1862	2888	494	1079	2679	11	4_Lwo	0,2306	515	1452	2214	504	1010	2242
1	10_Lw	0,1935	677	1906	2868	511	1315	2890	11	10_Lwo	0,204	497	1595	2419	480	1099	2298
1	10_Lwo	0,1512	634	1741	2792	567	1440	2732	11	10_Lwo	0,2918	533	1577	2028	491	1017	2147
1	11_Lwo	0,2509	702	2095	2933	568	1365	2568	11	11_Lwo	0,2189	621	1508	2279	498	1086	2273
1	11_Lwo	0,2329	660	2000	2782	505	1189	2442	11	11_Lwo	0,221	633	1447	2335	465	1091	2323
1	14_Lw	0,1807	677	2018	2927	471	1253	2111	11	14_Lwo	0,2098	509	1564	2071	500	1027	2182
1	14_Wo	0,139	638	1780	2888	555	1308	2872	11	14_NL	0,266	530	1644	2267	516	1030	2122
1	17_Lwo	0,2612	719	2211	3100	514	1274	2711	11	17_M	0,2423	571	1548	2286	501	1041	2189
1	17_Lwo	0,2593	784	2194	3066	512	1318	2744	11	17_M	0,2423	594	1524	2242	487	1026	2030
1	29_Lwo	0,1536	679	1854	2839	488	1462	2872	11	29_Lwo	0,2474	544	1493	2261	454	1116	2305
1	29_Lwo	0,1326	649	1929	2829	524	1430	2918	11	29_Lwo	0,2258	527	1560	2301	524	1083	2127
1	15_Lwo	0,2379	659	2080	2804	508	1135	2793	11	15_Lwo	0,2232	557	1636	2386	562	1127	2270
1	15_Lwo	0,2405	644	2049	2847	515	1271	2641	11	15_L	0,2331	545	1500	2138	520	1100	2056
1	3_Wo	0,1401	652	1975	2924	557	1208	2764	11	3_Wo	0,1744	545	1461	2187	532	984	2111
1	3_Wo	0,1172	653	1899	2804	564	1070	2836	11	3_Wo	0,241	535	1570	2371	547	1002	2151
1	13_LwN	0,2467	729	2028	2949	614	1191	2716	11	13_Wo	0,2681	564	1644	2402	487	987	2314
1	13_WN	0,2394	844	2097	2883	676	1820	2920	11	13_Wo	0,2281	602	1515	2299	493	1030	2135
1	16_Lwo	0,1786	656	2166	2876	552	1366	2913	11	16_Lwo	0,1691	530	1547	2373	513	1115	2248
1	16_Lwo	0,1382	653	1797	2869	579	1338	2893	11	16_Lwo	0,2113	514	1639	2403	489	1032	2148
1	9_Lwo	0,2801	640	2087	2906	540	1199	2607	11	9_Wo	0,2349	520	1517	2387	585	1020	2162
1	9_Lwo	0,2657	642	2089	2788	533	1123	2609	11	9_Lwo	0,2947	494	1477	2386	499	1004	2205
1	18_Lw	0,1958	642	1922	2779	481	1369	2786	11	18_Lw	0,2109	509	1451	2219	451	1023	2217
1	18_Lwo	0,1635	615	2041	2890	523	1373	2849	11	18_NL	0,2886	503	1686	2459	570	1094	2170
1	19_Lwo	0,241	628	2292	2914	564	1276	2497	11	19_Lwo	0,2676	490	1664	2347	548	1060	2307
1	19_Lwo	0,2369	613	2103	2940	513	1054	2734	11	19-Lwo	0,2748	512	1519	2173	520	987	2218
1	12_Lw	0,2213	671	2014	2815	468	1178	2729	11	12_L	0,2299	525	1526	2493	521	1051	2281
1	12_Lwo	0,1459	653	2003	2647	560	1507	2645	11	12_NL	0,3513	534	1582	2380	498	990	2235
1	6_Wo	0,1964	657	2371	3050	623	1255	2474	11	6_Lwo	0,2121	624	1363	2138	488	981	2281
1	6_Wo	0,1913	595	1808	2671	593	1165	2464	11	6_M	0,2753	578	1440	2071	451	1044	2177
1	5_Wo	0,1474	657	2099	2917	549	1128	2588	11	5_Lwo	0,2282	479	1538	2443	510	1008	2319
1	5_Wo	0,139	659	1898	2733	525	1049	2584	11	5_Lwo	0,3126	540	1529	2363	478	936	2251
1	21_Lwo	0,2561	687	2360	3180	527	1289	2632	11	21_Lwo	0,2613	514	1616	2314	503	1000	2164
1	21_Lwo	0,2614	719	2364	3121	530	1073	2535	11	21_Lwo	0,2468	568	1604	2381	477	1005	2174
1	20_Lw	0,176	679	2029	2722	485	1165	2549	11	20_Lwo	0,1618	568	1414	2451	510	1004	2220
1	20_Wo	0,1293	656	1854	2718	536	1067	2672	11	20_Lwo	0,2928	538	1641	2314	488	964	2159
1	8_Lw	0,2816	673	2292	3162	541	1367	2704	11	8_Lwo	0,2696	570	1568	2322	508	1047	2219
1	8_Lw	0,2506	785	2270	2983	501	1036	2532	11	8_Lwo	0,2293	573	1661	2412	490	1049	2165
2	1_Lwo	0,2668	628	2038	2897	664	1250	2773	12	1_Lwo	0,2391	536	1730	2470	611	966	2410

2 1_Wo	0,1485	609	1767	2844	697	1437	2880	12 1_Lwo	0,2665	476	1760	2445	634	988	2402
2 2_W	0,1922	774	2148	2791	566	1256	2634	12 2_Wo	0,1735	761	1788	2676	607	876	2344
2 2_Lw	0,1905	759	1959	2892	435	1173	2700	12 2_Wo	0,182	762	1795	2657	608	924	2296
2 3_Wo	0,1344	720	2003	2913	601	1268	2727	12 3_Wo	0,1872	536	1736	2202	483	922	2387
2 3_W	0,1427	672	2003	2972	449	1109	2537	12 3_Lwo	0,2217	555	1735	2394	493	876	2396
2 4_Wo	0,1877	676	1966	2774	654	1377	2627	12 4_Lwo	0,2294	597	1681	2322	573	881	2318
2 4_W	0,1804	768	1809	2907	426	1123	2270	12 4_Lwo	0,2255	620	1722	2387	549	897	2313
2 5_Wo	0,1758	678	2090	3017	563	1255	2589	12 5_Wo	0,1779	538	1667	2220	533	977	2400
2 5_W	0,1153	647	1998	2850	408	1078	2618	12 5_Lwo	0,2183	536	1809	2220	543	909	2446
2 6_WN	0,1961	816	1926	2787	421	1045	2124	12 6_WN	0,2056	732	1797	2502	747	1008	2217
2 6_WN	0,166	867	2150	2571	390	1073	2281	12 6_LwN	0,2411	776	1710	2447	583	992	2272
2 7_Wo	0,1724	698	2124	2961	617	1168	2429	12 7_Lwo	0,1852	517	1788	2329	615	996	2486
2 7_W	0,2306	678	1837	2812	330	969	2538	12 7_Lwo	0,1993	582	1739	2241	588	922	2415
2 8_Lw	0,2399	646	2220	2936	528	1317	2997	12 8_L	0,2289	671	1796	2509	654	969	2347
2 8_Lw	0,2466	682	2120	3012	331	1288	2907	12 8_Lwo	0,2284	696	1889	2715	658	1022	2396
2 9_Wo	0,2522	748	2067	2964	525	1128	2499	12 9_Lwo	0,2465	528	1833	2607	651	1008	2240
2 9_M	0,0612	582	1958	2816	725	1804	2794	12 9_Lwo	0,2024	533	1801	2431	650	1065	2447
2 10_NL	0,2675	681	2034	2810	433	1006	2725	12 10_Lwo	0,2439	537	1836	2375	515	949	2562
2 10_W	0,1243	639	1555	2767	388	1059	2841	12 10_Lwo	0,2277	602	1633	2584	503	935	2475
2 11_Wo	0,2035	696	2052	2737	600	1458	2700	12 11_Lwo	0,2389	763	1878	2579	584	999	2378
2 11_Lw	0,2122	779	2066	2808	387	1072	2386	12 11_Lwo	0,2518	735	1869	2589	580	1006	2374
2 12_Lw	0,1909	693	1954	2868	520	1330	2805	12 12_Lwo	0,2313	507	1787	2529	494	1041	2578
2 12_Lw	0,1525	656	1873	2799	510	1330	2782	12 12_Lwo	0,2669	583	1759	2298	515	1036	2423
2 13_LwN	0,1976	879	2016	2926	697	1346	2721	12 13_LwoN	0,1932	692	1842	2586	793	1072	2236
2 13_LwN	0,1952	802	1892	2935	299	1084	2397	12 13_WN	0,2104	768	1969	2767	766	1076	2375
2 14_NL	0,3321	719	2056	3022	430	1005	2560	12 14_NL	0,244	532	1786	2382	563	974	2616
2 14_WN	0,1455	696	1563	2770	321	1025	2367	12 14_Lwo	0,2372	575	1845	2402	574	939	2554
2 15_Lw	0,2996	777	2192	2893	520	1196	2800	12 15_Lwo	0,2107	609	1921	2567	622	989	2519
2 15_Lwo	0,2555	512	2198	3017	509	1157	2418	12 15_Lwo	0,2175	639	1821	2554	587	1020	2448
2 16_Lw	0,1941	668	2055	2835	414	1201	2747	12 16_Lwo	0,2107	539	1793	2294	545	992	2676
2 16_Lw	0,1551	733	1652	2783	369	1155	2779	12 16_Lwo	0,2193	532	1851	2417	541	990	2575
2 17_Lw	0,2442	600	2232	3116	631	1195	3026	12 17_M	0,2187	689	1747	2641	656	982	2390
2 17_M	0,2468	735	1909	2914	310	1096	2697	12 17_M	0,2697	682	1813	2672	657	1087	2438
2 18_Lw	0,2693	612	2415	3119	510	1478	3094	12 18_Lwo	0,2571	537	1824	2589	510	1045	2671
2 18_Lw	0,1668	723	1800	2855	509	1601	2995	12 18_Lwo	0,24	583	1903	2253	508	1042	2580
2 19_Lw	0,2194	592	2081	2861	598	1400	2775	12 19_Wo	0,2169	621	1731	2503	680	1014	2490
2 19_W	0,2049	630	1923	2834	448	1327	2780	12 19_Wo	0,1953	614	1812	2531	649	1094	2467
2 20_NL	0,2627	677	2050	2962	509	1169	2793	12 20_Lwo	0,2036	539	1809	2324	534	1053	2553
2 20_Lw	0,1389	658	1989	2861	350	1124	2814	12 20_Wo	0,1996	553	1757	2279	540	965	2340
2 21_Lwo	0,2308	618	2103	2996	644	1570	2876	12 21_Lwo	0,2161	666	1809	2612	562	957	2445
2 21_Lw	0,2173	669	2062	2981	471	1360	2739	12 21_Lwo	0,2307	669	1902	2659	592	979	2456
2 22_Lw	0,207	659	2107	2882	436	1450	2869	12 22_Lw	0,2258	567	1704	2308	461	967	2455
2 22_W	0,1296	673	1966	2836	303	1070	2521	12 22_Lwo	0,2365	484	1848	2325	508	949	2405
2 23_Lwo	0,2312	675	2136	2870	694	1242	2723	12 23_Wo	0,2203	497	1886	2318	671	964	2380
2 23_M	0,2209	666	2174	2857	300	1124	2565	12 23_Wo	0,2382	490	1921	2433	659	1046	2300
2 24_Wo	0,1683	710	1931	2760	650	1242	2592	12 24_Wo	0,1769	564	1838	2400	627	966	2420
2 24_W	0,1896	689	1770	2804	340	1116	2321	12 24_Lwo	0,2301	560	1795	2625	651	1149	2362
2 25_Lw	0,18	673	2135	2880	530	1101	2637	12 25_Wo	0,1785	532	1766	2280	578	947	2526
2 25_Lw	0,1412	732	2051	2918	359	1108	2521	12 25_Lwo	0,1979	544	1725	2105	560	941	2478
2 26_Lw	0,2139	702	1902	2838	481	1245	2384	12 26_Lwo	0,2369	613	1803	2418	596	938	2211
2 26_W	0,1927	553	1634	2732	313	1062	2431	12 26_Lwo	0,2508	558	1799	2652	572	1007	2457
2 27_Lw	0,1835	621	2155	2924	512	1159	2769	12 27_Lwo	0,2372	611	1612	2181	525	889	2701
2 27_Lw	0,1501	690	1663	2782	330	1380	2719	12 27_Lwo	0,2564	557	1675	2110	509	904	2584
2 28_Lw	0,23	743	1775	2778	447	1437	2759	12 28_Lwo	0,2106	550	1254	2340	610	1031	2339
2 28_W	0,2445	434	1229	2220	353	1130	2120	12 28_Lwo	0,2009	628	1473	2346	589	1104	2232
2 29_M	0,1895	653	2069	2932	502	1384	2928	12 29_Lwo	0,1955	499	1739	2364	550	1041	2461
2 29_M	0,1477	701	1773	2823	330	1271	2819	12 29_Wo	0,2344	535	1806	2200	569	975	2384
2 30_W	0,2114	764	1849	2936	449	1720	2674	12 30_M	0,2369	596	1704	2404	532	1257	2265
2 30_W	0,1865	708	1713	2730	380	1572	2324	12 30_M	0,2369	598	1802	2448	523	1311	2234
2 31_M	0,1753	611	1861	2727	394	1303	2438	12 31_M	0,2644	547	1632	2422	459	1108	2450
2 31_W	0,1327	588	1748	2711	337	1767	2715	12 31_M	0,2991	503	1867	2477	482	1152	2254
2 2_Wo	0,1799	686	2083	2817	510	1342	2647	12 2_Wo	0,1559	670	1629	2124	570	952	2070
2 2_W	0,2089	734	2001	2872	436	1200	2617	12 2_Wo	0,1674	755	1724	2468	605	1012	2402
2 1_Lwo	0,1646	582	2033	2868	661	1323	2827	12 1_Wo	0,204	583	1612	2249	683	1073	2266
2 1_L	0,2484	605	1839	2801	358	1249	2756	12 1_Wo	0,213	554	1645	2339	692	1167	2601
2 30_Wo	0,1832	668	1869	2823	514	1721	2879	12 30_M	0,2127	512	1776	2639	530	1296	2093
2 30_W	0,227	576	1726	2786	355	1761	2804	12 30_M	0,2336	551	1704	2616	534	1359	2253
2 25_Lw	0,1364	668	2002	2830	444	1102	2721	12 25_Wo	0,139	522	1663	2450	582	1020	2374
2 25_M	0,1951	686	1947	2914	352	1931	2933	12 25_Wo	0,1483	526	1648	2101	579	991	2345
2 28_Lw	0,2812	726	1720	2779	421	1457	2702	12 28_Lwo	0,1779	555	1175	2227	618	1059	2202
2 28_W	0,2217	506	1541	2475	331	1309	2135	12 28_Wo	0,1765	528	1259	2254	572	1090	2230
2 7_Lw	0,1694	689	2042	2770	516	1202	2705	12 7_Lwo	0,1413	534	1586	1973	579	981	2355
2 7_W	0,1111	671	1930	2819	369	1066	2417	12 7_Lwo	0,1499	567	1619	2171	590	942	2533
2 26_Lw	0,225	631	1948	2784	440	1424	2509	12 26_Lwo	0,2144	570	1648	2107	542	953	2204
2 26_W	0,1867	555	1525	2689	366	1189	2483	12 26_Lwo	0,2453	564	1755	2520	556	974	2316
2 31_Lw	0,261	668	2029	2902	415	1209	2712	12 31_M	0,2456	553	1696	2043	453	1227	2306

2 31_W	0,1607	648	1843	2705	357	1784	2750
2 24_M	0,2636	718	1807	2679	353	1519	2572
2 24_M	0,2137	563	1726	2732	327	1154	2383
2 22_Lw	0,1487	621	2089	2753	383	1397	2552
2 22_Lw	0,1165	682	1897	2782	407	1579	2524
2 23_M	0,3369	679	1850	2712	400	1017	2470
2 23_M	0,2079	667	1787	2880	371	1276	2589
2 27_Lw	0,1545	627	1675	2572	414	1277	2589
2 27_W	0,1722	697	1736	2646	320	1376	2720
2 4_M	0,1866	651	1983	2766	699	1654	2615
2 4_W	0,1667	693	1941	2853	404	1212	2816
2 10_M	0,1879	587	1794	2783	428	1324	2729
2 10_W	0,1456	641	1472	2750	317	1123	2809
2 11_Lw	0,234	557	1410	2665	391	1465	2778
2 11_Lw	0,1677	737	1743	3009	351	1174	2418
2 14_WN	0,1645	511	1898	2752	479	1155	2439
2 14_WN	0,1506	778	1688	2858	309	1110	2258
2 17_Lw	0,1805	704	2123	3173	456	1247	3023
2 17_W	0,1807	727	1801	2940	314	1055	2955
2 29_Lw	0,1464	668	1783	2667	414	1630	2377
2 29_W	0,1079	608	1610	2730	335	1834	2672
2 15_M	0,2941	522	1619	2198	443	1238	2817
2 15_M	0,2251	381	1263	2340	388	1111	2560
2 3_W	0,1167	622	1680	2685	448	1115	2556
2 3_W	0,0917	618	1634	2549	373	1181	2516
2 13_LwN	0,2383	758	2027	2838	328	1078	2385
2 13_WN	0,1819	761	1921	2888	296	1096	2374
2 16_Lw	0,1631	720	1828	2824	450	1370	2890
2 16_Lw	0,1376	664	1766	2887	371	1399	2787
2 9_Wo	0,236	642	1906	2741	595	1219	2615
2 9_W	0,1764	628	1538	2753	352	1125	2638
2 18_Lw	0,1967	640	2077	2882	500	1430	2747
2 18_W	0,1673	670	1804	2721	437	1577	2907
2 19_Lw	0,2196	576	1927	2767	491	1372	2780
2 19_Lw	0,1673	636	1893	2721	285	1208	2644
2 12_Lw	0,107	697	2018	2690	619	1357	2886
2 12_Lw	0,1377	684	1595	2948	291	1622	2942
2 6_WN	0,229	849	1906	2663	472	1067	2511
2 6_LwN	0,2143	779	1885	2945	360	1172	2459
2 5_Wo	0,12	619	2028	2769	428	1063	2478
2 5_W	0,1304	684	1504	2679	368	888	2641
2 21_Lw	0,2039	598	2075	2842	443	1330	2411
2 21_Lw	0,2103	670	1907	2895	640	1601	2699
2 20_NL	0,1721	697	1974	2775	456	1146	2798
2 20_W	0,1599	705	1844	2722	334	1113	2665
2 8_Lwo	0,1881	621	1976	2780	653	1622	2918
2 8_Lw	0,1597	741	1753	2896	294	1248	2742
3 1_L	0,2876	703	1903	2293	764	1244	2586
3 1_Lwo	0,2557	747	1870	2808	800	1328	2559
3 2_Lwo	0,2332	802	1907	2449	652	1080	2665
3 2_Lwo	0,1957	827	1422	2336	658	1080	2623
3 3_Lwo	0,2689	703	1771	2495	591	1034	2941
3 3_Lwo	0,2653	680	1846	2642	572	1045	2751
3 4_Lw	0,2458	726	1734	2799	682	1181	2732
3 4_Lwo	0,2713	753	1751	2357	642	1179	2712
3 5_NL	0,2972	699	1844	2539	555	1137	2885
3 5_Lwo	0,2425	666	1630	2364	565	938	2842
3 6_WoN	0,2197	817	1682	2152	747	1203	2464
3 6_WN	0,2262	864	1568	2213	788	1260	2579
3 7_Lwo	0,2099	645	1937	2756	748	1216	2782
3 7_Lwo	0,2619	719	1783	2192	656	1058	2753
3 8_L	0,2526	807	1926	2693	616	1360	2786
3 8_L	0,2093	793	1669	1848	828	1376	2699
3 9_L	0,3251	704	1792	2626	725	1191	2662
3 9_Lwo	0,2763	731	1587	2180	672	1139	2509
3 10_M	0,274	710	1828	2869	515	1359	2712
3 10_Lwo	0,244	662	1550	1900	548	1082	2992
3 11_Lwo	0,234	798	1863	2514	634	1344	2849
3 11_Lwo	0,2408	907	1784	2911	653	1187	2857
3 12_Lwo	0,2689	711	1812	2416	593	1236	3107
3 12_Lwo	0,3067	653	1480	1902	645	1242	2908
3 13_WoN	0,1994	849	1714	1874	751	1473	2381
3 13_WoN	0,2507	856	1630	2089	821	1280	2596
3 14_Lwo	0,2972	694	1742	2733	538	1107	2944
3 14_Lwo	0,2796	695	1795	2393	726	1218	2694
3 15_Lwo	0,2957	721	1965	2060	621	1348	2817

12 31_M	0,2017	601	1789	2560	477	1161	2261
12 24_Lwo	0,1976	503	1703	2389	606	998	2183
12 24_Lwo	0,2086	557	1722	2487	579	987	2313
12 22_Lwo	0,1812	489	1819	2367	552	1146	2154
12 22_Lw	0,2108	483	1879	2392	512	1003	2159
12 23_Lwo	0,2219	511	1749	2198	661	929	2249
12 23_Lwo	0,2087	532	1797	2212	612	1064	2385
12 27_Lwo	0,2229	539	1794	2443	503	937	2376
12 27_Lw	0,2315	646	1548	2252	489	900	2684
12 4_Lwo	0,2497	654	1599	2168	492	913	2254
12 4_Lwo	0,2743	612	1722	2383	489	939	2258
12 10_Lwo	0,1592	544	1595	2194	489	966	2436
12 10_Lwo	0,1722	591	1502	2122	504	947	2594
12 11_Lwo	0,2082	627	1738	2485	555	1112	2138
12 11_Lwo	0,1737	690	1820	2491	638	1056	2317
12 14_Wo	0,1873	493	1842	2640	604	1004	2228
12 14_WoN	0,1612	605	1681	1901	565	1045	2411
12 17_M	0,1855	665	1617	2204	615	1088	2259
12 17_M	0,2028	667	1770	2485	702	1174	2301
12 29_Lwo	0,1832	452	1693	2315	515	1113	2117
12 29_Wo	0,1685	485	1797	2776	527	1103	2211
12 15_Wo	0,1687	613	1695	2364	600	1068	2314
12 15_Wo	0,173	616	1780	2444	596	1130	2405
12 3_Wo	0,1503	555	1528	2298	476	929	2247
12 3_Wo	0,1766	570	1636	1987	488	996	2149
12 13_WoN	0,2025	684	1839	2351	720	1017	2215
12 13_WoN	0,2212	783	1798	2716	733	1055	2226
12 16_Lwo	0,1985	536	1719	2480	521	971	2381
12 16_Lwo	0,1823	564	1846	2698	529	971	2379
12 9_Wo	0,2472	604	1636	2160	607	969	2187
12 9_Wo	0,2064	604	1721	2595	621	1038	2180
12 18_Lwo	0,2019	529	1809	2594	516	997	2380
12 18_Lwo	0,1809	618	1681	2649	531	978	2419
12 19_Wo	0,1784	584	1583	2176	649	1029	2223
12 19-Wo	0,173	608	1668	2343	659	1049	2273
12 12_Lwo	0,1752	525	1692	2119	511	998	2407
12 12_Lwo	0,1661	638	1523	2166	523	994	2346
12 6_WN	0,1687	798	1707	2506	750	1124	2242
12 6_WN	0,1617	765	1757	2579	768	1449	2530
12 5_Wo	0,1274	608	1549	2099	548	945	2356
12 5_Wo	0,1554	635	1536	2236	557	920	2306
12 21_Lwo	0,175	623	1709	2278	574	1037	2227
12 21_Lwo	0,1921	702	1755	2440	593	1061	2216
12 20_Wo	0,1525	525	1715	2221	513	961	2187
12 20_Wo	0,1689	828	1960	2735	497	960	2228
12 8_Lwo	0,1689	645	1764	2315	628	1045	2256
12 8_Lwo	0,1574	608	1789	2271	683	1060	2261
13 1_Wo	0,1879	519	1516	2428	540	1020	2275
13 1_Lwo	0,2177	483	1591	2431	560	899	2302
13 2_Wo	0,156	577	1466	2234	495	894	2127
13 2_Wo	0,1509	658	1232	2140	456	912	2229
13 3_W	0,154	507	1363	2415	413	845	2144
13 3_Wo	0,1897	500	1409	2470	444	821	2172
13 4_Wo	0,2082	510	1458	2237	483	915	2211
13 4_M	0,1837	557	1409	2255	507	925	2208
13 5_W	0,1568	505	1493	2425	452	867	2107
13 5_Wo	0,1886	524	1510	2378	490	805	2330
13 6_WoN	0,1457	568	1536	2282	629	931	2257
13 6_WoN	0,1526	671	1458	2117	736	1098	2912
13 7_Wo	0,148	480	1453	2380	529	841	2111
13 7_Wo	0,1899	472	1592	2504	524	900	2055
13 8_Lwo	0,203	532	1624	2402	506	987	2334
13 8_Wo	0,1226	619	1440	2368	821	1050	2364
13 9_Wo	0,2034	525	1430	2526	567	912	2223
13 9_Wo	0,0977	541	1164	2461	523	1079	2259
13 10_Lw	0,1721	484	1504	2442	455	921	2322
13 10_Lwo	0,2041	550	1572	2426	471	884	2318
13 11_M	0,1843	562	1439	2122	457	973	2248
13 11_Lw	0,1861	634	1430	2223	446	952	2221
13 12_Lwo	0,162	541	1528	2445	493	991	2260
13 12_NL	0,2085	566	1503	2411	486	965	2249
13 13_LwoN	0,1632	602	1463	1998	581	929	2288
13 13_WoN	0,1598	659	1301	2421	514	928	2442
13 14_Wo	0,179	492	1446	2337	490	909	2098
13 14_WoN	0,127	575	1511	2363	606	1012	2100
13 15_Lwo	0,2349	547	1545	2282	448	932	2371

3	15_Lwo	0,2777	748	1679	2100	588	1239	2798	13	15_Lwo	0,2241	553	1583	2460	540	1105	2446
3	16_Lwo	0,25	692	1741	2761	613	1292	3029	13	16_Lw	0,1656	461	1607	2426	453	957	2457
3	16_L	0,2353	663	1770	2429	675	1316	2895	13	16_Lwo	0,1648	526	1637	2430	472	975	2439
3	17_Lw	0,3083	766	1810	2809	559	1374	2744	13	17_M	0,2085	581	1632	2399	513	949	2393
3	17_M	0,2851	742	1556	1926	783	1341	2697	13	17_M	0,2178	574	1622	2131	544	985	2292
3	18_Lwo	0,2641	701	1900	2838	671	1210	2916	13	18_Lw	0,177	494	1432	2351	410	886	2325
3	18_Lw	0,2697	647	1503	2187	599	1564	2451	13	18_Lw	0,2238	488	1406	2444	370	936	2414
3	19_Lwo	0,2728	760	1808	2840	685	1278	2697	13	19_Lwo	0,2211	445	1564	2322	523	948	2263
3	19_Wo	0,2434	730	1808	2578	707	1214	2513	13	19_Lwo	0,2088	490	1461	2316	451	920	2224
3	20_Lwo	0,2139	672	1806	2534	593	1304	2814	13	20_W	0,159	451	1510	2298	394	1004	2029
3	20_Lwo	0,2452	698	1785	2542	571	1264	2750	13	20_W	0,1643	498	1434	2399	400	900	2196
3	21_Lwo	0,2726	773	1970	2499	652	1300	2677	13	21_Lw	0,2603	527	1623	2350	431	883	2142
3	21_Lwo	0,2646	773	1872	2302	692	1145	2626	13	21_Lw	0,2096	483	1483	2307	469	905	2144
3	22_Lw	0,3048	685	1814	2377	588	1209	2756	13	22_Wo	0,1275	533	1477	2260	461	1067	2064
3	22_Lwo	0,2546	681	1878	2353	617	1254	2752	13	22_Wo	0,1793	544	1522	2255	453	962	2243
3	23_Lwo	0,3	681	1860	2881	723	1216	2610	13	23_Wo	0,2426	485	1565	2142	550	859	2283
3	23_Lwo	0,2981	713	1863	2867	629	1262	2511	13	23_Wo	0,2086	473	1602	2111	580	942	2214
3	24_Lwo	0,2753	745	1846	2587	673	1194	2606	13	24_Wo	0,2104	516	1470	2485	495	890	2253
3	24_Lwo	0,2371	708	1672	2095	693	1275	2679	13	24_Wo	0,2171	499	1494	2514	553	969	2217
3	25_Wo	0,2221	758	1753	2846	662	1205	2835	13	25_Wo	0,1705	496	1481	2360	461	861	2000
3	25_Lwo	0,25	718	1846	2703	645	1186	2803	13	25_W	0,157	479	1456	2423	361	856	2169
3	26_M	0,2591	735	1756	2607	728	1339	2699	13	26_Lwo	0,2052	499	1529	2458	482	898	2152
3	26_M	0,2593	723	1817	2641	713	1286	2616	13	26_M	0,2238	460	1488	2471	526	953	2279
3	27_Lwo	0,2477	699	1868	2686	596	1242	2999	13	27_W	0,1679	500	1373	2302	359	845	2166
3	27_Lw	0,2786	658	1783	2714	507	1112	2811	13	27_Wo	0,1868	536	1464	2404	430	812	2226
3	28_Lwo	0,2857	765	1730	2593	575	1553	2761	13	28_Lw	0,2342	550	1351	2271	427	912	2349
3	28_L	0,2614	714	1488	2543	632	1341	2755	13	28_Wo	0,1537	502	1145	2298	535	1029	2305
3	29_Lwo	0,2629	674	1833	2563	572	1374	2793	13	29_Wo	0,1735	423	1414	2460	439	948	2237
3	29_Lwo	0,2228	690	1631	1879	636	1467	2416	13	29_Lwo	0,1684	534	1546	2360	431	853	2226
3	30_Lwo	0,3137	704	1805	2309	560	1642	2742	13	30_Lw	0,193	522	1466	2474	417	933	2173
3	30_Lw	0,2466	663	1858	2325	684	1585	2524	13	30_Lwo	0,2097	510	1475	2544	476	1013	2180
3	31_Lw	0,2632	717	1858	2827	518	1620	2735	13	31_M	0,1822	492	1327	2262	399	1204	1991
3	31_W	0,2288	664	1678	2547	520	1523	2671	13	31_M	0,1707	500	1367	2398	389	1064	2176
3	2_Lwo	0,2305	843	1896	2727	666	1209	2831	13	2_Wo	0,1616	609	1428	2233	493	905	2199
3	2_Wo	0,2357	851	1783	2393	624	1036	2679	13	2_Lwo	0,1515	605	1340	2263	477	872	2123
3	1_L	0,3006	739	1810	2624	758	1212	2840	13	1_Wo	0,1784	516	1452	2379	555	972	2342
3	1_Lwo	0,2818	753	1858	2887	771	1275	2731	13	1_Lwo	0,1978	497	1531	2424	536	971	2191
3	30_Lwo	0,3286	715	1781	2941	600	1574	2895	13	30_Lwo	0,1988	485	1487	2488	504	1030	2263
3	30_Lwo	0,3549	726	1777	2910	593	1750	2670	13	30_Lwo	0,2335	510	1503	2496	465	1169	2551
3	25_Lwo	0,2499	739	1814	2905	643	1242	2885	13	25_Wo	0,1392	490	1382	2400	500	921	2151
3	25_Lwo	0,2096	718	1824	2791	632	1138	2873	13	25_Wo	0,1863	543	1347	2398	503	890	2317
3	28_Wo	0,264	785	1761	2749	615	1597	2715	13	28_Lwo	0,2164	514	1286	2333	524	1002	2416
3	28_Wo	0,1994	682	1542	2759	523	1640	2733	13	28_Wo	0,19	512	1195	1979	524	972	2226
3	7_Wo	0,1793	679	1913	2913	726	1252	2723	13	7_WN	0,136	491	1418	2320	496	875	2196
3	7_Lwo	0,2235	681	1877	2621	624	1154	2779	13	7_Wo	0,1399	528	1538	2395	594	832	2216
3	26_Wo	0,2563	740	1858	2945	708	1346	2649	13	26_Wo	0,2167	501	1445	2443	482	958	2227
3	26_Wo	0,2712	710	1877	2845	679	1207	2541	13	26_Lwo	0,2436	511	1494	2419	463	939	2265
3	31_Lw	0,2346	691	1888	2844	550	1704	2847	13	31_M	0,2266	498	1368	2369	474	1108	2075
3	31_Lwo	0,2454	649	1926	2758	574	1488	2677	13	31_Lw	0,2003	516	1362	2529	396	1125	2243
3	24_Lw	0,2521	693	1912	2440	663	1346	2599	13	24_Wo	0,2088	475	1459	2503	505	993	2295
3	24_Wo	0,2366	709	1783	2736	655	1125	2362	13	24_Wo	0,2205	496	1493	2485	534	1019	2268
3	22_Lwo	0,2298	658	1884	2887	589	1400	2617	13	22_Wo	0,1334	499	1342	2107	453	1146	1973
3	22_Lwo	0,2332	690	1843	2834	591	1310	2603	13	22_NL	0,2055	522	1467	2440	468	940	2123
3	23_Lwo	0,334	688	1916	2900	700	1203	2585	13	23_Lwo	0,2504	446	1534	2578	542	938	2441
3	23_Wo	0,2511	635	1947	2931	761	1373	2528	13	23_Wo	0,2102	453	1635	2561	558	999	2263
3	27_Lw	0,2318	664	1960	2857	552	1136	2919	13	27_Wo	0,1848	527	1443	2469	417	920	2214
3	27_Lwo	0,253	633	2031	2825	605	1109	2842	13	27_Wo	0,1871	572	1375	2414	450	878	2226
3	4_Lwo	0,2732	721	1753	2660	717	1290	2723	13	4_Lwo	0,2387	509	1481	2316	475	876	2259
3	4_Lwo	0,2672	712	1820	2750	694	1259	2783	13	4_Lwo	0,2803	536	1483	2339	432	939	2251
3	10_Lwo	0,2265	663	1902	2741	616	1316	3053	13	10_Wo	0,1568	487	1472	2348	454	1009	2238
3	10_Lwo	0,2258	696	1852	2767	618	1148	2817	13	10_W	0,1813	476	1487	2279	424	815	2309
3	11_Lwo	0,2212	809	1901	2786	660	1504	2793	13	11_Lwo	0,2092	555	1566	2324	462	968	2263
3	11_Lwo	0,191	796	1758	2596	619	1417	2848	13	11_Lwo	0,1945	597	1372	2579	456	864	2428
3	14_Lwo	0,2122	671	1871	2853	784	1379	2475	13	14_WoN	0,1473	477	1354	2370	586	1083	2162
3	14_Lwo	0,2283	655	1982	2764	677	1306	2715	13	14_WoN	0,194	460	1442	2417	576	1048	2077
3	17_Lwo	0,288	781	1899	2814	681	1346	2704	13	17_M	0,2536	521	1565	2303	463	1052	2278
3	17_Lwo	0,2428	752	1774	1972	817	1328	2543	13	17_M	0,1957	553	1571	2408	523	944	2193
3	29_Lwo	0,1988	669	1904	2904	592	1693	2887	13	29_Wo	0,1156	485	1291	2330	456	1167	2036
3	29_Lwo	0,2054	597	1617	2429	550	1471	2513	13	29_Lwo	0,1797	469	1483	2457	466	932	2123
3	15_Lwo	0,2976	797	1925	2454	630	1312	2828	13	15_Lwo	0,2231	556	1436	2397	443	959	2507
3	15_Lwo	0,2617	784	1512	2166	669	1306	2563	13	15_Lwo	0,2488	532	1617	2428	450	1040	2503
3	3_Wo	0,2078	650	1876	2841	674	1114	2760	13	3_Wo	0,145	454	1343	2333	444	897	2145
3	3_Wo	0,1774	687	1795	2765	623	1113	2704	13	3_W	0,13	528	1116	2315	400	821	2216
3	13_WoN	0,2609	831	1820	2231	735	1243	2623	13	13_WoN	0,1987	647	1409	2311	529	945	2166
3	13_WoN	0,2612	838	1738	1953	778	1306	2600	13	13_WoN	0,1403	629	1467	2241	589	997	2028
3	16_Lwo	0,2085	685	1854	2838	647	1401	2759	13	16_Lw	0,1466	462	1411	2510	451	1042	2458

3	16_Lwo	0,2126	708	1768	2844	600	1253	2961	13	16_Lwo	0,1627	455	1551	2530	490	982	2630
3	9_Lwo	0,3306	686	1795	2876	708	1202	2721	13	9_Wo	0,2533	487	1444	2564	541	941	2337
3	9_L	0,3265	720	1712	2457	768	1231	2535	13	9_Wo	0,2689	547	1305	2367	456	1488	2724
3	18_M	0,222	671	1933	2729	625	1597	2817	13	18_Lw	0,1952	474	1370	2294	382	1023	2465
3	18_Lwo	0,2395	640	1956	2794	606	1410	2789	13	18_Lw	0,1819	533	1208	2443	379	916	2482
3	19_Lw	0,2696	753	1836	2731	617	1237	2584	13	19_Lwo	0,1964	458	1624	2378	512	964	2305
3	19_Lw	0,2694	731	1836	2527	681	1179	2576	13	19-Lwo	0,2362	484	1452	2331	468	991	2272
3	12_Lwo	0,231	665	1834	2521	659	1370	2883	13	12_Wo	0,1505	481	1461	2484	491	1068	2427
3	12_Lw	0,2644	678	1816	2693	568	1323	2873	13	12_Lwo	0,175	461	1440	2472	463	967	2447
3	6_WN	0,2302	809	1805	2296	727	1338	2330	13	6_WoN	0,1759	611	1551	2261	639	936	2250
3	6_WN	0,2644	844	1744	1826	881	1372	2643	13	6_WoN	0,1945	653	1445	2205	597	895	2212
3	5_Lwo	0,2295	702	1694	2822	652	1118	2865	13	5_Wo	0,1407	508	1357	2394	503	908	2099
3	5_Lwo	0,2378	721	1926	2801	621	1033	2858	13	5_Wo	0,1533	506	1423	2360	493	900	2229
3	21_L	0,2505	768	1886	2630	731	1357	2706	13	21_Lwo	0,2748	542	1567	2278	475	1011	2259
3	21_L	0,2565	770	1832	2469	744	1307	2637	13	21_Lw	0,2645	575	1575	2542	445	961	2232
3	20_Lw	0,2572	723	1827	2702	601	1250	2735	13	20_W	0,1537	478	1475	2418	439	996	2198
3	20_Lwo	0,2104	686	1865	2343	560	1455	2786	13	20_Wo	0,1895	486	1522	2485	483	940	2324
3	8_Lwo	0,248	797	1865	2514	717	1398	2828	13	8_Lwo	0,2421	405	1604	2328	533	1061	2368
3	8_Lwo	0,23	773	1754	2574	755	1327	2671	13	8_Lwo	0,2393	536	1537	2469	510	1031	2334
4	1_Lwo	0,2267	606	2165	2964	607	1349	2764	14	1_Wo	0,2096	528	1791	2380	519	949	2269
4	1_Lw	0,2909	662	2049	2991	591	1369	2802	14	1_Wo	0,1487	464	1745	2400	401	1166	2094
4	2_Wo	0,2311	704	2330	2968	543	1218	2776	14	2_Wo	0,1671	572	1929	2657	511	970	2322
4	2_W	0,2484	742	2050	2833	428	1336	2736	14	2_W	0,1305	576	1831	2473	411	1004	2239
4	3_W	0,131	628	1990	3054	477	1153	2765	14	3_Wo	0,1388	533	1765	2675	470	970	2371
4	3_W	0,1403	586	2193	2925	457	1087	2731	14	3_Wo	0,1266	522	1681	2402	444	1060	2381
4	4_Lw	0,2662	670	2011	2799	463	1111	2793	14	4_Lwo	0,1702	532	1682	2421	497	1042	2495
4	4_Lw	0,2754	722	1990	2743	332	1234	2625	14	4_Wo	0,1281	525	1714	2452	482	1079	2278
4	5_Wo	0,1627	585	2060	3010	471	1068	2690	14	5_Wo	0,1466	503	1795	2684	503	1035	2301
4	5_W	0,161	577	1879	2862	316	1076	2669	14	5_Lwo	0,1395	539	1707	2644	477	1024	2378
4	6_Lw	0,2055	761	2155	2795	543	1194	2521	14	6_Wo	0,1731	630	1268	2236	540	896	2135
4	6_WN	0,1934	808	2142	2896	674	1365	2801	14	6_Wo	0,1217	602	1808	2611	562	968	2120
4	7_Lwo	0,1525	594	1662	2754	617	1328	2667	14	7_Wo	0,1181	569	1650	2630	519	977	2192
4	7_Lwo	0,1137	590	2073	2892	533	1162	2526	14	7_LWo	0,089	562	1453	2594	532	1039	2388
4	8_Lw	0,2479	709	2129	3017	488	1391	2893	14	8_Lwo	0,1756	574	1849	2758	492	1065	2540
4	8_Lw	0,2599	721	2086	3049	404	1301	2887	14	8_Lwo	0,1313	532	1929	2856	502	1592	2691
4	9_Lw	0,2569	617	2216	2949	494	1146	2739	14	9_Wo	0,1735	524	1671	2538	526	1085	2272
4	9_W	0,3093	670	2101	3040	346	1087	2849	14	9_Lwo	0,1812	520	1724	2731	474	1480	2346
4	10_Lw	0,1484	604	2124	2985	439	1350	2857	14	10_Wo	0,1434	559	1673	2594	470	1107	2447
4	10_Lw	0,1198	567	1755	2807	378	1271	2954	14	10_Lwo	0,15	575	1480	2660	483	1110	2513
4	11_Lw	0,2434	669	2058	2792	438	1205	2850	14	11_Lwo	0,1992	641	1580	2453	481	957	2536
4	11_Lw	0,2447	739	2115	2815	445	1302	2792	14	11_Lwo	0,1866	589	1813	2644	462	1088	2251
4	12_Lw	0,1498	612	2098	2909	479	1448	2853	14	12_Lwo	0,1659	561	1763	2836	490	1122	2477
4	12_W	0,1124	615	1868	2739	442	1428	2863	14	12_Wo	0,1394	528	1585	2584	472	1228	2428
4	13_WN	0,2053	644	2328	2907	720	1711	2833	14	13_W	0,236	641	1172	2290	448	920	2358
4	13_LwN	0,2339	706	2169	2887	489	1370	2703	14	13_W	0,1878	628	1176	2352	474	980	2334
4	14_NL	0,1814	547	2101	3061	490	1135	2708	14	14_Wo	0,1415	526	1786	2783	543	1106	2115
4	14_WN	0,123	590	1919	2777	396	1196	2277	14	14_Wo	0,1253	522	1698	2699	532	1021	2099
4	15_W	0,2294	697	2162	2986	490	1237	2740	14	15_Lwo	0,186	575	1865	2752	508	1104	2643
4	15_W	0,229	763	2031	2871	484	1233	2859	14	15_M	0,2046	459	2026	2932	401	1249	2491
4	16_Lw	0,1763	518	1579	2653	454	1473	2913	14	16_Wo	0,1335	512	1716	2738	506	1236	2517
4	16_Lw	0,1403	597	2108	2854	402	1470	2893	14	16_Lwo	0,1459	515	1734	2716	514	1369	2650
4	17_Lw	0,2781	669	2075	2841	536	1260	2886	14	17_L	0,2001	555	1876	2820	514	837	2091
4	17_Lw	0,283	709	2116	3032	407	1236	2850	14	17_L	0,2446	397	1411	2144	451	1314	2594
4	18_Lw	0,1799	598	2185	2957	438	1293	2951	14	18_Lw	0,1758	515	1777	2724	479	1222	2590
4	18_Lw	0,1168	639	1908	2885	409	1399	2980	14	18_Lw	0,2061	520	1769	2795	476	1154	2585
4	19_W	0,254	608	2108	2959	506	1491	2842	14	19_Wo	0,1826	472	1834	2445	533	1022	2245
4	19_W	0,2983	678	2013	2962	437	1396	2631	14	19_Wo	0,1242	511	1786	2342	538	1274	2325
4	20_Lw	0,1357	526	2166	3014	418	1430	2876	14	20_Wo	0,0995	536	1711	2707	476	1281	2493
4	20_Lw	0,1298	639	1903	2937	433	1373	2902	14	20_M	0,2546	376	2086	2950	738	2216	3105
4	21_Lwo	0,279	696	2175	3067	490	1254	2819	14	21_Lwo	0,1814	548	1823	2471	487	905	2083
4	21_Lw	0,3052	701	2138	3065	412	1209	2702	14	21_Lw	0,1744	519	1953	2802	519	1132	2407
4	22_Lw	0,2113	549	2237	2948	386	1131	2767	14	22_Wo	0,1406	551	1737	2582	462	1202	2392
4	22_Lw	0,1303	570	2009	2808	332	1196	2692	14	22_Lw	0,137	547	1737	2658	408	1284	2273
4	23_Lw	0,2896	633	2104	2784	415	1120	2627	14	23_Lwo	0,2153	550	1819	2656	549	1007	2411
4	23_Lw	0,2869	675	2073	2874	480	1249	2783	14	23_Wo	0,1799	546	1785	2558	477	1195	2215
4	24_Lw	0,2667	638	2131	2967	522	1235	2705	14	24_Wo	0,1606	557	1659	2574	542	1079	2442
4	24_Lw	0,2447	719	2179	3004	469	1133	2809	14	24_Wo	0,171	565	1750	2751	520	1336	2491
4	25_Wo	0,1446	589	2186	3030	520	1183	2793	14	25_Wo	0,1278	517	1707	2658	516	1136	2295
4	25_Lw	0,1545	601	2172	2905	454	1070	2779	14	25_Wo	0,122	509	1754	2700	518	1146	2378
4	26_Lwo	0,2254	654	2122	2947	529	1200	2770	14	26_Lwo	0,1912	546	1687	2584	483	1049	2509
4	26_Lw	0,2799	731	2157	2965	399	1211	2822	14	26_Wo	0,1785	532	1712	2573	447	1057	2265
4	27_Wo	0,1495	556	2149	2993	487	1206	2770	14	27_Wo	0,1624	527	1707	2617	439	987	2330
4	27_W	0,1455	582	2050	2924	370	1009	2791	14	27_Wo	0,1401	531	1637	2621	452	1025	2429
4	28_Wo	0,2233	700	1862	2810	471	1388	2814	14	28_Lw	0,1953	541	1362	2166	430	1152	2621
4	28_Lw	0,2372	768	1925	2862	400	1266	2757	14	28_Wo	0,1556	519	1546	2350	461	1102	2178
4	29_Lw	0,1553	626	2276	2977	434	1347	2836	14	29_Lwo	0,1642	576	1863	2829	460	1201	2587

4	29_Lw	0,1931	601	2135	3042	454	1422	2821	14	29_Wo	0,1447	562	1574	2568	448	1304	2402
4	30_Lwo	0,2396	662	2105	3013	527	1424	2733	14	30_Lw	0,2149	522	1634	2586	430	1317	2636
4	30_Lwo	0,2717	574	1535	2475	460	1647	2829	14	30_Lw	0,1785	552	1595	2651	427	1376	2543
4	31_Lw	0,1704	659	2030	3034	437	1338	2850	14	31_Wo	0,173	523	1756	2764	422	1345	2395
4	31_Lw	0,2024	636	2031	2981	438	1533	2805	14	31_Lw	0,1448	523	1729	2619	432	1383	2451
4	2_Wo	0,2063	748	2060	2816	525	1155	2791	14	2_Wo	0,1368	614	1617	2434	507	872	2365
4	2_Lwo	0,2379	776	2044	2891	581	1332	2797	14	2_Wo	0,1233	614	1648	2498	514	936	2210
4	1_Lwo	0,2604	619	2174	2869	519	1106	2730	14	1_Wo	0,224	526	1797	2511	526	1065	2240
4	1_Lwo	0,295	647	2127	2997	566	1184	2720	14	1_Wo	0,1403	527	1752	2468	598	1105	2276
4	30_Lwo	0,2519	669	2084	2959	515	1443	2842	14	30_Lw	0,2377	583	1564	2650	481	1190	2410
4	30_Lw	0,2757	743	1999	2918	401	1401	2893	14	30_Lwo	0,2054	600	1544	2598	500	1176	2324
4	25_Wo	0,1418	656	2152	2990	526	1311	2772	14	25_Wo	0,1377	542	1743	2651	514	1141	2382
4	25_Wo	0,119	587	2004	2926	494	1221	2801	14	25_Wo	0,1427	547	1688	2671	512	1016	2438
4	28_Lwo	0,2254	774	1861	2798	515	1556	2863	14	28_W	0,1845	541	1381	2302	414	1193	2406
4	28_Lwo	0,1966	696	1838	2845	530	1409	2749	14	28_W	0,157	500	1119	2421	415	936	2476
4	7_Wo	0,1216	637	2147	2947	523	1184	2481	14	7_Wo	0,112	541	1643	2658	523	1005	2206
4	7_W	0,1006	497	1740	2733	516	1051	2666	14	7_Wo	0,1103	533	1554	2414	513	921	2279
4	26_Lwo	0,2198	688	2034	2884	565	1299	2697	14	26_Lwo	0,1898	564	1701	2610	503	1024	2460
4	26_Lwo	0,2361	754	2002	2953	536	1266	2765	14	26_Lwo	0,2093	520	1722	2655	469	1104	2366
4	31_Lw	0,1634	606	1954	3003	405	1397	2946	14	31_Lw	0,1747	515	1707	2708	385	1380	2447
4	31_Lw	0,1625	601	2015	2817	381	1586	2844	14	31_Lwo	0,1291	531	1648	2536	406	1414	2435
4	24_Lw	0,2337	624	2198	3022	497	1219	2797	14	24_Lwo	0,1877	561	1642	2607	485	895	2443
4	24_Lwo	0,2295	717	2046	3092	552	1184	2737	14	24_Lwo	0,1735	557	1537	2545	475	911	2490
4	22_W	0,149	513	2236	3024	454	1272	2618	14	22_W	0,1604	546	1624	2546	409	1236	2252
4	22_W	0,1427	584	2056	2929	423	1195	2728	14	22_Lw	0,1321	532	1651	2661	412	1199	2500
4	23_Lwo	0,2629	651	2181	2859	522	1206	2542	14	23_Lwo	0,2184	553	1741	2552	523	970	2296
4	23_Lwo	0,2524	684	2135	2969	599	1228	2764	14	23_Wo	0,1682	517	1669	2579	502	966	2374
4	27_Lwo	0,1734	665	2049	2934	507	1216	2746	14	27_W	0,1668	499	1700	2754	428	1076	2326
4	27_W	0,1424	620	1971	2805	418	1113	2729	14	27_W	0,1649	525	1636	2618	408	1104	2460
4	4_Lwo	0,214	691	1970	2790	613	1395	2799	14	4_Lwo	0,1744	567	1615	2480	443	920	2482
4	4_Lw	0,2589	791	1943	2841	576	1288	2852	14	4_Lwo	0,1216	581	1271	2478	444	958	2544
4	10_Lw	0,1469	678	1958	2913	426	1265	2840	14	10_Wo	0,1179	555	1688	2677	511	1129	2616
4	10_Lw	0,139	626	1953	2866	418	1265	2831	14	10_Wo	0,1252	548	1530	2586	471	959	2578
4	11_Lwo	0,2444	812	1911	2738	480	1158	2902	14	11_Lw	0,2386	622	1279	2458	347	928	2639
4	11_Lw	0,2763	804	1891	2946	438	1257	2829	14	11_L	0,2148	606	1375	2471	351	1088	2347
4	14_Lw	0,1688	656	1964	2938	455	1163	2780	14	14_Wo	0,142	509	1677	2651	515	1065	2293
4	14_Wo	0,1149	665	1841	2810	523	1340	2019	14	14_Wo	0,147	530	1672	2660	517	1096	2151
4	17_Lw	0,2592	717	1974	3003	481	1294	2828	14	17_Lw	0,2183	553	1811	2709	438	944	2637
4	17_Lwo	0,2456	700	2045	3047	653	1344	2760	14	17_M	0,1861	512	1723	2736	460	1026	2431
4	29_W	0,1287	618	2045	2960	440	1533	2801	14	29_Wo	0,116	556	1562	2599	485	1315	2568
4	29_W	0,1273	557	1940	2851	355	1352	2738	14	29_Lwo	0,1557	546	1581	2563	494	1039	2398
4	15_Lwo	0,2251	777	2029	2830	485	1467	2937	14	15_Lwo	0,1868	595	1784	2702	469	1035	2590
4	15_M	0,2758	729	2023	2941	490	1304	2761	14	15_Lw	0,1577	624	1397	2712	432	997	2520
4	3_Wo	0,1251	606	1957	2972	486	1194	2689	14	3_Wo	0,0894	545	1647	2487	489	1016	2401
4	3_Wo	0,1082	546	1900	2727	445	1098	2567	14	3_Wo	0,093	535	1620	2567	463	996	2382
4	13_LwN	0,2225	741	2111	2891	534	1194	2377	14	13_WN	0,2747	642	1235	2224	381	1008	2353
4	13_WN	0,2668	797	1910	2902	544	1397	2430	14	13_WoN	0,1893	618	1520	2698	452	1010	2323
4	16_Lw	0,1464	668	1985	2984	469	1326	2976	14	16_Wo	0,1201	540	1626	2636	484	1177	2582
4	16_Lw	0,1512	639	1942	2879	454	1315	2850	14	16_Wo	0,1138	517	1630	2629	456	1174	2584
4	9_Lwo	0,2836	638	2225	2918	566	1086	2822	14	9_Lwo	0,2252	540	1718	2645	517	979	2214
4	9_Lwo	0,2548	685	2183	3084	580	1174	2849	14	9_Wo	0,1619	561	1478	2557	502	1126	2480
4	18_Lw	0,1627	633	1979	3085	436	1351	3014	14	18_Wo	0,1476	515	1635	2780	469	1207	2425
4	18_Lw	0,1229	658	1689	2795	441	1264	2967	14	18_Lwo	0,1324	562	1542	2587	466	1207	2566
4	19_Lwo	0,2598	641	2100	2928	516	1190	2722	14	19_Wo	0,1835	503	1820	2671	487	933	2307
4	19_Lw	0,2493	669	1972	2938	584	1345	2760	14	19_Wo	0,1622	509	1773	2475	484	1189	2124
4	12_Wo	0,1155	611	2023	2953	444	1395	2939	14	12_Lwo	0,1327	551	1678	2674	436	1286	2409
4	12_W	0,1356	601	1817	2837	422	1534	2945	14	12_Lw	0,1581	580	1461	2583	381	1070	2369
4	6_WoN	0,1836	742	2134	2872	651	1192	2776	14	6_WoN	0,1637	632	1129	2331	498	941	2230
4	6_WoN	0,2189	752	2081	2923	667	1277	2597	14	6_W	0,1724	591	1344	2416	434	956	2253
4	5_Wo	0,1121	652	1884	2760	466	1019	2838	14	5_Wo	0,1208	529	1626	2560	457	971	2405
4	5_Wo	0,1086	573	1777	2823	425	985	2248	14	5_W	0,0828	522	1500	2537	441	1046	2609
4	21_Lw	0,2588	663	2087	2819	485	1156	2589	14	21_Lw	0,2268	559	1941	2641	427	972	2444
4	21_Lw	0,3021	707	2144	2974	389	1241	2786	14	21_Lw	0,1706	569	1884	2724	449	1083	2208
4	20_Lw	0,1414	555	2113	2933	437	1321	2866	14	20_W	0,0914	525	1468	2522	395	1152	2433
4	20_W	0,1264	637	1762	2625	384	1176	2739	14	20_W	0,121	485	1657	2697	427	1354	2500
4	8_Lw	0,2405	636	2163	2988	472	1258	2805	14	8_Lwo	0,1804	573	1762	2767	445	976	2666
4	8_Lw	0,2822	709	2154	2982	391	1290	2862	14	8_Lwo	0,1614	555	1787	2789	617	1595	2665
5	1_Wo	0,2267	655	1791	2289	579	1137	2517	15	1_Wo	0,2607	628	2078	2932	538	1081	2608
5	1_Wo	0,1824	643	2109	2574	584	1395	2737	15	1_Wo	0,3041	637	2076	2958	500	1330	2733
5	2_Wo	0,132	741	1989	2395	649	1438	2761	15	2_Wo	0,2166	770	2196	3109	559	1070	2743
5	2_W	0,1282	718	2207	3151	534	1144	2543	15	2_Wo	0,225	788	2180	3039	560	1072	2539
5	3_Wo	0,1298	694	2062	2755	601	1182	2699	15	3_Wo	0,1596	629	2095	2930	561	1104	3053
5	3_Wo	0,0891	735	2024	2928	565	1084	2729	15	3_Wo	0,1842	560	2096	2934	507	1095	2480
5	4_Wo	0,1789	711	2076	2904	591	1440	2516	15	4_Wo	0,2402	676	1960	2832	515	1037	2614
5	4_Wo	0,1649	673	2112	3028	569	1441	2815	15	4_Wo	0,1935	611	1942	2829	620	1341	2452
5	5_Wo	0,1255	684	2055	2851	583	1085	2679	15	5_W	0,2074	655	2045	2853	530	1065	2886

5	5_Wo	0,1034	672	2037	2491	615	1101	2775	15	5_Wo	0,2035	567	2023	2768	484	1031	2529
5	6_WN	0,1915	626	2177	2582	616	1183	2457	15	6_WoN	0,2224	746	2121	3211	742	1154	2607
5	6_WN	0,1554	691	2231	3049	499	1202	2533	15	6_WN	0,2188	754	2190	3177	689	1193	2503
5	7_Lw	0,1419	631	2148	2772	510	1213	2584	15	7_Wo	0,1666	648	2183	2982	623	1139	2827
5	7_Lwo	0,1738	764	2009	2989	546	1026	2553	15	7_Wo	0,1864	599	2164	2873	575	1129	2528
5	8_Lwo	0,2049	686	2172	3177	519	1552	3035	15	8_Lwo	0,2435	679	2205	3139	560	1210	2970
5	8_Lw	0,1831	734	2143	3242	556	1533	3079	15	8_Wo	0,2409	737	2201	3121	564	1312	2707
5	9_Wo	0,2365	668	2180	2337	596	1421	2667	15	9_Wo	0,2451	671	2053	3019	579	1099	2513
5	9_Lw	0,2148	721	2136	3155	479	1131	2460	15	9_Wo	0,2435	687	2090	3035	597	1180	2544
5	10_Lwo	0,1936	692	1849	2706	547	1145	3145	15	10_Wo	0,1897	640	2119	3009	592	1177	2974
5	10_Lwo	0,1974	715	2032	2323	562	1300	2950	15	10_Lw	0,2081	586	2039	2832	470	1104	2563
5	11_Lwo	0,1715	737	1964	2734	534	1519	3032	15	11_Lw	0,2697	757	2169	3081	486	1156	2766
5	11_Lwo	0,1816	658	2018	2568	527	1464	2983	15	11_Lw	0,2661	736	2227	3112	548	1223	2613
5	12_Lwo	0,1613	666	2068	2255	591	1467	2721	15	12_Lwo	0,2541	615	2159	3034	555	1307	3156
5	12_Wo	0,1351	725	2005	2976	585	1463	2865	15	12_Lwo	0,2273	580	2053	2954	502	1292	2449
5	13_WoN	0,2012	700	2265	3092	676	1487	2287	15	13_WoN	0,2532	691	2183	3109	756	1368	2538
5	13_WN	0,1766	645	1647	2259	544	1322	2512	15	13_WoN	0,2488	778	2120	3039	600	1186	2546
5	14_Lw	0,1357	682	1957	2114	596	1352	2445	15	14_Wo	0,2161	644	2124	3010	543	1235	2737
5	14_W	0,1373	692	2021	2584	560	1322	2554	15	14_W	0,2548	622	2080	2895	495	1277	2521
5	15_M	0,1581	621	1864	2409	525	1393	2976	15	15_Lw	0,2545	720	2194	3080	477	1238	2732
5	15_M	0,1843	677	1942	2120	537	1538	2645	15	15_W	0,1582	666	2156	2970	649	1448	2769
5	16_Lwo	0,121	612	2091	2852	506	1524	2781	15	16_Lw	0,1994	615	2061	2918	523	1385	2906
5	16_Lwo	0,1009	654	2010	2904	523	1570	3013	15	16_Wo	0,1953	531	2114	3072	516	1359	2614
5	17_M	0,2112	487	2023	3132	541	1408	2676	15	17_M	0,2488	676	2187	3035	526	1363	2780
5	17_M	0,2024	639	2207	3158	662	1608	2925	15	17_M	0,2474	718	2178	3100	515	1290	2680
5	18_Wo	0,141	617	2034	2237	460	1513	3059	15	18_NL	0,2494	590	2116	2932	517	1352	3010
5	18_Lw	0,1392	714	2068	2877	466	1511	2576	15	18_Lw	0,2861	557	2090	2824	446	1481	2692
5	19_Wo	0,1754	667	1944	2880	630	1319	2769	15	19_Wo	0,2657	629	2224	2974	569	1151	2683
5	19_Lwo	0,1821	651	2043	2893	576	1328	2707	15	19_W	0,2373	595	2188	3007	540	1154	2539
5	20_Lwo	0,1509	638	1875	2182	530	1222	2805	15	20_Wo	0,1894	595	2158	2972	536	1086	2736
5	20_Lwo	0,1175	674	2024	2962	524	1311	2651	15	20_Wo	0,2072	574	2149	2933	488	1152	2606
5	21_W	0,1841	634	1545	2307	563	1513	2744	15	21_Wo	0,2477	649	2221	3044	546	1279	2616
5	21_W	0,1834	653	2110	3109	501	1707	2845	15	21_Wo	0,2677	663	2212	3101	562	1252	2544
5	22_Lw	0,1055	586	2069	3001	499	1636	2670	15	22_Lw	0,2085	579	2183	2941	519	1227	2806
5	22_Lwo	0,1251	691	2109	3042	511	1400	2785	15	22_Lw	0,2221	537	2128	2946	493	1109	2576
5	23_Wo	0,2231	668	2093	3023	614	1217	2635	15	23_Wo	0,2869	594	2187	3007	573	1168	2678
5	23_Lwo	0,173	637	2137	3005	598	1346	2656	15	23_W	0,3035	624	2167	3051	444	1139	2463
5	24_Lw	0,181	727	1760	2497	625	1283	2893	15	24_Wo	0,2709	646	2093	3011	521	1093	2664
5	24_Lw	0,1888	628	1844	2915	608	1221	2891	15	24_W	0,2357	640	2090	3008	559	1191	2593
5	25_Wo	0,1342	632	2114	2882	637	1341	2942	15	25_Lw	0,2581	606	2151	3000	500	1095	3050
5	25_Wo	0,1599	683	1767	2453	628	1367	2919	15	25_Wo	0,2166	546	2240	3001	528	1221	2687
5	26_Lwo	0,2024	695	1669	2133	626	1301	2906	15	26_Wo	0,2693	684	2088	3004	537	1087	2661
5	26_Wo	0,2167	691	2102	3068	557	1196	3003	15	26_W	0,2997	655	2072	3030	512	1064	2534
5	27_Lwo	0,1604	661	2110	2938	521	1077	2805	15	27_Wo	0,2237	587	2200	3021	530	1142	2902
5	27_Lwo	0,169	710	1903	2878	480	1179	2960	15	27_Wo	0,2347	567	2097	2912	500	1117	2632
5	28_W	0,1549	688	1878	2674	580	1594	2953	15	28_W	0,246	665	2046	2934	428	1514	2879
5	28_Lwo	0,1841	662	1956	2952	513	1571	2907	15	28_W	0,189	588	1810	2839	550	1495	2699
5	29_Lwo	0,1549	592	2128	2925	527	1622	2840	15	29_Lw	0,2052	594	2159	2990	457	1786	2892
5	29_Lw	0,1223	672	1972	2924	511	1650	2895	15	29_Lw	0,189	589	2160	2920	461	1329	2698
5	30_Lw	0,2399	666	2104	2558	492	1718	2844	15	30_M	0,3063	637	2079	2953	448	1359	2682
5	30_Lw	0,2183	638	1922	2696	495	1617	3032	15	30_M	0,3154	634	2076	2938	465	1521	2731
5	31_Lw	0,1825	622	1916	2126	456	1812	2967	15	31_M	0,2774	624	2201	2978	508	1515	2860
5	31_Lw	0,1542	681	1965	2429	471	1869	3040	15	31_M	0,2774	609	2173	2970	433	1514	2735
5	2_Wo	0,1471	714	2131	2570	661	1566	2714	15	2_Wo	0,2352	780	2246	2988	544	1059	2805
5	2_Wo	0,1639	682	2169	2763	584	1265	2630	15	2_W	0,2643	764	2159	3092	558	1087	2507
5	1_Lwo	0,2088	643	2120	2868	653	1366	2721	15	1_Wo	0,3028	633	2155	2966	574	1129	2502
5	1_Lwo	0,216	655	2058	2856	577	1188	2545	15	1_Wo	0,2833	597	2059	3004	622	1295	2430
5	30_Lwo	0,2261	697	2018	2808	544	1544	2772	15	30_M	0,2898	632	2100	2978	509	1215	2597
5	30_Lw	0,2281	650	2100	3026	458	1650	2953	15	30_M	0,2209	631	2031	2987	613	1440	2545
5	25_Wo	0,1627	634	2040	2362	619	1311	2715	15	25_Wo	0,2448	656	2089	2935	565	1105	2817
5	25_Wo	0,1821	684	1982	2248	584	1117	2671	15	25_W	0,2188	574	2065	2928	494	1233	2614
5	28_Lw	0,1832	700	1922	2699	595	1487	2743	15	28_W	0,2457	699	1999	2860	473	1384	2778
5	28_Lw	0,1687	702	1900	2801	513	1598	2738	15	28_W	0,2243	661	1840	2812	582	1478	2647
5	7_Lwo	0,1307	619	2040	2793	613	1245	2547	15	7_Wo	0,2112	608	2171	3050	650	1066	2670
5	7_Lwo	0,117	685	1974	2838	500	1159	2523	15	7_Wo	0,2205	584	2136	2900	636	1111	2507
5	26_Lwo	0,2203	655	2075	2878	564	1256	2703	15	26_Wo	0,2881	688	2018	3102	573	1096	2776
5	26_Lw	0,2371	664	1842	2608	564	1197	2829	15	26_W	0,2894	695	2053	3033	546	1072	2512
5	31_Lw	0,2042	631	2134	2835	484	1438	2695	15	31_NL	0,2616	566	2241	2982	502	1667	2762
5	31_Lwo	0,1407	672	2071	2697	531	1681	2811	15	31_Lw	0,2651	619	2118	2918	435	1708	2762
5	24_Wo	0,1675	664	2026	2697	637	1342	2686	15	24_Wo	0,3095	677	2077	2976	574	1161	2754
5	24_Wo	0,1918	677	2132	2905	582	1251	2727	15	24_W	0,2598	663	2048	2963	587	1223	2516
5	22_Wo	0,1701	552	2124	2975	521	1393	2661	15	22_Wo	0,2067	625	2176	2939	553	1317	2729
5	22_Wo	0,126	703	2163	3072	519	1328	2727	15	22_Wo	0,2202	607	2112	2944	568	1224	2541
5	23_Wo	0,2212	698	2125	3100	661	1125	2620	15	23_Wo	0,3117	661	2154	2941	564	1068	2624
5	23_Lwo	0,2013	663	2194	3138	563	1321	2747	15	23_W	0,3388	634	2112	3006	470	1213	2584
5	27_Lw	0,1851	661	2034	2956	472	1247	2933	15	27_W	0,2302	640	2147	2946	504	1147	2763

5 27_Lw	0,1677	772	1889	2771	498	1167	2790
5 4_Wo	0,1766	681	2100	2822	627	1362	2963
5 4_Wo	0,1705	691	2113	2979	574	1308	2927
5 10_Lwo	0,1801	651	2187	3211	552	1286	3081
5 10_Lwo	0,2	697	1912	2116	522	1295	2963
5 11_Lw	0,1887	717	2161	2808	547	1472	2833
5 11_Lwo	0,1724	705	2127	2934	507	1427	2793
5 14_Lwo	0,168	680	2048	2890	589	1416	2580
5 14_Wo	0,1135	715	1993	2792	597	1388	2511
5 17_Lw	0,1754	680	1908	2359	584	1257	2684
5 17_Lw	0,1812	699	2167	3137	540	1309	2777
5 29_Lwo	0,139	649	2007	2810	486	1676	2737
5 29_Wo	0,1184	627	2040	3032	506	1773	2860
5 15_Lwo	0,1871	678	2276	2828	547	1377	2632
5 15_Lwo	0,1891	657	2111	3067	595	1452	2824
5 3_Wo	0,1293	641	2096	3062	588	1163	2941
5 3_Wo	0,0875	702	1924	2990	536	1142	2891
5 13_LwN	0,2258	680	1735	2416	614	1245	2880
5 13_WN	0,2089	712	1909	2458	520	1333	2362
5 16_Lwo	0,1439	666	2034	2841	526	1533	2953
5 16_Lwo	0,142	664	2155	3041	528	1391	3052
5 9_Lwo	0,208	666	2102	2710	621	1194	2695
5 9_Wo	0,1961	645	1767	2775	576	1408	2658
5 18_Lw	0,1453	633	2041	2635	489	1491	2786
5 18_Lw	0,1377	678	1958	2841	514	1434	2840
5 19_Wo	0,1875	693	2065	2883	619	1334	2672
5 19_Wo	0,1925	681	1989	2794	607	1451	2673
5 12_Lw	0,1475	606	2124	2229	492	1400	3020
5 12_Lwo	0,1506	665	1814	2409	536	1469	3026
5 6_WN	0,1677	645	2104	2301	711	1332	2859
5 6_WN	0,1931	658	2118	2837	469	1178	2451
5 5_Wo	0,1353	630	2140	2732	620	1225	2885
5 5_Wo	0,1016	726	1957	3035	585	1073	2849
5 21_Lw	0,178	663	2147	3088	532	1347	2836
5 21_Wo	0,1776	607	1939	3001	603	1442	2827
5 20_Wo	0,1116	695	1867	2287	495	1208	2570
5 20_Wo	0,1043	694	1977	2132	545	1352	2532
5 8_Lw	0,1964	693	1632	2210	542	1496	2842
5 8_Lw	0,1747	665	2087	3048	498	1338	2793
6 1_Lwo	0,2653	598	2133	2903	594	1153	2723
6 1_Lw	0,2466	609	2008	2871	510	997	2544
6 2_Wo	0,2033	736	2120	3159	586	1132	2742
6 2_Wo	0,1941	656	2026	2913	477	1024	2623
6 3_Wo	0,1493	621	1977	2803	599	1166	2551
6 3_W	0,1235	596	1833	2739	372	1040	2857
6 4_Wo	0,1879	642	1854	2796	629	1198	2482
6 4_W	0,1952	571	1960	2767	462	1070	2461
6 5_W	0,167	657	2080	2626	419	1000	2561
6 5_W	0,1268	575	1048	2512	444	921	2497
6 6_WN	0,163	640	1984	2970	558	911	2510
6 6_WN	0,1902	575	1998	3007	421	1001	2437
6 7_Wo	0,131	635	1666	2579	554	1023	2514
6 7_W	0,1092	440	1477	2628	399	1067	2546
6 8_Lwo	0,2093	711	2131	2975	593	1235	2764
6 8_Lw	0,2101	682	2118	2699	478	1227	2536
6 9_Lw	0,2984	623	1765	2763	505	1023	2645
6 9_Lw	0,2177	642	2054	2854	444	1046	2519
6 10_NL	0,2727	674	1692	2910	354	1055	2915
6 10_Wo	0,1315	607	1813	2880	501	1135	2524
6 11_Lw	0,2153	598	1984	3020	392	1123	2874
6 11_Lw	0,2337	659	1994	2987	439	1244	2731
6 12_Lw	0,1787	632	1692	2735	474	1317	2750
6 12_Lw	0,1415	650	2005	2602	426	1315	2649
6 13_WN	0,1798	780	2185	3092	546	1016	2405
6 13_WN	0,1835	647	2127	2812	400	1177	2331
6 14_WN	0,1711	644	1859	2746	566	1420	2596
6 14_WN	0,1175	347	1183	2476	317	1077	2500
6 15_Lw	0,2355	666	2222	3017	507	1204	2915
6 15_W	0,2193	550	1960	2909	468	1223	2615
6 16_Lw	0,1343	663	1620	2712	453	1177	2835
6 16_W	0,0935	516	1649	2641	403	1378	2934
6 17_Lw	0,2197	625	2151	3084	502	1073	2715
6 17_W	0,2174	607	2156	3133	436	1135	2730
6 18_Lw	0,1918	613	1250	2620	399	1220	2819
6 18_W	0,1435	544	1839	2606	379	1222	2628
6 19_W	0,2435	570	1938	2756	497	1107	2656
15 27_Wo	0,2291	605	2121	2938	525	1189	2659
15 4_W	0,3083	682	2138	2900	521	1090	2616
15 4_W	0,2602	637	2000	2874	535	1130	2515
15 10_Lwo	0,2257	610	2159	2985	535	1167	2950
15 10_Lwo	0,2131	597	2048	2917	501	1133	2676
15 11_Lw	0,3045	752	2157	2902	457	1092	2858
15 11_Lw	0,3045	735	2238	3084	527	1275	2737
15 14_Lwo	0,2342	633	2094	2944	613	1146	2581
15 14_Lwo	0,2309	582	2049	2804	576	1186	2401
15 17_M	0,2939	703	2165	3032	503	1155	2824
15 17_Lw	0,3078	756	2145	3064	463	1111	2503
15 29_Lw	0,1921	629	2044	2932	467	1601	2933
15 29_Lw	0,2151	604	2052	2880	481	1534	2830
15 15_Lw	0,2861	760	2209	3132	483	1289	2914
15 15_Lw	0,3088	731	2262	3191	488	1290	2692
15 3_Wo	0,1997	625	2123	3024	525	1082	2781
15 3_Wo	0,2271	584	2160	2950	513	1137	2482
15 13_M	0,3128	734	2203	3103	693	1150	2583
15 13_WN	0,27	778	2189	3040	629	1333	2501
15 16_Lw	0,2309	575	2157	2970	520	1407	2940
15 16_Lw	0,2523	608	2116	2926	481	1256	2783
15 9_Wo	0,2902	684	2143	2971	584	1112	2609
15 9_W	0,2902	700	2010	2956	490	1134	2568
15 18_Lw	0,2628	608	2072	2878	444	1467	2913
15 18_Lw	0,2325	593	2111	2906	512	1402	2637
15 19_Wo	0,2594	639	2111	2939	579	1164	2677
15 19_W	0,2384	629	2194	3062	584	1319	2613
15 12_Lwo	0,236	606	2065	2987	548	1312	2916
15 12_Lw	0,2515	615	2056	2872	517	1423	2756
15 6_WoN	0,2276	763	2161	3077	756	1250	2574
15 6_WN	0,2731	761	2195	3084	674	1317	2439
15 5_Wo	0,2095	636	2101	2909	589	1145	2664
15 5_Wo	0,2362	590	2119	2926	526	1050	2657
15 21_W	0,2925	692	2224	3004	526	1132	2622
15 21_Lwo	0,2809	713	2156	3043	569	1208	2561
15 20_Wo	0,2066	610	2146	2986	518	1172	2757
15 20_Lwo	0,2235	575	2177	2936	516	1409	2626
15 8_Lw	0,3054	709	2332	3169	467	1239	2877
15 8_Lw	0,2905	662	2281	3191	552	1234	2800
16 1_Lwo	0,2465	613	2273	3101	550	1101	3085
16 1_Lwo	0,2399	602	2032	3005	499	1332	3033
16 2_Lw	0,2322	682	2021	2667	457	956	3021
16 2_Lwo	0,2213	707	2183	3073	515	1047	2981
16 3_NL	0,2411	643	943	2133	522	1057	3051
16 3_Wo	0,2015	653	1051	2102	493	1039	2973
16 4_M	0,1875	358	2399	2910	356	1229	2659
16 4_M	0,1942	425	2287	2864	291	1403	2804
16 5_Wo	0,1564	647	2004	2479	532	1048	2448
16 5_Lwo	0,1888	639	1209	2233	535	946	3017
16 6_LwN	0,2013	739	2006	2884	583	1170	2507
16 6_LwN	0,2218	723	2171	3149	554	1273	2916
16 7_Lwo	0,1733	652	1164	2116	658	1148	3155
16 7_Lwo	0,1866	591	1890	2687	627	1089	2671
16 8_Lw	0,249	687	1471	2249	489	1440	3018
16 8_Lw	0,3387	388	1837	2797	529	1558	2982
16 9_M	0,2115	662	1523	2257	643	1262	3030
16 9_M	0,1813	567	1669	2800	505	1456	2873
16 10_Lw	0,224	598	1221	2148	504	1179	3279
16 10_Lw	0,2023	680	1086	2328	402	1152	3004
16 11_Lw	0,2515	675	2038	2955	493	1291	3120
16 11_Lw	0,2515	663	1359	2569	420	1586	3033
16 12_Lwo	0,2436	647	1388	2480	485	1298	3233
16 12_Lw	0,2586	689	2101	3134	511	1267	3068
16 13_LwN	0,2146	645	1679	2702	597	1246	2754
16 13_LwN	0,2354	767	2306	3142	650	1457	3005
16 14_NL	0,2766	661	1328	2296	471	942	3254
16 14_Lw	0,2336	574	845	2268	573	1228	2872
16 15_Lwo	0,2357	687	1930	2552	489	1140	3123
16 15_Lw	0,2541	628	2156	3008	412	1400	2990
16 16_Lwo	0,2139	621	1146	2243	508	1274	3185
16 16_Lwo	0,2176	640	1104	2146	518	1485	3125
16 17_Lwo	0,2308	669	1079	2275	527	1395	3114
16 17_M	0,1791	691	2014	2875	587	1324	2905
16 18_NL	0,2717	627	2051	3021	483	955	3205
16 18_Lw	0,2383	650	987	2128	450	1318	2926
16 19_Lwo	0,2251	612	2005	2925	531	1166	3035

6 19_W	0,219	562	1847	2753	411	1168	2536
6 20_W	0,1665	594	1990	2676	396	1000	2536
6 20_W	0,1346	656	1828	2809	380	1171	2546
6 21_Lwo	0,2159	654	2223	3093	571	1218	2554
6 21_Lwo	0,1962	706	2258	2957	475	1018	2576
6 22_W	0,1548	546	1665	2653	464	1134	2469
6 22_W	0,125	489	1608	2335	372	1166	2528
6 23_Lw	0,2677	578	2013	2860	367	987	2719
6 23_Wo	0,1964	538	1978	2762	426	1276	2496
6 24_Lwo	0,1932	659	1823	2883	530	1055	2884
6 24_Lw	0,1925	572	2063	2817	394	1181	2568
6 25_W	0,1421	541	1724	2693	397	1179	2518
6 25_W	0,1166	479	1832	2815	421	1234	2418
6 26_Lw	0,2133	598	1794	2811	430	1047	2571
6 26_W	0,2268	327	1784	2880	423	1140	2493
6 27_W	0,1475	386	1599	2623	407	1232	2377
6 27_W	0,128	421	1951	2732	323	1180	2484
6 28_Lw	0,2345	604	1602	2645	403	1207	2610
6 28_Lw	0,1932	583	1941	2726	332	1459	2541
6 29_W	0,1381	408	1678	2580	356	1421	2354
6 29_W	0,1312	439	1513	2649	393	1335	2436
6 30_Lw	0,2454	587	1757	2819	411	1222	2517
6 30_W	0,2752	580	1841	2740	423	1949	2666
6 31_Lw	0,194	599	1589	2649	394	1165	2565
6 31_W	0,176	358	1707	2485	331	1908	2628
6 2_Lwo	0,1822	681	2157	2813	490	1005	2738
6 2_Wo	0,1705	278	1556	2734	448	1018	2775
6 1_Lwo	0,259	547	1910	2847	489	1107	2673
6 1_Wo	0,2148	585	2070	2622	517	1179	2592
6 30_Lw	0,2344	658	1758	2745	422	1372	2536
6 30_W	0,2567	554	1725	2583	363	2220	2638
6 25_W	0,123	533	1789	2725	448	1232	2502
6 25_Lw	0,1197	578	1350	2620	427	1147	2552
6 28_Lw	0,1952	615	1476	2513	460	1275	2594
6 28_Lw	0,256	490	1440	2545	408	1073	2545
6 7_WN	0,1046	487	1475	2389	290	1140	2395
6 7_WN	0,0955	463	1488	2483	409	1064	2334
6 26_Lw	0,2217	633	1752	2742	437	1018	2739
6 26_Lw	0,2175	650	2071	2845	323	967	2518
6 31_M	0,1591	583	1871	2537	397	1929	2600
6 31_Lw	0,1577	369	1815	2722	347	1629	2526
6 24_W	0,1935	706	1774	2909	450	1098	2613
6 24_Lw	0,2241	642	1728	2850	406	1061	2474
6 22_W	0,1645	536	1747	2684	449	1185	2522
6 22_W	0,1389	530	1675	2645	436	1107	2432
6 23_Lw	0,268	533	1617	2791	477	1123	2670
6 23_Lw	0,2557	595	1913	2767	445	1131	2520
6 27_Lw	0,1547	345	1720	2638	321	1284	2585
6 27_Lw	0,1276	425	1640	2547	392	1195	2364
6 4_Lw	0,3171	604	1665	2662	415	966	2791
6 4_Wo	0,175	612	1858	2699	498	985	2491
6 10_W	0,1729	438	1391	2565	451	1085	2709
6 10_NL	0,2837	574	1834	2768	367	988	2840
6 11_Lw	0,2756	641	2136	2887	439	1123	2744
6 11_Lwo	0,2889	499	1733	2659	524	1268	2799
6 14_Wo	0,1386	357	1820	2668	508	1317	2584
6 14_W	0,1408	399	1885	2699	463	1254	2490
6 17_M	0,3009	648	2219	3001	397	926	2669
6 17_M	0,176	508	2057	2910	457	1368	2621
6 29_W	0,1626	399	1536	2543	369	1428	2332
6 29_W	0,1568	485	1624	2721	316	1365	2491
6 15_Lw	0,2597	628	1955	2611	453	1116	2925
6 15_W	0,2095	462	1928	2877	535	1347	2693
6 3_W	0,1476	655	1645	2652	380	1011	2621
6 3_W	0,0978	458	1620	2687	422	1124	2480
6 13_LwN	0,2695	501	1921	2624	762	1430	3053
6 13_WN	0,1834	646	2034	2755	540	1484	2827
6 16_W	0,1316	597	1058	2496	380	1370	2773
6 16_Lw	0,1381	375	1607	2453	334	1345	2672
6 9_Lw	0,2725	638	1869	2891	476	1011	2716
6 9_Wo	0,1243	550	1869	2784	558	1491	2494
6 18_Lw	0,1919	528	1821	2595	364	1344	2814
6 18_Lw	0,1841	374	1763	2596	350	1379	2843
6 19_Wo	0,2663	534	2000	2677	493	1133	2422
6 19_Wo	0,1855	491	1513	2517	406	912	2481
6 12_Wo	0,1398	596	1728	2543	468	1435	2663

16 19_W	0,1738	585	1971	2916	523	1344	2985
16 20_Wo	0,1967	649	1271	2218	487	995	3069
16 20_Wo	0,1519	715	2023	2818	451	938	2844
16 21_Lw	0,2365	694	2280	3034	458	1062	2930
16 21_Lw	0,2219	698	2099	2919	459	1542	2874
16 22_Lw	0,1863	606	1568	2256	547	1215	2631
16 22_Lw	0,2114	634	1073	2142	492	1170	2845
16 23_Wo	0,2177	623	2198	3035	550	1053	2825
16 23_Wo	0,1887	616	2097	3120	570	1191	2831
16 24_Lw	0,2336	633	2064	2432	540	980	3125
16 24_Lwo	0,2213	601	1318	2230	513	971	2884
16 25_Wo	0,2032	642	1820	2281	541	1124	3113
16 25_Lwo	0,1735	612	1373	2429	600	1205	3080
16 26_Lwo	0,1897	597	1315	2057	592	1194	2995
16 26_Lwo	0,1854	689	1662	2730	500	1037	2999
16 27_Lw	0,2102	654	1711	2512	459	1075	3078
16 27_Lw	0,2143	696	1167	2089	484	953	2899
16 28_Lwo	0,2066	646	1866	2840	472	1300	2970
16 28_Lw	0,1784	624	1580	2427	513	1182	2957
16 29_Lw	0,1897	638	1565	2172	476	1329	2989
16 29_Lw	0,2034	552	1205	2230	504	1299	2929
16 30_Lw	0,2141	684	1933	3092	448	1305	2986
16 30_Lw	0,2117	674	1299	2094	411	1283	2878
16 31_Lw	0,2248	652	1880	2794	445	1370	2953
16 31_Lw	0,1789	613	1171	2226	437	1413	2774
16 2_Lwo	0,2212	647	1963	2795	502	1121	3032
16 2_Lwo	0,1926	656	1520	2656	496	1106	2986
16 1_Wo	0,2629	613	1829	2853	491	1030	2861
16 1_Lwo	0,2579	597	2080	3018	441	1137	3027
16 30_Lw	0,226	618	1608	2475	455	1278	2972
16 30_Lw	0,2062	616	1314	2210	422	1312	2866
16 25_Lwo	0,1832	624	1295	2233	588	1207	3061
16 25_Lwo	0,1823	636	1060	2178	503	1005	2879
16 28_M	0,1556	648	1676	2912	618	2093	2951
16 28_M	0,145	571	1451	3007	677	1973	3002
16 7_Lw	0,1945	614	919	2307	554	1063	2975
16 7_Lwo	0,1893	632	1838	2770	569	962	2522
16 26_Lwo	0,2101	619	977	2030	539	1055	3017
16 26_Lwo	0,1858	652	1384	2203	494	1107	2867
16 31_Lw	0,1785	655	1361	2247	478	1422	2958
16 31_Lw	0,1852	644	1143	2180	447	1275	2821
16 24_M	0,2584	622	1875	2829	539	1025	3155
16 24_Lwo	0,1901	620	1157	2192	500	1108	2947
16 22_Lwo	0,2055	638	1299	2219	493	1233	3047
16 22_Lw	0,1478	630	1805	2824	444	1088	2860
16 23_Lwo	0,2306	614	2166	2322	555	1144	2823
16 23_Lwo	0,1726	616	2082	2848	535	1246	2792
16 27_Lw	0,2168	655	1763	2455	459	1066	3075
16 27_Wo	0,2029	631	1482	2791	521	919	3091
16 4_Lw	0,2577	651	2019	2953	501	1180	3017
16 4_Lw	0,2054	620	1998	2881	492	1248	2751
16 10_Lw	0,1552	659	2063	3054	576	1110	3039
16 10_Lw	0,218	682	1165	2046	458	1272	2519
16 11_Lw	0,2152	678	1854	2827	464	1430	2962
16 11_Lw	0,2372	748	2074	3038	461	1454	3010
16 14_NL	0,1667	631	1284	2320	565	1089	2895
16 14_Lw	0,2047	612	1129	2228	609	1704	3189
16 17_Lwo	0,2207	648	1873	2890	535	1329	3109
16 17_M	0,2139	592	2283	3191	537	1460	3020
16 29_Lwo	0,1776	632	1576	2251	488	1410	2903
16 29_Lw	0,1913	628	1507	2259	467	1324	2906
16 15_Lw	0,2547	665	2005	2936	478	1346	3169
16 15_Lwo	0,2467	658	1991	2992	481	1357	3091
16 3_Wo	0,1731	627	1674	2362	454	1014	2854
16 3_Lwo	0,1475	632	1245	2428	512	1084	3007
16 13_WN	0,2495	626	1920	2929	550	1435	2749
16 13_LwN	0,2273	767	2188	3059	567	1499	3023
16 16_Lwo	0,1807	554	1127	2441	514	1414	3162
16 16_Lwo	0,1761	621	1370	2210	529	1435	3081
16 9_Lwo	0,2519	622	1740	2515	545	1112	2931
16 9_Lw	0,1809	628	1273	2068	525	1352	2971
16 18_Lw	0,2494	633	1273	2192	444	1181	3112
16 18_Lw	0,2103	623	1446	2700	464	1291	3074
16 19_Lwo	0,2643	600	2127	2952	510	1118	2867
16 19_Lwo	0,2068	596	1940	2858	631	1199	3062
16 12_Lw	0,1761	662	1602	2098	426	1151	3086

6	12_W	0,1285	527	1639	2632	424	1486	2850	16	12_Lwo	0,1635	643	1628	2095	581	1568	3138
6	6_WN	0,1793	720	1972	2861	585	1116	2597	16	6_WN	0,2089	784	2243	3098	586	1213	2956
6	6_M	0,149	538	2014	2768	246	1260	2525	16	6_LwN	0,1926	664	1856	2900	564	1136	2774
6	5_W	0,1351	455	1644	2556	437	997	2428	16	5_Wo	0,2154	569	1500	2386	522	921	3025
6	5_M	0,0596	566	1783	2873	502	17.46269(6)500]TJ ET Q q 4370 0 0 1 290.16 713.0033 0 0 c 2552 6077.667 m 2370 6077.674										

7 1_Lwo	0,2714	664	2057	2896	657	1206	2567
7 30_M	0,2878	681	1716	2735	561	1113	2234
7 30_W	0,3013	564	1460	2438	531	1350	2774
7 25_L	0,2795	669	1893	2872	529	1110	1879
7 25_L	0,2518	650	1263	2459	508	1142	2967
7 28_W	0,4195	458	1105	2699	596	1952	2857
7 28_M	0,552	566	1553	2766	389	1743	3196
7 7_L	0,2448	638	1529	2551	538	1206	2747
7 7_Lwo	0,1756	675	2010	3048	585	1210	2690
7 26_Lwo	0,2876	656	1910	2960	593	1138	2675
7 26_Lw	0,2827	587	951	2117	543	1137	2891
7 31_L	0,2806	637	2170	3177	590	1192	2659
7 31_L	0,2922	689	2098	2977	476	1516	2927
7 24_Lwo	0,2809	592	2106	3012	613	1162	2724
7 24_Lwo	0,2478	540	1278	2195	614	1099	2803
7 22_L	0,258	624	2200	3020	468	1210	2771
7 22_Lw	0,2118	681	1946	2957	479	1242	2817
7 23_Wo	0,347	642	2161	3110	530	998	2627
7 23_Wo	0,2094	603	2075	2993	667	1207	2742
7 27_L	0,2494	631	2166	2996	501	1283	2975
7 27_Lw	0,2198	629	1894	2714	436	1413	2820
7 4_Lw	0,2698	715	2365	2902	501	1094	2653
7 4_Lwo	0,2793	658	2082	2966	609	1258	2846
7 10_Lw	0,2843	637	1809	2766	515	1159	2743
7 10_Lwo	0,2043	751	1776	2910	511	1350	2948
7 11_Lw	0,3089	712	2193	3073	507	1041	2713
7 11_Lw	0,2659	611	2367	3048	534	1177	2838
7 14_LwN	0,2748	719	2238	2990	517	957	2685
7 14_Lw	0,2334	691	1778	2787	555	1149	2652
7 17_L	0,3048	569	1580	2760	538	1222	2890
7 17_L	0,3416	704	2071	3114	513	1258	2980
7 29_Lwo	0,2428	588	2110	3004	573	1139	2831
7 29_Lw	0,2	674	1895	2898	458	1226	2710
7 15_L	0,2691	712	2288	3073	608	1105	2580
7 15_L	0,2785	587	2160	3104	514	1127	2821
7 3_L	0,2525	679	1886	2841	473	1227	2563
7 3_L	0,1943	696	1900	2987	462	1291	3010
7 13_WoN	0,248	689	2330	3153	670	1109	2403
7 13_WoN	0,2426	557	2270	3068	588	1029	2607
7 16_L	0,2389	707	2079	2955	496	1130	2848
7 16_Lwo	0,2057	698	1886	2846	485	1125	2905
7 9_Lwo	0,3417	678	2060	3069	569	1128	2717
7 9_Lwo	0,3128	635	2030	2976	578	1160	2810
7 18_Lwo	0,2506	710	1825	2786	498	1180	2929
7 18_Lw	0,2807	670	2059	3059	481	1148	2909
7 19_Wo	0,2597	609	1862	2849	583	1103	2485
7 19_Wo	0,319	488	1738	2519	496	1099	2860
7 12_Lwo	0,2675	703	1954	2886	540	1152	2851
7 12_Lw	0,2008	678	1879	2908	470	1136	2826
7 6_WoN	0,2183	711	2083	2778	601	1016	1962
7 6_LwoN	0,2585	501	1207	2270	538	1062	2761
7 5_Lwo	0,2409	712	2043	2959	536	1003	2758
7 5_Lwo	0,1732	660	1969	2860	497	1183	2760
7 21_M	0,3797	627	1308	2509	554	1232	2849
7 21_M	0,2896	647	1324	2590	606	1203	2831
7 20_Lw	0,2426	680	1977	3033	475	1333	2880
7 20_Lw	0,1937	709	1807	2850	439	1167	2846
7 8_Lwo	0,2686	660	2095	3112	556	1096	2533
7 8_Lwo	0,3056	690	2167	2958	494	1079	2809
8 1_Lwo	0,2716	612	2133	2841	579	979	3013
8 1_L	0,26	609	2115	2826	561	948	2933
8 2_Lwo	0,1937	811	1985	2805	529	908	2936
8 2_Wo	0,1579	825	2009	2887	560	1097	2998
8 3_W	0,1571	613	2171	2931	466	929	2781
8 3_Wo	0,1341	657	2052	2844	506	888	2695
8 4_M	0,1939	715	1866	2724	645	1066	2995
8 4_Lw	0,2387	726	1903	2681	474	970	2507
8 5_Wo	0,1674	679	2016	2804	545	947	2863
8 5_Lwo	0,1425	693	1825	2614	581	938	2852
8 6_WN	0,2134	789	1774	2741	545	918	2988
8 6_WN	0,2133	725	1723	2685	539	1056	2757
8 7_Wo	0,177	772	2191	2976	566	1007	3045
8 7_Wo	0,1437	717	2035	2619	560	1019	2906
8 8_L	0,2182	780	2163	2732	724	1223	2946
8 8_L	0,2409	764	2103	2776	628	1085	2945
8 9_Lwo	0,2665	656	2078	2825	578	989	2994

17 1_Wo	0,2243	522	2167	2271	615	1448	2513
17 30_Lwo	0,2084	657	2134	3101	557	1697	2872
17 30_Lwo	0,2077	606	2218	3064	503	1670	2691
17 25_Wo	0,134	633	2152	3081	606	1205	2609
17 25_Wo	0,1527	614	2178	3087	549	1096	2583
17 28_Wo	0,206	633	1997	2798	552	1671	2620
17 28_Lwo	0,189	649	2146	2836	491	1520	2682
17 7_Wo	0,1717	656	2081	3008	546	1050	2481
17 7_Lwo	0,1717	580	2196	3079	547	1153	2561
17 26_Lwo	0,2263	621	1697	2328	538	1212	2663
17 26_Lwo	0,2461	590	1762	2285	533	1253	2534
17 31_W	0,174	635	2165	3125	477	1857	2767
17 31_W	0,1807	588	1448	2221	427	1599	2530
17 24_Lwo	0,1875	633	1911	2924	591	1298	2627
17 24_Wo	0,2121	630	2244	3041	521	1260	2727
17 22_NL	0,2785	641	2300	3032	492	1123	2672
17 22_Lw	0,1568	582	2094	3041	461	1305	2568
17 23_Wo	0,2178	620	2195	3044	600	1311	2556
17 23_Wo	0,255	565	2245	3218	631	1281	2677
17 27_Wo	0,1919	669	2021	2996	479	1108	2719
17 27_Wo	0,1559	596	2099	3091	488	1076	2667
17 4_Lwo	0,2381	651	1859	2741	558	1190	2553
17 4_Lw	0,2595	624	2178	2995	492	1189	2586
17 10_Wo	0,1564	622	2200	2988	565	1375	2862
17 10_Wo	0,154	555	2023	2995	490	1308	3043
17 11_Lwo	0,2255	694	2303	3069	551	1545	2920
17 11_Lwo	0,2872	659	2250	3045	489	1211	2893
17 14_Wo	0,1876	652	2243	3118	551	1434	2769
17 14_Wo	0,1561	599	2029	3058	602	1394	2589
17 17_Lwo	0,2395	658	1756	2691	540	1301	2716
17 17_M	0,2284	585	2085	2889	528	1297	2685
17 29_NL	0,2184	653	1955	3116	466	1201	2521
17 29_Lw	0,1204	565	2043	2970	493	1605	2734
17 15_Lwo	0,1983	630	2055	2360	627	1627	2752
17 15_Lwo	0,2552	522	1706	2219	557	1361	2832
17 3_Wo	0,1482	645	2184	3156	475	1202	2462
17 3_Wo	0,1468	624	2031	3044	457	1184	2406
17 13_LwN	0,1777	650	2109	2731	617	1399	2539
17 13_WoN	0,2123	656	2273	3019	556	1139	2467
17 16_Lwo	0,1765	591	2053	2923	521	1384	3089
17 16_Lwo	0,2351	600	1959	2975	478	1359	2850
17 9_Wo	0,2207	632	2259	3190	586	1205	2572
17 9_Wo	0,2504	585	2161	2748	556	1078	2532
17 18_Wo	0,1636	625	2186	3153	528	1383	3139
17 18_Lw	0,1894	605	2152	3105	494	1382	3039
17 19_Wo	0,1847	586	2120	2286	585	1562	2601
17 19_Wo	0,1856	552	2171	2798	550	1840	2684
17 12_Lwo	0,1886	654	2186	3079	531	1344	2859
17 12_Lwo	0,1768	592	2101	2952	519	1343	2940
17 6_W	0,1724	690	2211	2954	795	1533	2697
17 6_Wo	0,2138	764	2213	2931	710	1145	2365
17 5_Wo	0,1631	686	2134	3083	541	1048	2590
17 5_Wo	0,1339	636	2109	2992	504	1111	2523
17 21_Wo	0,225	658	1687	2271	542	1493	2538
17 21_Lw	0,2318	590	2252	3069	501	1173	2378
17 20_Wo	0,1463	614	2030	2951	522	1283	2419
17 20_Wo	0,1402	621	2034	3106	452	1384	2756
17 8_Lwo	0,2117	635	2064	2288	552	1459	2704
17 8_Lwo	0,2271	563	1923	2577	571	1652	2620
18 1_Wo	0,2017	462	1760	2338	573	1043	2292
18 1_Wo	0,1629	459	1523	2223	567	992	2323
18 2_Wo	0,1859	641	1512	2247	494	907	2426
18 2_Wo	0,1569	568	1505	2388	508	955	2424
18 3_Lwo	0,1717	484	1814	2542	473	946	2618
18 3_Wo	0,184	473	1771	2491	425	887	2515
18 4_M	0,2299	269	1766	2577	341	943	2181
18 4_M	0,1713	303	1718	2100	311	924	2187
18 5_Wo	0,1383	540	1472	2417	450	942	2556
18 5_Wo	0,1582	520	1677	2457	471	968	2457
18 6_WoN	0,2049	634	1592	2261	706	881	2434
18 6_WN	0,1927	589	1513	2291	613	969	2406
18 7_Lwo	0,2458	502	1742	2236	466	836	2460
18 7_Wo	0,1606	496	1682	2445	463	908	2448
18 8_Lwo	0,2703	530	1907	2217	490	776	2493
18 8_Lwo	0,1556	571	1469	2224	538	1028	2475
18 9_L	0,2153	505	1714	2425	560	932	2342

8	9_Lwo	0,2654	690	2054	2760	498	964	2953	18	9_Wo	0,165	493	1800	2593	554	957	2363
8	10_Lw	0,1771	686	2035	2705	485	1064	2965	18	10_Lw	0,2348	519	1734	2205	350	861	2426
8	10_Lw	0,1475	681	1885	2685	433	1148	2970	18	10_Lwo	0,1471	523	1468	2376	444	875	2452
8	11_Lwo	0,1917	864	1925	2896	554	1109	3100	18	11_Lwo	0,2669	590	1677	2221	478	852	2459
8	11_Lwo	0,2403	823	1852	2755	499	1409	3022	18	11_Wo	0,1787	588	1827	2381	542	1015	2253
8	12_Lwo	0,1647	675	2026	2832	504	1110	2995	18	12_Lwo	0,2338	488	1785	2458	470	965	2587
8	12_Lwo	0,1475	686	1948	2815	557	1201	2928	18	12_Lw	0,2431	509	1847	2472	411	967	2717
8	13_LwoN	0,2309	765	2032	2794	603	1117	2966	18	13_WoN	0,2622	576	1811	2194	598	979	2439
8	13_LwoN	0,2295	770	2068	2756	674	1101	2881	18	13_WoN	0,2137	590	1453	2160	607	933	2363
8	14_NL	0,2863	719	1916	2668	433	1039	3055	18	14_Wo	0,204	463	1830	2556	620	934	2494
8	14_LwN	0,1608	713	2083	2697	593	1008	2909	18	14_Lwo	0,1841	507	1653	2531	483	998	2585
8	15_Lwo	0,2559	760	2172	2636	520	1058	3041	18	15_Lw	0,3354	532	1958	2100	458	811	2546
8	15_Lwo	0,2845	773	2167	2816	621	1193	2946	18	15_Lwo	0,2448	446	1741	2663	496	931	2542
8	16_Lwo	0,1562	683	1983	2803	511	878	2982	18	16_Lw	0,1707	512	1688	2273	508	1090	2641
8	16_Lwo	0,1641	626	2090	2866	519	1142	3047	18	16_Lwo	0,1686	480	1738	2468	452	981	2619
8	17_Lwo	0,2868	818	1893	2773	521	1034	3264	18	17_M	0,2147	596	1635	2354	534	949	2454
8	17_Lw	0,2911	768	2079	2662	519	993	2887	18	17_M	0,1525	520	1751	2242	557	995	2416
8	18_Lw	0,1733	695	1967	2846	475	1165	2999	18	18_Lw	0,239	494	1688	2422	429	1040	2636
8	18_Lw	0,1726	651	2021	2812	476	1233	3038	18	18_Lw	0,1902	496	1551	2642	430	1157	2752
8	19_Lwo	0,2714	751	1967	2894	541	1033	3048	18	19_Wo	0,2082	518	1746	2237	510	898	2273
8	19_Wo	0,2385	673	2065	2857	563	1089	2864	18	19_Wo	0,159	509	1690	2303	524	961	2412
8	20_Lwo	0,1474	711	1962	2816	579	1110	2937	18	20_Wo	0,2065	431	1630	2573	453	917	2354
8	20_Lwo	0,1557	756	2013	2726	501	1083	2845	18	20_W	0,1575	465	1740	2449	416	935	2398
8	21_Lwo	0,2283	814	1824	2809	635	1046	2967	18	21_Lw	0,2075	560	1660	2330	450	841	2533
8	21_Lwo	0,2472	800	1967	2732	651	1061	2882	18	21_W	0,2202	551	1735	2340	431	856	2387
8	22_Lw	0,1662	692	1960	2841	479	1113	2792	18	22_NL	0,2797	487	1806	1994	442	886	2599
8	22_Lw	0,1722	763	2092	2659	481	1209	2804	18	22_W	0,1504	495	1695	2221	430	990	2280
8	23_Lwo	0,288	725	1832	2793	619	1042	3021	18	23_Lwo	0,2155	472	1796	2045	535	779	2042
8	23_Lw	0,2684	710	2122	2755	556	1014	2885	18	23_Wo	0,1454	537	1412	2169	592	1212	2494
8	24_Lwo	0,2621	773	1892	2765	648	1062	2828	18	24_W	0,1652	583	1354	2363	445	912	2504
8	24_Lwo	0,2595	753	1953	2801	654	1092	2517	18	24_M	0,1385	531	1508	2548	493	1000	2364
8	25_NL	0,1878	654	1963	2889	579	1062	2728	18	25_Lw	0,241	471	1732	2457	413	852	2555
8	25_Lwo	0,1456	662	1890	2994	604	1126	2819	18	25_Wo	0,1577	491	1647	2379	451	886	2533
8	26_Lwo	0,2834	752	1856	2761	525	1022	2950	18	26_Lwo	0,2521	530	1631	2484	466	840	2356
8	26_Lw	0,2921	775	1933	2713	496	985	2763	18	26_Lwo	0,1604	505	1666	2524	471	975	2330
8	27_Lw	0,2011	684	1939	2654	498	1100	2822	18	27_Lw	0,2305	525	1619	2200	378	938	2472
8	27_Lw	0,1899	692	1987	2667	482	1008	2809	18	27_W	0,1848	497	1416	2389	392	982	2377
8	28_L	0,2308	775	1705	2424	705	1169	3076	18	28_W	0,1908	650	1329	2326	410	753	2401
8	28_Lwo	0,2544	757	1640	2796	571	1162	2887	18	28_Wo	0,1808	536	1350	2144	474	1057	2335
8	29_Lwo	0,1741	652	1958	2789	512	1266	2879	18	29_W	0,1468	531	1651	2262	433	1038	2416
8	29_Lwo	0,1629	677	2082	2689	545	1191	2735	18	29_W	0,1383	495	1634	2244	401	1055	2436
8	30_Lwo	0,263	741	1747	2785	505	1125	3082	18	30_M	0,4904	570	1634	2244	355	889	2429
8	30_Lw	0,2541	749	1910	2846	519	1145	3091	18	30_Wo	0,151	509	1724	2275	494	1129	2170
8	31_Lw	0,1767	645	2051	2758	492	1270	2957	18	31_M	0,2455	497	1769	2098	381	1028	2373
8	31_Lw	0,179	724	2014	2961	471	1310	3172	18	31_M	0,1437	489	1432	2260	321	1409	2183
8	2_Wo	0,1973	856	1859	2919	578	986	2980	18	2_Wo	0,1689	614	1379	2086	439	858	2349
8	2_Lwo	0,2416	807	1960	2745	638	1049	2917	18	2_W	0,1518	597	1383	2161	460	930	2261
8	1_Lwo	0,2917	650	2001	2925	648	1057	2976	18	1_Wo	0,1897	465	1776	2163	598	994	2288
8	1_Lwo	0,3247	652	1903	2841	534	999	2943	18	1_Wo	0,1796	541	1568	2329	557	973	2261
8	30_Lw	0,2703	681	1974	2930	523	1135	3087	18	30_Lwo	0,2869	530	1615	2343	414	1080	2310
8	30_Lwo	0,29	687	2029	2906	528	1165	2872	18	30_Wo	0,2161	533	1543	2439	379	1161	2235
8	25_Wo	0,1657	705	1985	2732	546	1047	2852	18	25_Wo	0,1454	485	1762	2624	458	942	2361
8	25_Wo	0,161	680	1969	2860	555	939	2923	18	25_Wo	0,1086	493	1509	2526	476	1010	2341
8	28_Lwo	0,2163	753	1748	2575	560	1300	3010	18	28_Lw	0,2019	527	1657	2331	530	953	2435
8	28_Lw	0,2837	675	1627	2767	514	1057	3015	18	28_Wo	0,1965	483	1349	2129	523	1086	2308
8	7_Lwo	0,1635	627	2049	3027	588	1188	2989	18	7_Wo	0,1507	495	1745	2368	480	954	2407
8	7_Lwo	0,1476	686	1973	2508	600	1078	2907	18	7_Wo	0,1153	513	1504	2276	483	930	2434
8	26_Lwo	0,2567	773	1898	2915	616	1086	3015	18	26_Lwo	0,2683	565	1624	2402	451	916	2433
8	26_Lw	0,2957	775	2008	2875	492	1089	2921	18	26_M	0,2092	575	1412	2429	480	976	2361
8	31_Lw	0,1679	686	1986	2846	447	1364	2907	18	31_M	0,4084	589	1495	2299	319	837	2370
8	31_Lw	0,1686	666	2060	2935	418	1204	2811	18	31_W	0,1419	534	1479	2364	323	1373	2113
8	24_M	0,256	768	1914	2960	530	1036	3000	18	24_Lwo	0,2189	523	1671	2476	473	908	2441
8	24_Lwo	0,2764	786	1911	2919	554	983	2983	18	24_Wo	0,1655	516	1562	2426	468	959	2437
8	22_Lw	0,1635	691	1942	2868	465	1217	2763	18	22_W	0,1485	472	1756	2371	422	1045	2251
8	22_Lwo	0,1511	677	1946	2862	521	1269	2817	18	22_W	0,1061	501	1474	2399	369	1055	2154
8	23_Lwo	0,265	740	1891	2902	528	923	3189	18	23_Wo	0,1815	556	1592	2231	556	926	2450
8	23_Lwo	0,2447	669	2046	2787	493	942	2804	18	23_Wo	0,1427	497	1642	2135	618	1062	2474
8	27_Lwo	0,1786	674	1947	2945	483	1074	3008	18	27_W	0,193	557	1655	2299	378	880	2475
8	27_Wo	0,1844	643	2120	2889	472	1020	2773	18	27_Lw	0,2563	502	1811	2310	359	820	2518
8	4_M	0,2296	699	1823	2738	569	1028	2963	18	4_Lwo	0,2516	484	1686	2194	480	925	2436
8	4_M	0,2056	695	1821	2747	562	1098	2882	18	4_Lw	0,2011	550	1486	2325	426	924	2376
8	10_Lw	0,1672	688	1983	2820	463	1185	3058	18	10_Lw	0,2191	565	1579	2223	404	915	2596
8	10_Lw	0,1482	657	1780	2835	490	1211	2925	18	10_W	0,1182	527	1383	2346	428	1033	2593
8	11_Lw	0,24	771	2047	2782	535	1129	3166	18	11_Lw	0,2688	583	1709	2346	402	979	2554
8	11_Lwo	0,2642	728	1992	2793	459	1134	3048	18	11_Lwo	0,1775	596	1750	2372	512	961	2398
8	14_Lw	0,2034	699	2058	2913	498	1118	3061	18	14_W	0,1891	516	1659	2210	468	1072	2578

8	14_Lwo	0,164	698	1774	2842	605	1182	2814	18	14_M	0,2047	513	1454	2268	406	854	2464
8	17_Lwo	0,262	730	1638	2521	576	1120	3031	18	17_M	0,2043	591	1650	2081	517	861	2457
8	17_Lwo	0,2616	752	1993	3130	629	1185	2966	18	17_M	0,16	573	1532	2235	475	871	2389
8	29_Lwo	0,135	665	1776	2665	504	1307	2848	18	29_W	0,1495	493	1706	2490	421	1048	2344
8	29_Lw	0,1716	659	1961	2817	500	1204	2912	18	29_W	0,1786	516	1657	2411	413	917	2439
8	15_Lwo	0,2345	696	2282	2716	627	1079	2965	18	15_Lw	0,219	563	1731	2314	445	893	2406
8	15_Lwo	0,2265	758	1836	2792	561	993	2976	18	15_Wo	0,1443	630	1626	2324	520	983	2379
8	3_Wo	0,1314	653	2068	2950	525	1050	2782	18	3_NL	0,1923	509	1668	2400	437	893	2410
8	3_Wo	0,1396	688	2058	2876	528	998	2822	18	3_Wo	0,0959	468	1428	2330	404	865	2372
8	13_WN	0,222	739	2083	2821	637	1056	2977	18	13_WoN	0,2075	674	1671	2374	520	1045	2413
8	13_WN	0,2281	714	1909	2694	665	1105	2894	18	13_WN	0,1396	667	1467	2384	630	955	2444
8	16_Lwo	0,1712	728	1780	2858	510	1058	3047	18	16_M	0,243	536	1715	2184	394	950	2606
8	16_Lw	0,157	650	1914	2828	485	1176	2958	18	16_W	0,1344	514	1492	2477	388	1051	2671
8	9_Lwo	0,3096	761	1895	2773	555	1040	2993	18	9_Lwo	0,2062	530	1726	2392	563	933	2249
8	9_Lw	0,2924	790	2121	2758	427	864	2920	18	9_Wo	0,1495	558	1597	2482	588	918	2339
8	18_Lwo	0,2028	705	1907	2702	489	1145	3042	18	18_Lw	0,2599	494	1749	2273	398	1100	2697
8	18_Lwo	0,1622	642	1868	2925	525	1194	2924	18	18_M	0,1551	503	1443	2467	421	1023	2646
8	19_Lwo	0,2525	753	1989	2798	559	1057	2994	18	19_Wo	0,2204	450	1857	2197	477	871	2120
8	19_Lwo	0,249	671	1875	2809	615	1074	2857	18	19_Wo	0,1516	511	1539	2250	502	959	2243
8	12_Lwo	0,1592	658	2046	2850	536	1291	2845	18	12_Lwo	0,1814	477	1609	2331	425	1024	2496
8	12_Lwo	0,181	676	1967	2859	553	1200	3096	18	12_Wo	0,1196	469	1401	2566	401	1163	2726
8	6_WoN	0,1956	729	1742	2789	616	996	2966	18	6_WN	0,1856	606	1601	2296	497	960	2504
8	6_WoN	0,1859	766	1752	2750	590	981	2998	18	6_WoN	0,1458	584	1615	2132	673	812	2376
8	5_Wo	0,1363	731	1843	2942	593	1032	3025	18	5_W	0,1508	477	1642	2422	453	897	2393
8	5_Wo	0,1559	727	1842	2827	628	1108	2954	18	5_W	0,1151	460	1480	2522	406	947	2430
8	21_Lwo	0,2571	716	1978	2745	563	974	3060	18	21_Lwo	0,2078	535	1687	2292	441	881	2354
8	21_Lwo	0,2644	772	1983	2730	572	1078	2953	18	21_Lw	0,1717	625	1207	2360	392	843	2362
8	20_Lwo	0,1614	689	1900	2958	548	1095	2903	18	20_W	0,1399	468	1780	2513	446	1003	2370
8	20_Wo	0,1826	640	1967	2763	501	1012	2858	18	20_Wo	0,1118	464	1579	2496	412	1022	2252
8	8_Lwo	0,2536	687	2172	2804	604	1003	3077	18	8_Lwo	0,1908	521	1811	2208	494	942	2332
8	8_Lwo	0,2818	684	2164	2737	542	1015	2963	18	8_Lwo	0,1672	586	1508	2285	533	1160	2436
9	1_Lwo	0,3426	621	2129	2377	679	1072	2462	19	1_Lwo	0,3275	611	1871	3112	590	1081	2927
9	1_Lwo	0,3986	623	2266	3133	656	1046	2303	19	1_Lwo	0,2415	601	1935	3073	535	1185	2703
9	2_Lwo	0,29	801	1873	2813	624	1026	2992	19	2_Wo	0,2033	653	1940	3147	608	1147	2894
9	2_Lwo	0,2927	862	2001	2932	541	951	2429	19	2_Wo	0,2109	657	2205	2861	547	1149	2799
9	3_Lwo	0,1924	603	1861	2273	644	1077	3096	19	3_Wo	0,0968	617	1899	3122	510	1205	2690
9	3_Lwo	0,2153	718	2105	3175	607	1003	3013	19	3_Wo	0,0861	388	2110	3235	567	1284	2767
9	4_Lwo	0,2904	635	1943	2786	641	1126	2818	19	4_Wo	0,1921	666	1994	2971	629	1135	2864
9	4_Lwo	0,2983	712	2144	3063	616	1057	2939	19	4_Lwo	0,2494	655	1970	3156	608	1315	3045
9	5_Lwo	0,2288	643	1829	2241	635	1041	2893	19	5_Wo	0,0883	501	1756	3116	564	1157	2421
9	5_Lwo	0,1939	671	1910	2781	619	1022	3046	19	5_W	0,1255	713	1718	3113	340	1272	2856
9	6_WoN	0,2184	776	1157	2051	893	1300	2954	19	6_WoN	0,1566	586	1880	3107	642	1152	3185
9	6_WoN	0,2709	863	1691	2692	831	1264	2498	19	6_WoN	0,2127	751	2304	3246	445	1174	2419
9	7_Lwo	0,1847	690	1670	2503	641	1123	3074	19	7_Lwo	0,0986	615	1915	3019	552	1225	2967
9	7_M	0,1993	790	2064	2986	400	1656	2372	19	7_Lwo	0,0942	761	1694	3117	544	1025	2838
9	8_Lwo	0,2818	672	1974	2654	585	1243	3075	19	8_Lwo	0,2454	553	2008	2892	559	1146	3065
9	8_Lwo	0,3399	664	2158	3043	556	1203	2940	19	8_Lwo	0,2626	583	2112	3150	468	1263	2978
9	9_Lwo	0,3555	632	1819	2388	654	1094	3005	19	9_Wo	0,2521	654	2169	3547	592	1058	2840
9	9_Lwo	0,3432	604	1893	2339	613	1138	2926	19	9_Lwo	0,2762	601	1949	3055	477	1193	2752
9	10_Lwo	0,2057	592	1931	2780	547	1243	2847	19	10_Wo	0,1106	681	1775	3181	526	1281	3178
9	10_Lwo	0,1991	640	2117	3226	651	1133	2869	19	10_Lw	0,1234	704	1769	3139	396	1215	3003
9	11_Lwo	0,3081	812	1977	2961	611	1247	2910	19	11_Lwo	0,2192	676	2039	3183	619	1161	2809
9	11_Lwo	0,294	740	1774	2672	646	1181	2667	19	11_Lw	0,2313	781	2230	3240	379	1232	2777
9	12_Lwo	0,2388	642	1931	2225	605	1328	3233	19	12_Lwo	0,1354	546	1989	3116	525	1459	3211
9	12_Lwo	0,2816	607	2027	2909	630	1244	2906	19	12_Lw	0,1121	634	1811	3163	450	1417	3079
9	13_WoN	0,3035	737	2078	2876	791	1061	2482	19	13_LwN	0,2118	659	1949	3284	502	995	2065
9	13_WoN	0,3066	610	1708	2751	665	1099	2354	19	13_WN	0,2142	454	1942	2944	420	1119	2307
9	14_LwoN	0,3009	612	1720	2350	428	1462	2245	19	14_LwN	0,1395	635	1983	3261	451	1288	1863
9	14_Lwo	0,2546	552	1999	2762	608	1121	2756	19	14_Lw	0,1278	652	1863	3189	461	1453	3228
9	15_Lwo	0,3401	652	1323	2600	606	1101	2955	19	15_Lwo	0,2426	652	2047	3165	600	1121	3255
9	15_Lwo	0,407	656	1021	2537	548	1119	2816	19	15_Lwo	0,2572	622	2160	3187	483	1088	3012
9	16_Lwo	0,1915	531	1251	2302	611	1324	2684	19	16_Wo	0,1232	621	2010	3237	609	1403	3322
9	16_Lwo	0,1822	595	1620	2425	600	1204	2650	19	16_Wo	0,0832	585	1865	3244	643	1026	3184
9	17_Lwo	0,2997	634	1904	2505	642	1256	2811	19	17_M	0,2632	618	2049	3555	566	1071	3031
9	17_M	0,3688	659	1535	2513	618	1133	2946	19	17_M	0,2347	440	1759	2670	466	1035	2469
9	18_Lwo	0,1917	598	2141	2678	583	1216	3039	19	18_Lw	0,155	631	1884	3156	450	1291	3389
9	18_Lwo	0,2173	673	2117	3029	539	1277	2973	19	18_Lw	0,1409	705	1785	3208	439	1344	3290
9	19_Wo	0,2844	668	2229	2516	603	1080	2694	19	19_Wo	0,2396	614	2095	3514	609	1277	2831
9	19_Lwo	0,3054	648	1837	2315	557	1063	2943	19	19_Lwo	0,2465	581	2157	3254	547	1031	2917
9	20_Lwo	0,1683	573	1900	3073	576	1186	2805	19	20_Wo	0,1179	617	2085	3208	581	1209	2603
9	20_Lwo	0,1696	621	1620	2398	599	1234	2937	19	20_Wo	0,1179	563	1958	3109	484	1278	2764
9	21_Wo	0,2674	754	2318	3046	624	1090	3029	19	21_Lwo	0,2404	570	1989	3198	573	1142	2842
9	21_Lwo	0,3364	741	2306	3284	562	1085	2831	19	21_Lwo	0,2837	492	1831	2961	490	1164	2912
9	22_Lw	0,1742	653	2046	2999	553	1180	2843	19	22_Lw	0,1368	601	1967	3289	509	1236	2726
9	22_Lwo	0,2009	580	1762	2865	511	1072	2944	19	22_Lwo	0,1252	590	2010	3181	512	1144	2855
9	23_Wo	0,3261	721	2091	2866	667	1056	2772	19	23_Lwo	0,289	608	2056	2826	559	999	3000

9	23_Lwo	0,3661	740	1980	2607	626	1013	2360	19	23_Lwo	0,2938	610	2142	3380	402	1104	2436
9	24_Lwo	0,3084	732	1774	2166	612	1039	2856	19	24_Lwo	0,2401	650	1609	2882	593	1065	2972
9	24_Lwo	0,29	704	1833	2488	602	1034	2960	19	24_Lwo	0,2543	626	1943	2988	468	1083	2924
9	25_Wo	0,1949	665	1824	2504	667	1148	3024	19	25_Wo	0,1139	642	1911	3235	645	1134	2850
9	25_Lwo	0,2039	647	1658	2671	615	1100	3090	19	25_W	0,0905	565	1801	3020	578	1153	2835
9	26_Lwo	0,3198	707	1793	2251	642	1013	2940	19	26_M	0,2322	634	2250	3461	628	1185	2730
9	26_Lwo	0,342	720	1753	2214	621	1085	2910	19	26_Lw	0,2297	615	1981	3355	523	1021	2846
9	27_Lw	0,2819	695	1717	2248	508	1017	2835	19	27_Lw	0,1718	587	1952	3138	449	1303	2706
9	27_Lwo	0,2504	702	1600	2168	633	1091	2999	19	27_Lw	0,1526	673	1911	3137	418	1214	2787
9	28_Lwo	0,3233	756	1828	2950	592	1066	2679	19	28_Lw	0,2544	676	1829	2252	561	1122	2711
9	28_Lwo	0,2705	807	1846	2035	598	1004	2428	19	28_M	0,2444	595	1819	3179	477	1193	2687
9	29_Lwo	0,1955	568	1674	2200	596	1144	2696	19	29_W	0,0995	668	1927	3187	501	1563	3051
9	29_Lwo	0,1585	645	1959	3155	537	1370	3188	19	29_Wo	0,0981	646	1923	3081	459	1357	2839
9	30_M	0,2748	686	2206	3284	595	1260	2876	19	30_Lwo	0,2471	648	1873	3310	526	1295	2617
9	30_M	0,2787	731	1874	2866	554	1259	3084	19	30_Lwo	0,234	593	1956	3174	498	1353	2744
9	31_Lwo	0,2622	656	2080	3042	545	1212	2939	19	31_M	0,1642	591	1861	3082	431	1873	2866
9	31_Lwo	0,2553	673	2272	3193	537	1296	2838	19	31_W	0,1048	499	1787	2976	422	1889	2884
9	2_Lwo	0,2565	816	1827	2547	616	1061	2665	19	2_Wo	0,209	634	2110	2735	602	1066	2862
9	2_Lwo	0,2603	807	1862	2815	579	1059	2567	19	2_Wo	0,2471	628	2289	3429	475	1029	2923
9	1_Lwo	0,3073	574	1758	2648	652	1233	2869	19	1_Lw	0,2742	621	2079	3193	592	1127	3057
9	1_Lwo	0,3406	609	1695	2344	617	1109	2588	19	1_Lwo	0,2848	606	2101	3243	430	1224	3034
9	30_M	0,2692	689	1733	2224	518	1355	2771	19	30_Lw	0,2299	653	2034	3439	539	1388	2718
9	30_M	0,2934	668	1486	2236	521	1240	2689	19	30_M	0,2077	707	1359	2232	456	1069	2796
9	25_Lwo	0,1859	550	1778	2792	593	1123	2834	19	25_Wo	0,1137	671	2043	3281	587	1142	2858
9	25_Lwo	0,1869	622	1830	2992	561	1202	3035	19	25_Wo	0,1026	705	1877	3190	571	1174	2878
9	28_Lwo	0,2738	694	1803	2887	576	1120	3017	19	28_Lwo	0,2195	679	1862	2734	597	1394	2755
9	28_Lwo	0,2914	700	1898	2567	577	1202	2906	19	28_Lw	0,2674	621	1993	2936	448	1201	2670
9	7_Lw	0,1746	592	2039	2564	529	1093	2809	19	7_WoN	0,1239	605	1909	3278	558	1061	1882
9	7_Lwo	0,185	600	1631	2232	716	1243	2944	19	7_Lwo	0,1136	691	1813	3270	574	1208	2746
9	26_Lwo	0,279	684	1536	2712	669	1193	2849	19	26_Lwo	0,2552	676	2194	3510	596	1080	2891
9	26_Lwo	0,313	689	1539	2328	633	1140	2759	19	26_Lwo	0,3253	623	2032	3373	489	1085	3010
9	31_Lw	0,2468	624	1980	2240	516	1435	2760	19	31_M	0,1327	649	2051	3428	457	1707	2702
9	31_Lwo	0,2667	600	2141	2819	562	1425	2885	19	31_M	0,1509	584	1798	2902	457	1989	2883
9	24_Wo	0,2919	637	1830	2494	616	1053	2765	19	24_Lwo	0,2052	692	2173	3399	645	1125	2987
9	24_Wo	0,2886	659	1645	2466	582	1047	2860	19	24_Lwo	0,2355	671	2190	3452	540	1020	2927
9	22_Lw	0,1985	579	1976	2632	534	1204	2944	19	22_Wo	0,1187	671	1964	3155	482	1170	2910
9	22_Lwo	0,2135	668	1761	2417	577	1083	2804	19	22_Wo	0,1367	641	2033	3244	494	1044	2789
9	23_Wo	0,3106	693	1896	2806	624	1086	2859	19	23_Wo	0,2851	620	2126	2617	703	1108	3037
9	23_Lwo	0,3443	671	1948	2732	685	1213	2641	19	23_Wo	0,2677	590	2215	3353	469	1160	2902
9	27_Lwo	0,2148	605	1800	2448	602	1179	3136	19	27_Lw	0,1684	633	1915	3212	473	1137	2669
9	27_Lwo	0,2298	641	1734	2043	604	1073	2821	19	27_W	0,1471	569	1706	3167	420	1209	2843
9	4_Lwo	0,3654	714	1770	2641	609	1065	2630	19	4_Lwo	0,2467	670	2186	3044	627	1136	2709
9	4_Lwo	0,3377	692	1816	2317	634	1159	2743	19	4_Lwo	0,2369	639	2104	3292	626	1170	2754
9	10_Lwo	0,1742	582	2051	3251	615	1198	3038	19	10_Lwo	0,1333	621	1726	2649	467	1272	2328
9	10_Wo	0,1624	738	1791	2500	636	1145	2564	19	10_Lw	0,125	701	1749	3176	496	1060	2622
9	11_Lwo	0,3158	733	1308	2396	590	1201	2916	19	11_Lwo	0,2554	619	2071	2887	580	1150	2835
9	11_Lwo	0,3361	841	1622	2640	583	1252	3037	19	11_Lwo	0,2749	660	2310	3191	454	1149	3131
9	14_LwN	0,183	615	1873	2292	689	1360	3076	19	14_LwoN	0,1252	637	1732	2879	516	1347	3124
9	14_WoN	0,222	602	1780	2292	590	1206	2844	19	14_LwoN	0,1552	601	1910	3143	427	1226	1668
9	17_M	0,3748	605	1915	2995	598	1122	2834	19	17_Lwo	0,2647	592	2139	3545	622	1244	3401
9	17_M	0,4187	645	1705	2896	583	1229	2750	19	17_M	0,2865	524	2137	3097	435	1066	3083
9	29_Wo	0,1949	587	2204	2854	593	1348	2937	19	29_FT	0,1105	693	1770	3086	485	1451	2820
9	29_Lwo	0,1814	595	1917	2478	542	1477	2960	19	29_TF	0,1073	605	1897	3200	422	1392	2701
9	15_Lwo	0,3477	667	2184	2424	555	1170	2757	19	15_Lwo	0,2742	661	2106	3176	604	1087	3244
9	15_Lwo	0,3536	672	1768	2744	580	1221	2918	19	15_Lw	0,3076	625	2299	2966	402	955	2441
9	3_Wo	0,1688	609	1970	2533	610	1178	2797	19	3_Wo	0,0938	563	1831	3240	451	1199	2677
9	3_Lw	0,2811	632	1940	2998	547	1000	2804	19	3_W	0,0993	504	1760	3033	454	1061	2574
9	13_WN	0,2433	903	1633	1878	715	902	2301	19	13_LwN	0,2147	631	2061	2852	591	1285	2294
9	13_WoN	0,2502	832	1610	2419	846	1037	2473	19	13_LwN	0,2452	531	2132	3398	460	1176	2849
9	16_Lwo	0,1902	537	1634	2439	634	1265	2867	19	16_Wo	0,1024	658	1822	3327	566	1365	3355
9	16_Lwo	0,2298	632	2007	2487	607	1411	2954	19	16_Lw	0,1079	641	1904	3271	520	1392	3234
9	9_Lwo	0,3392	666	2127	2887	696	1121	2565	19	9_Wo	0,2375	649	2101	3459	739	1227	2858
9	9_Lwo	0,3869	674	1643	2272	619	1117	2705	19	9_Lwo	0,2871	626	2100	3461	526	1199	2714
9	18_Lwo	0,2549	573	1961	2110	576	1074	2666	19	18_Lw	0,1676	693	1810	3243	478	1311	3277
9	18_Lwo	0,2092	607	2026	2647	599	1251	2919	19	18_Lw	0,1619	685	1889	3128	474	1258	3107
9	19_Lwo	0,2893	527	2064	2654	628	1142	3000	19	19_Wo	0,2405	613	2092	3069	596	1120	2963
9	19-Lwo	0,2983	647	2072	3043	642	1129	2638	19	19_Lw	0,2877	608	2065	3186	428	1067	2633
9	12_Lwo	0,2367	603	2067	3214	566	1288	2893	19	12_Lw	0,1365	587	2032	3171	477	1371	3174
9	12_Lwo	0,2609	563	2052	2694	546	1175	2803	19	12_Lwo	0,1362	664	1844	3173	532	1424	3316
9	6_WoN	0,2938	696	1534	2400	873	1244	2772	19	6_WN	0,1612	653	1797	2980	629	1111	2902
9	6_WoN	0,2107	688	1875	2270	890	1340	2925	19	6_LwN	0,1949	644	2277	3153	439	1360	2780
9	5_Lwo	0,2257	599	1492	2261	606	1046	3071	19	5_Wo	0,1036	729	1842	3179	547	1034	2723
9	5_Lwo	0,189	640	1803	2357	625	959	2924	19	5_W	0,1161	699	1753	3106	563	968	2949
9	21_Lwo	0,33	665	2192	2680	574	1101	2919	19	21_Lwo	0,2725	580	2178	3523	590	1087	2869
9	21_L	0,3333	651	2238	3175	541	1003	2828	19	21_Lw	0,2816	605	2261	3247	440	1039	2850
9	20_Lwo	0,1774	577	1635	1937	618	1110	3053	19	20_W	0,0943	680	1712	3042	469	1107	2717

9	20_Lwo	0,1791	655	1520	2399	617	1055	2775	19	20_Wo	0,1044	660	1910	3163	617	1244	2894
9	8_Lwo	0,3185	623	2140	2612	588	1244	2869	19	8_Lwo	0,233	603	2085	3211	547	1177	3078
9	8_Lwo	0,321	734	1893	2812	601	1305	2857	19	8_Lwo	0,2462	537	2146	3142	479	1098	2725
10	1_Wo	0,3267	595	2127	2899	545	1088	2452	20	1_Wo	0,2329	592	2174	2818	679	1205	2678
10	1_Wo	0,2898	606	2074	2734	427	1109	2454	20	1_Wo	0,1894	594	2027	2788	648	1162	2611
10	2_Wo	0,256	750	2206	2960	581	1041	2531	20	2_Lwo	0,2193	739	2125	2961	596	992	2555
10	2_Lwo	0,2784	684	2194	3025	474	1052	2492	20	2_Wo	0,1635	616	2028	2635	528	1018	2321
10	3_Wo	0,1713	617	1987	2757	507	945	2546	20	3_Wo	0,162	643	1898	2679	624	1092	2616
10	3_Wo	0,2081	593	2290	2991	514	984	2522	20	3_Wo	0,205	598	2058	2907	612	1104	2786
10	4_Wo	0,2599	657	2043	2671	561	986	2366	20	4_Wo	0,2146	656	1950	2797	629	1115	2675
10	4_Wo	0,269	580	2029	2802	544	1055	2402	20	4_Wo	0,2175	678	1909	2719	591	1078	2553
10	5_Wo	0,2129	657	2208	2777	561	1041	2397	20	5_Wo	0,1502	635	1931	2400	651	1127	2788
10	5_Wo	0,239	543	2115	3022	556	1011	2293	20	5_Wo	0,1685	651	2046	2818	564	995	2571
10	6_WoN	0,2851	716	2167	3044	565	1007	2571	20	6_WoN	0,2046	752	2060	2887	727	989	2729
10	6_WoN	0,2368	809	2138	2877	362	923	2536	20	6_WoN	0,1796	731	2180	2939	659	1016	2508
10	7_Wo	0,2025	519	2226	2976	536	1020	2524	20	7_Wo	0,1542	637	2041	2904	664	1016	2491
10	7_Wo	0,2085	539	2244	2999	432	941	2638	20	7_Wo	0,1637	656	2070	2797	659	1042	2399
10	8_Lw	0,276	786	2230	2983	507	1157	2555	20	8_Lwo	0,2602	645	2170	2936	587	1218	2842
10	8_Lw	0,236	730	2123	2824	506	1169	2543	20	8_Lwo	0,2425	697	2103	2866	464	1018	2626
10	9_Wo	0,3008	657	2134	2909	619	1121	2448	20	9_Wo	0,2457	643	2035	2613	602	964	2473
10	9_Wo	0,2019	632	2000	2558	648	1298	2341	20	9_Wo	0,2271	693	1901	2856	628	1055	2613
10	10_Lwo	0,2044	611	1975	3043	547	1197	2367	20	10_Lwo	0,1948	633	1980	2846	612	1187	2822
10	10_Lwo	0,2196	613	1982	2864	513	1157	2587	20	10_Lw	0,1889	655	1812	2628	529	1044	2732
10	11_Lwo	0,2794	697	2113	3032	539	1301	2479	20	11_Lwo	0,2478	658	2106	2927	605	1196	2664
10	11_Lwo	0,2489	633	2145	2849	525	1152	2425	20	11_Lwo	0,1978	673	2128	2864	555	1104	2647
10	12_Lwo	0,239	564	2160	2902	512	1165	2451	20	12_Lw	0,1869	586	2049	2840	540	1252	2656
10	12_Lwo	0,2348	599	1659	2393	579	1192	2673	20	12_Lwo	0,1784	609	1993	2646	594	1143	2570
10	13_WN	0,2864	626	2229	2901	527	1064	2550	20	13_WoN	0,1894	784	1828	2816	664	1035	2385
10	13_LwN	0,2964	640	2315	2926	416	1075	2560	20	13_WoN	0,1964	730	2049	2875	680	1192	2339
10	14_Lwo	0,2529	654	2149	3038	602	1201	2642	20	14_WoN	0,1767	605	2258	3061	698	1227	2709
10	14_Lw	0,2858	655	2018	2872	494	1227	2749	20	14_WoN	0,1735	619	2054	2861	540	1125	2311
10	15_Lw	0,3399	634	2364	3092	496	1033	2448	20	15_Lw	0,2368	663	2144	2959	510	1075	2944
10	15_Lw	0,351	620	2230	3035	437	1115	2520	20	15_Lwo	0,223	691	2056	2853	737	1298	2703
10	16_Lwo	0,2094	626	2167	2955	501	1183	2594	20	16_Lwo	0,1712	648	2049	2690	571	1291	2936
10	16_L	0,1918	617	2082	2928	590	1470	2663	20	16_Lwo	0,1601	660	2021	2851	524	1113	2800
10	17_Lw	0,3936	669	2185	2948	505	1382	2597	20	17_M	0,2927	748	2094	2924	584	1171	3012
10	17_Lwo	0,2816	765	2206	3009	447	1098	2621	20	17_M	0,2572	742	2046	2900	503	1011	2528
10	18_Lw	0,2483	631	2097	2887	456	1131	2592	20	18_Lwo	0,2001	605	1999	2848	540	1271	3030
10	18_Lwo	0,2077	628	1970	2425	529	1312	2694	20	18_Lw	0,1846	628	1898	2690	473	1231	2865
10	19_Wo	0,3204	572	2019	2661	585	1149	2546	20	19_Lwo	0,2589	609	2037	2876	594	1054	2652
10	19_Lwo	0,3031	618	1803	2662	583	1139	2501	20	19_Lw	0,2365	634	1985	2815	522	980	2492
10	20_Lw	0,2192	599	2205	2959	514	1155	2283	20	20_Wo	0,1613	609	2027	2849	547	1101	2490
10	20_Wo	0,1966	574	1802	2712	515	1109	2517	20	20_W	0,1555	641	1972	2893	490	1044	2526
10	21_Lw	0,3461	702	2059	3098	496	1099	2599	20	21_Lw	0,2692	652	2186	2945	562	1032	2612
10	21_Lwo	0,2675	826	2203	2941	519	1140	2643	20	21_Lw	0,2522	663	2056	2839	375	984	2475
10	22_Lwo	0,2528	528	2307	2996	504	1090	2441	20	22_Lwo	0,1636	652	1657	2349	569	1126	2580
10	22_Lw	0,197	615	1629	2277	500	1143	2301	20	22_Lw	0,1941	717	1981	2837	443	1068	2486
10	23_Wo	0,295	594	2357	2980	570	1125	2292	20	23_Lwo	0,2612	667	1933	2779	599	952	2445
10	23_Wo	0,2444	611	2071	2909	618	1229	2307	20	23_Lwo	0,3024	681	1959	2842	505	1295	2756
10	24_Wo	0,2615	680	2085	2963	565	1034	2308	20	24_Lwo	0,2411	706	1988	2897	548	1025	2643
10	24_Wo	0,2397	599	1998	2895	558	1047	2313	20	24_Lwo	0,1967	743	1846	2802	510	994	2488
10	25_Lw	0,1784	664	2040	2933	514	1146	2484	20	25_Wo	0,1442	628	1957	2702	585	1061	2609
10	25_Lwo	0,191	607	2036	2789	545	1155	2670	20	25_Wo	0,1409	631	1981	2754	528	1011	2596
10	26_Wo	0,2664	646	1814	2589	542	1054	2243	20	26_Lwo	0,2547	635	2060	2881	550	1039	2485
10	26_Wo	0,2433	625	2074	2571	519	1011	2422	20	26_Lwo	0,2379	702	1941	2798	566	988	2439
10	27_Lw	0,2203	665	2098	2939	458	981	2555	20	27_Lwo	0,1741	648	1891	2715	582	1099	2704
10	27_Lw	0,2579	603	1612	2557	479	1009	2655	20	27_Lwo	0,1953	673	1945	2857	512	997	2687
10	28_Wo	0,2399	628	1897	2378	508	1065	2307	20	28_Lw	0,2214	738	1973	2629	565	1198	2606
10	28_Lw	0,2645	610	1809	2889	456	1062	2416	20	28_Lw	0,2303	694	1993	2670	465	1322	2417
10	29_Lw	0,1844	605	2124	2967	432	1238	2614	20	29_Lwo	0,1741	579	2162	2882	540	1347	2908
10	29_Lw	0,2144	658	2077	2876	460	1332	2651	20	29_Lwo	0,1579	660	1976	2841	512	1267	2582
10	30_Lw	0,3507	614	1987	2892	538	1204	2371	20	30_Lwo	0,215	733	1859	2874	502	1220	2606
10	30_Lw	0,2974	645	1749	2184	485	1210	2368	20	30_Lw	0,2222	666	1925	2906	432	1079	2431
10	31_W	0,2697	627	1450	2030	393	1441	2515	20	31_Wo	0,1968	586	1973	2644	472	1626	2449
10	31_Lw	0,2556	642	1883	2600	489	1305	2592	20	31_Wo	0,1831	667	1901	2841	459	1340	2507
10	2_Wo	0,2395	732	2203	3012	584	1084	2398	20	2_Wo	0,2324	646	2229	2964	637	1075	2720
10	2_Wo	0,2294	762	2329	3028	634	1065	2443	20	2_Wo	0,2024	656	2175	2799	570	1078	2551
10	1_Wo	0,2739	629	2098	2716	610	1234	2487	20	1_Wo	0,2848	589	2143	2784	589	943	2782
10	1_Wo	0,2657	602	2040	2712	665	1213	2404	20	1_M	0,2617	609	2016	2845	564	1308	2821
10	30_Lwo	0,3094	647	2210	2975	527	1177	2359	20	30_Lwo	0,2542	700	1961	2938	567	1242	2608
10	30_Lw	0,223	661	1992	2884	498	1176	2309	20	30_Wo	0,2157	699	1986	3036	603	1156	2556
10	25_Wo	0,1929	602	2091	2930	518	1127	2589	20	25_Wo	0,179	595	2057	2870	582	1102	2665
10	25_Wo	0,208	614	2032	2885	500	1044	2606	20	25_Wo	0,1558	631	2011	2967	566	1056	2605
10	28_Lwo	0,267	642	1830	2490	551	1144	2462	20	28_Lwo	0,2309	721	1911	2684	556	1453	2606
10	28_Lwo	0,2528	636	1769	2623	467	1127	2521	20	28_Lw	0,197	663	1857	2595	481	1124	2511
10	7_Lwo	0,2228	667	1865	2851	565	1054	2622	20	7_Wo	0,1379						

10	7_Lwo	0,2522	631	2119	2880	553	1051	2716	20	7_Wo	0,1268	627	1970	2306	640	1059	2449
10	26_M	0,3236	623	1239	2374	543	1007	2618	20	26_Lwo	0,2371	685	1980	2827	593	1066	2687
10	26_M	0,2621	650	2094	2894	541	1057	2445	20	26_Wo	0,2126	653	1964	2860	552	1015	2563
10	31_Lw	0,2187	651	2217	2950	405	1175	2639	20	31_Lw	0,1856	642	2020	2837	537	1240	2461
10	31_Lw	0,2298	660	2086	2858	472	1100	2498	20	31_W	0,1807	633	2034	2945	479	1359	2447
10	24_Wo	0,2553	651	1929	2826	581	1183	2221	20	24_Wo	0,2465	638	2105	2899	574	988	2694
10	24_Lw	0,2393	654	2022	2898	475	1131	2476	20	24_Lw	0,2034	635	1983	2722	505	972	2403
10	22_Lw	0,219	636	2218	3020	493	1179	2673	20	22_Wo	0,1527	605	1782	2899	557	1174	2656
10	22_Lw	0,2252	665	2099	2821	434	998	2439	20	22_Wo	0,1525	657	2030	2977	631	1133	2560
10	23_Wo	0,2796	655	2293	2893	541	1120	2308	20	23_Lwo	0,3026	665	2058	2980	651	943	2843
10	23_Wo	0,2046	603	2017	2805	630	1314	2397	20	23_Wo	0,2862	653	2035	2880	693	1609	2733
10	27_Lw	0,2134	655	2145	2949	449	1090	2557	20	27_Wo	0,1699	627	2007	2791	534	1044	2615
10	27_Lwo	0,217	612	1821	2756	502	951	2627	20	27_NL	0,1791	560	2158	2906	498	1322	2340
10	4_Wo	0,284	666	2040	2800	520	1022	2341	20	4_Lwo	0,2557	616	2041	2832	586	953	2658
10	4_Lwo	0,2438	638	2014	2646	502	995	2418	20	4_Lwo	0,2866	695	1974	2747	425	1025	2398
10	10_Lw	0,218	636	2085	2955	473	982	2554	20	10_Lwo	0,1935	603	2115	2914	524	1185	2765
10	10_Lw	0,2315	635	2171	2859	394	957	2555	20	10_NL	0,1748	614	1757	2769	677	1338	2726
10	11_Lwo	0,2652	713	2213	2974	522	1154	2485	20	11_Lw	0,257	659	2139	2968	500	1160	2977
10	11_Lw	0,2829	611	1507	2572	512	1210	2548	20	11_Lw	0,2164	684	2150	2896	467	1080	2515
10	14_Lw	0,2343	619	2124	2978	458	1104	2725	20	14_Lwo	0,168	575	2084	2970	650	1210	2770
10	14_Wo	0,1898	550	1367	2526	646	1221	2474	20	14_LwoN	0,1617	609	2055	2905	651	1120	2486
10	17_Wo	0,2865	788	2259	2911	506	1042	2441	20	17_Lwo	0,2884	747	2050	2949	631	1137	3055
10	17_M	0,3619	753	2216	2934	465	958	2594	20	17_M	0,3101	728	2100	2901	535	1336	2803
10	29_Lw	0,2003	630	2206	2835	469	1172	2711	20	29_Lw	0,1755	612	1994	2878	510	1246	2451
10	29_Lwo	0,2703	627	2072	2904	524	1263	2707	20	29_Lw	0,1592	657	1855	2599	507	1280	2507
10	15_Lw	0,2849	645	1333	2564	489	1091	2542	20	15_Lwo	0,255	620	2175	3006	574	1060	2834
10	15_Wo	0,2214	672	2119	3026	565	1225	2365	20	15_Wo	0,2121	662	1965	2671	554	1171	2818
10	3_Wo	0,1451	613	1113	2292	531	1121	2442	20	3_Wo	0,1489	539	2062	2904	577	1064	2608
10	3_Wo	0,1818	623	2025	2904	521	1031	2751	20	3_Wo	0,1447	555	2004	3023	510	1009	2551
10	13_M	0,2275	713	2179	2988	770	1182	2665	20	13_WoN	0,2184	750	2136	2951	649	1108	2578
10	13_Wo	0,2275	691	1995	2963	597	1118	2594	20	13_LwoN	0,2108	716	2088	3020	596	929	2502
10	16_Lw	0,2171	651	2135	2970	497	1202	2821	20	16_Lwo	0,1706	595	2059	2903	613	1384	2913
10	16_Lw	0,2095	653	2112	2878	497	1219	2921	20	16_Lw	0,1742	648	2009	2886	520	1183	2630
10	9_Wo	0,3051	588	1622	2719	566	1055	2300	20	9_Wo	0,326	642	2055	2859	598	971	2516
10	9_Wo	0,2435	614	2121	2852	622	1194	2358	20	9_Lw	0,2776	707	1942	2833	532	1227	2498
10	18_Lw	0,2194	637	1690	2345	506	1168	2669	20	18_Lw	0,192	582	2044	2852	522	1274	2916
10	18_Lw	0,2415	651	1940	2751	485	1047	2590	20	18_Lw	0,2099	690	1884	2563	493	1305	2820
10	19_Wo	0,2657	645	1819	2510	596	1240	2569	20	19_Lwo	0,251	623	2092	2919	645	1011	2799
10	19_Wo	0,2539	630	1681	2463	534	1108	2436	20	19_Lwo	0,2276	681	1991	2781	614	1331	2654
10	12_Lwo	0,2674	625	2164	2933	521	1149	2670	20	12_Lwo	0,1743	606	2037	2875	546	1223	2869
10	12_Lwo	0,2328	589	2112	2821	558	1103	2488	20	12_Lw	0,1842	517	2067	2921	560	1287	2637
10	6_WN	0,2902	677	2219	3015	597	1031	2548	20	6_LwN	0,22	793	2174	2961	674	968	2477
10	6_WoN	0,258	689	2185	2983	729	1115	2583	20	6_LwN	0,2043	734	2098	2847	526	932	2311
10	5_Wo	0,193	669	2152	3057	618	1068	2453	20	5_Lwo	0,1735	680	1850	2682	619	1018	2825
10	5_Lwo	0,2127	622	1549	2250	595	1036	2650	20	5_Wo	0,1566	663	1954	2783	583	1006	2504
10	21_W	0,2777	790	2146	2842	531	1195	2441	20	21_Lwo	0,2664	719	2182	2949	648	1107	2761
10	21_Lw	0,2717	785	2269	2983	548	1017	2577	20	21_Lwo	0,2699	642	2163	2945	575	1135	2550
10	20_W	0,2303	558	1902	2719	462	1025	2478	20	20_Wo	0,1512	566	1959	2808	523	1063	2479
10	20_W	0,2033	610	1997	2966	436	1051	2721	20	20_M	0,1807	626					

APPENDIX L

PRAAT SCRIPT

```
##
#### Script description
##
##      Get formants mean and calculate the ratios F3/F1 and F2/F1 of
##      stretches of a soundwave which encompasses part of the syllable peak and
##      part of the steady state of the phoneme /l/ in coda position
##
##      This script measures the first three formants from two selected time.
##      The time selection is done by the operator who chooses the percentile to be used.
##      Also, it calculates the ratio F3/F1 and F2/F1 from the syllable peak and /l/
##      and the ratio F2/F2 from both (PEAK and LATERAL).
##      It separates several contexts to be analyzed
##      Finally, it appends the results to a text file.
##      Any labeled label in the specified tier will be logged.
##      The result of this script will be a file called: formants.txt
##
##      Each participant refers to a soundfile which is named with numbers and characters.
##      The file name start with numbers from 10 to 30 (20 participants); the sixth character
##      is 'M' or 'F' which identifies the participant's gender. The other characters may be
##      whatever to identify the participants.
##
##      By Jacir Paulo Baratieri (2006)
##
#### End of description

form Measuring formants (burg)
    comment Which are the directory to read from/write to: and the participants (10 to 30 or * for all):
    sentence Directory_to_read_from C:\project\data\Final_data
    sentence Directory_to_write_to C:\project\data\results\formants
    sentence File_to_write formants.txt
    comment Which is the participant? (from 10 to 30 or * for all)
    sentence Participant_number 10
    comment Which tier do you want to extract the formants from?
    optionmenu Tear_number
    option 1
    option 2
    option 3
    option 4
    option 5
comment ------------------------------------------------------------------------------------------------------------
    comment SET PEAK MEASUREMENT
    comment Which % to mark as peak initial and end points?
    natural initial_percentile_peak 5
    natural final_percentile_peak 20
comment ------------------------------------------------------------------------------------------------------------
    comment SET LATERAL MEASUREMENT
    comment Which % to mark as lateral initial and end points?
    natural initial_percentile_lateral 65
    natural final_percentile_lateral 100
comment ------------------------------------------------------------------------------------------------------------
    comment Other details:
    positive Max_number_of_formants 5
    boolean Pre-emphasis_6dB/oct yes
endform

# shorten variables
```

```
directory$ = directory_to_read_from$
directory_to_write$ = directory_to_write_to$
file$ = participant_number$
write$ = file_to_write$
tier$ = tear_number$
point1 = initial_percentile_peak
point2 = final_percentile_peak
point3 = initial_percentile_lateral
point4 = final_percentile_lateral

filedelete 'directory_to_write$'\'write$'

header_row$ = "alloph" + tab$ + "Part" + tab$ + "Gend" + tab$ +  "Alloph"
...+ tab$ +"nasal" + tab$ + "cont" + tab$ + "cont1" + tab$ + "voic" + tab$
...+ "mann" + tab$ + "plac" + tab$ + "Dur(ms.)" + tab$ + "peakF1" + tab$
...+ "peakF2" + tab$ + "peakF3" + tab$ + "rpF3:F1" + tab$ + "rpF2:F1"
...+ tab$ + "liqF1" + tab$ + "liqF2" + tab$ + "liqF3" + tab$ + "rlF3:F1"
...+ tab$ + "rlF2:F1" + tab$ + "PL_F2/F2" +  tab$  + "grade" + tab$ + newline$

fileappend "'directory_to_write$'\'write$'" 'header_row$'

Create Strings as file list...  list 'directory$'\'file$'*.wav
number_files = Get number of strings

for j from 1 to number_files


    select Strings list
    current_token$ = Get string... 'j'
    Read from file... 'directory$'\'current_token$'

    object_name$ = selected$ ("Sound")

    # Male or female?

    g$ = mid$(object_name$, 6, 1)

    if g$ = "M"
        To Formant (burg)... 0.0025 5 5000 0.025 50
      else
        To Formant (burg)... 0.0025 5 5500 0.025 50

    endif

    select Sound 'object_name$'
    To Pitch... 0.01 75 600

    Read from file... 'directory$'\'object_name$'.TextGrid

    select TextGrid 'object_name$'
    number_of_intervals = Get number of intervals... 'tier$'
   count = 0
    for b from 1 to number_of_intervals
       select TextGrid 'object_name$'
        interval_label$ = Get label of interval... 'tier$' 'b'

        if interval_label$ != ""
                        count += 1
            lab'count' = b
```

```
        alloph$ = right$ (interval_label$, 2)

    # L = 1
        if alloph$    = "_L"
        alloph$ = "1"
    # Lwo = 2
        elsif alloph$ = "wo"
        alloph$ = "2"
    # Lw = 3
        elsif alloph$ = "Lw"
        alloph$ = "3"
    # Wo = 4
        elsif alloph$ = "Wo"
        alloph$ = "4"
    # W = 5
        elsif alloph$ = "_W"
        alloph$ = "5"

        else
        alloph$ = "99"

        endif

# Check for nasal realizations - if the label contains N

        nasal$ = right$ (interval_label$, 1)

    # N = 1
        if nasal$ = "N"
        nasal$ = "1"

        else
        nasal$ = "2"

        endif

# transform nominal labels into numeric labels
# Context

        context$ = left$ (interval_label$, 2)

    # final L = 1
        if context$ = "1_"
        context$ = "1"
        elsif context$ = "9_"
        context$ = "1"
        elsif context$ = "23"
        context$ = "1"
    # Lp = 2
        elsif context$ = "2_"
        context$ = "2"
    # L p = 3
        elsif context$ = "3_"
        context$ = "3"
    # Lb = 4
        elsif context$ = "4_"
        context$ = "4"
    # L b = 5
        elsif context$ = "5_"
        context$ = "5"
```

```
# Lm = 6
        elsif context$ = "6_"
        context$ = "6"
# L m = 7
        elsif context$ = "7_"
        context$ = "7"
# Lt = 8
        elsif context$ = "8_"
        context$ = "8"
# L t = 10
        elsif context$ = "10"
        context$ = "10"
# Ld = 11
        elsif context$ = "11"
        context$ = "11"
# L d = 12
        elsif context$ = "12"
        context$ = "12"
# Ln = 13
        elsif context$ = "13"
        context$ = "13"
# L n = 14
        elsif context$ = "14"
        context$ = "14"
# Ls = 15
        elsif context$ = "15"
        context$ = "15"
# L s = 16
        elsif context$ = "16"
        context$ = "16"
# Lz = 17
        elsif context$ = "17"
        context$ = "17"
# L z = 18
        elsif context$ = "18"
        context$ = "18"
# Lk = 19
        elsif context$ = "19"
        context$ = "19"
# L k = 20
        elsif context$ = "20"
        context$ = "20"
# Lg = 21
        elsif context$ = "21"
        context$ = "21"
# L g = 22
        elsif context$ = "22"
        context$ = "22"
# Lf = 24
        elsif context$ = "24"
        context$ = "24"
# L f= 25
        elsif context$ = "25"
        context$ = "25"
# Lv = 26
        elsif context$ = "26"
        context$ = "26"
# L v = 27
        elsif context$ = "27"
        context$ = "27"
```

```
    # Lsh = 28
            elsif context$ = "28"
            context$ = "28"
    # L sh = 29
            elsif context$ = "29"
            context$ = "29"
    # Lj = 30
            elsif context$ = "30"
            context$ = "30"
    # L j = 31
            elsif context$ = "31"
            context$ = "31"

            else context$ = "99"

            endif

# transform nominal labels into numeric labels
# Voicing

 voice$ = left$ (interval_label$, 2)

    # final L = 99
            if voice$ = "1_" or voice$ = "9_" or voice$ = "23"
            voice$ = "99"

    # unvoiced = 2
            elsif voice$ = "2_" or voice$ = "3_" or voice$ = "8_" or voice$ = "10"
            ...or voice$ = "15" or voice$ = "16" or voice$ = "19" or voice$ = "20"
            ...or voice$ = "24" or voice$ = "25" or voice$ = "28" or voice$ = "29"
            voice$ = "2"

    # voiced = 1
            elsif voice$ = "4_" or voice$ = "5_" or voice$ = "11" or voice$ = "12"
            ...or voice$ = "17" or voice$ = "18" or voice$ = "21" or voice$ = "22"
            ...or voice$ = "26" or voice$ = "27" or voice$ = "30" or voice$ = "31"
            ...or voice$ = "6_" or voice$ = "7_" or voice$ = "13" or voice$ = "14"
             voice$ = "1"

            else voice$ = "99"

            endif

# transform nominal labels into numeric labels
# context within or accross words

 context1$ = left$ (interval_label$, 2)

    # final L = 1
            if context1$ = "1_" or context1$ = "9_" or context1$ = "23"
            context1$ = "1"

    # within the word = 2
            elsif context1$ = "2_" or context1$ = "4_" or context1$ = "6_"
            ...or context1$ = "8_" or context1$ = "11" or context1$ = "13"
            ...or context1$ = "15" or context1$ = "17" or context1$ = "19"
            ...or context1$ = "21" or context1$ = "24" or context1$ = "26"
            ...or context1$ = "28" or context1$ = "30"
            context1$ = "2"
```

```
    # accross the word = 3
            elsif context1$ = "3_" or context1$ = "5_" or context1$ = "7_"
            ...or context1$ = "10" or context1$ = "12" or context1$ = "14"
            ...or context1$ = "16" or context1$ = "18" or context1$ = "20"
            ...or context1$ = "22" or context1$ = "25" or context1$ = "27"
            ...or context1$ = "29" or context1$ = "31"
            context1$ = "3"

            else context1$ = "99"

            endif

# transform nominal labels into numeric labels
# Manner of articulation

 place$ = left$ (interval_label$, 2)

    # final L = 1
            if place$ = "1_" or place$ = "9_" or place$ = "23"
            place$ = "99"

    # bilabial = 1
            elsif place$ = "2_" or place$ = "3_" or place$ = "4_" or place$ = "5_"
            ...or place$ = "6_" or place$ = "7_"
            place$ = "1"

    # labialdental = 2
            elsif place$ = "24" or place$ = "25" or place$ = "26" or place$ = "27"
            place$ = "2"

    # alveolar = 3
            elsif place$ = "8_" or place$ = "10" or place$ = "11" or place$ = "12"
            ...or place$ = "13" or place$ = "14" or place$ = "15" or place$ = "16"
            ...or place$ = "17" or place$ = "18"
            place$ = "3"

    # post-alveolar = 4
            elsif place$ = "28" or place$ = "29" or place$ = "30" or place$ = "31"
            place$ = "4"

    # velar = 5
            elsif place$ = "19" or place$ = "20" or place$ = "21" or place$ = "22"
            place$ = "5"

            else place$ = "99"

            endif

# transform nominal labels into numeric labels
# Manner of articulation

 manner$ = left$ (interval_label$, 2)

    # final L = 1
            if manner$ = "1_" or manner$ = "9_" or manner$ = "23"
            manner$ = "99"

    # plosive = 1
            elsif manner$ = "2_" or manner$ = "3_" or manner$ = "4_" or manner$ = "5_"
            ...or manner$ = "8_" or manner$ = "10" or manner$ = "11" or manner$ = "12"
```

```
        ...or manner$ = "19" or manner$ = "20" or manner$ = "21" or manner$ = "22"
        manner$ = "1"

    # nasal = 2
        elsif manner$ = "6_" or manner$ = "7_" or manner$ = "13" or manner$ = "14"
        manner$ = "2"

    # fricative = 3
        elsif manner$ = "15" or manner$ = "16" or manner$ = "17" or manner$ = "18"
        ...or manner$ = "24" or manner$ = "25"
      ...or manner$ = "26" or manner$ = "27" or manner$ = "28" or manner$ = "29"
        ...or manner$ = "30" or manner$ = "31"
        manner$ = "3"

        else manner$ = "99"

        endif

    ## Grade the productions according to the allophones produced
    ## W or Wo = 10  --  Lw or Lwo = 5  ---- and L = 0


        grade$ = right$ (interval_label$, 2)

        if grade$    = "_W" or grade$ = "Wo"
        grade$ = "10"
        elsif grade$ = "Lw" or grade$ = "wo"
        grade$ = "5"
        elsif grade$ = "_L"
        grade$ = "0"
      else
      grade$ = "99"

        endif


# Here the participants and their gender will be turned into numeric variables

     part$= left$(object_name$, 2)
     gender$ = mid$(object_name$, 6, 1)
     if gender$ = "M"
     gender$ = "1"
    else
     gender$ = "2"
    endif

     # set time, duration, etc. that will be used to extrat the formants from
     # it refers to the labeled intervals

          begin = Get starting point... 'tier$' 'b'
          end = Get end point... 'tier$' 'b'
          duration = end - begin
          start_peak = begin + (duration * point1 / 100)
          finish_peak = begin + (duration * point2 / 100)
          start_lateral = begin + (duration * point3 / 100)
          finish_lateral = begin + (duration * point4 / 100)

     # point1, 2, 3 and point4 were defined when you run the script
```

```
            select Formant 'object_name$'

            pf1 = Get mean... 1 'start_peak' 'finish_peak' Hertz
            pf2 = Get mean... 2 'start_peak' 'finish_peak' Hertz
            pf3 = Get mean... 3 'start_peak' 'finish_peak' Hertz
            lf1 = Get mean... 1 'start_lateral' 'finish_lateral' Hertz
            lf2 = Get mean... 2 'start_lateral' 'finish_lateral' Hertz
            lf3 = Get mean... 3 'start_lateral' 'finish_lateral' Hertz

    # calculate the ratios and make the variables

            rl1 = lf3 / lf1
            rl2 = lf2 / lf1
            rp1 = pf3 / pf1
            rp2 = pf2 / pf1
            rpl1 = pf2 / lf2

    #  Write in the file: formant.txt

 fileappend "'directory_to_write$'\'write$'" 'interval_label$"tab$"part$"tab$"gender$"tab$"alloph$"tab$'
...'nasal$"tab$"context$"tab$"context1$"tab$"voice$"tab$"manner$"tab$"place$"tab$"duration:4"tab$'
…'tab$"pf1:0"tab$"pf2:0"tab$"pf3:0"tab$"rp1:2"tab$"rp2:2"tab$"lf1:0"tab$"lf2:0"tab$"lf3:0"tab$"rl1:2'
…'tab$"rl2:2"tab$"rpl1:2"tab$"grade$"tab$"newline$'

        endif
    endfor

    select all
    minus Strings list
    Remove
endfor

select all
Remove
clearinfo
print Ok, done.
```

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