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# Acoustic Analysis of the Allophones of the Mid-Front Spanish Vowel /e/

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ACOUSTIC ANALYSIS OF THE ALLOPHONES OF THE SPANISH  
MID-FRONT VOWEL /e/

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Dean of the Graduate School

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Raquel González de Anda

2013

## **Dedication**

To my husband.

ACOUSTIC ANALYSIS OF THE ALLOPHONES OF THE SPANISH  
MID-FRONT VOWEL /e/

by

RAQUEL GONZALEZ DE ANDA, BA

THESIS

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## **Chapter 1: Phonetics and Phonology of /e/**

### **1.0 Introduction**

The study of the sounds of a language can be divided in two: the mental representation of sounds and their physical realization. When speech is produced, ‘individual’ sounds blend into the following ‘individual’ sound, which is termed ‘coarticulation’. Despite this blending, the human mind perceives speech sounds as discrete elements (consonants and vowels). The mental representations of these discrete elements/sounds are called phonemes. In speech, sounds (phonemes) vary; these variations that do not have an impact on the sound category being perceived are called allophones. This study focuses on the Spanish phoneme /e/ and its open/lower allophone(s).

It has been observed that /e/ tends to open in certain phonetic environments (Delattre 1946, Morrison 2004). However, there is no complete agreement with regards to the specific phonetic environments that trigger the opening of /e/. Vowel opening refers to an increase in the distance between the tongue and the palate; the tongue moves down so the space between it and the palate gets larger; and the vowel becomes lower. The purpose of this study is to: i) advance in the clarification of the current literature discrepancies, ii) learn if vowel opening occurs in free variation or in conditioned distribution, and iii) to provide a more accurate description of the allophone(s).

### **1.1 Articulatory Phonetics: Vowels**

According to Hammond (2001:31-32), “In articulatory phonetics vowels are traditionally described according to the following four dimensions: the relative position of the tongue in the oral cavity on a front-back axis, the relative position of the tongue in the oral cavity on an up-down axis, lip configuration, and position of the velum.” Regarding the up-down axis, Hammond (2001) stated that the Spanish vowels produced with a high tongue at a small distance from the palate, are high vowels (/i/ and

/u/). The ones produced with more space between the tongue and the palate, are low vowels (/a/). Lastly, the ones produced between these extremes are mid vowels (/e/ and /o/). Furthermore, on a front-back axis, vowels are traditionally divided into front, central, and back (Hammond 2001). In Spanish, /i/ and /e/ are front, /a/ is central, and /o/ and /u/ are back (see Table 1.1).

**Table 1.1** Spanish vowel phonemes.

	Front	Central	Back
High	/i/		/u/
Mid	↓ /e/		/o/
Low		/a/	

**Note:** The arrow next to /e/ shows vowel opening, /e/ moves down and becomes a lower vowel.

The Spanish vowel inventory is very common. As Hualde (2005) pointed “Five is the most common number of vowel phonemes cross-linguistically, and among these, symmetrical systems, as in Spanish, are the majority”. The Spanish vowel inventory consists of five different phonemes, /a e i o u/ (see Table 1.1). In Spanish, the most frequently occurring vowel is the mid front vowel /e/ (Perissinotto, 1975). One phenomenon that is commonly discussed in the literature is the fact that Spanish mid vowels tend to open. For /e/ this means that according to the surrounding sounds it can be pronounced as a regular mid [e], or as an open/lower allophone (some authors also talk about a more closed allophone).

## 1.2 Surrounding Sounds: The Spanish Syllable Structure

Syllabic structure is important because the occurrence of the allophones of /e/ has long been related to the syllable characteristics in which /e/ is found. Sounds that precede and follow vowels are often part of the same syllable. In fact, most research refers to the influence of the coda on /e/. This is because segments that precede and follow a sound show the effects of coarticulation. Thomas (2001)

stated that anticipatory effects (effects that result from following sounds) result in vowel variation more than perseveratory effects (effects that result from preceding sounds).

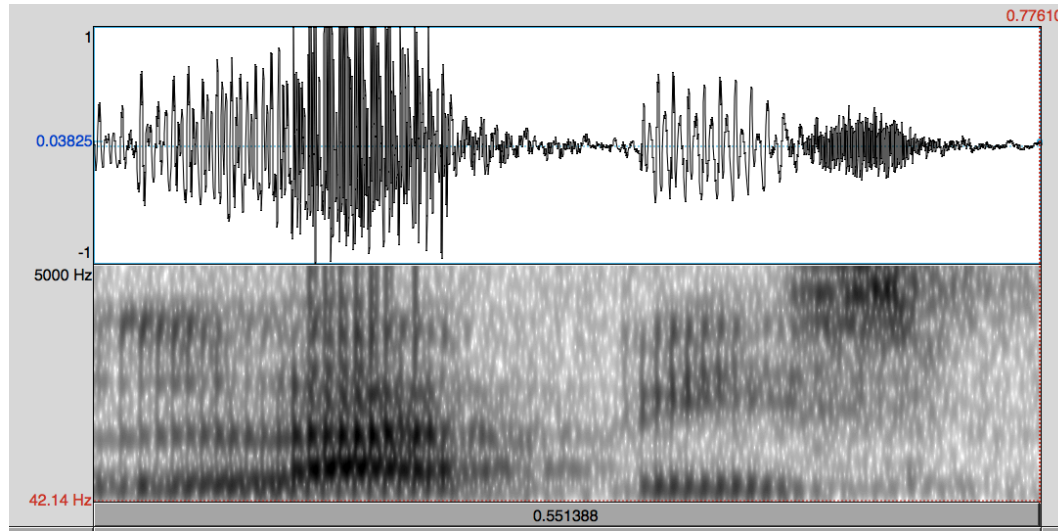
A syllable can be regarded as a higher level of individual sound segment organization (Hammond, 2001). Syllables are composed by an obligatory nucleus (in Spanish the possible nuclei are /a e i o u/), and they can optionally be accompanied by consonants. Consonants that precede vowels in a syllable are called onsets, and the ones that follow vowels are called codas. Spanish syllable structure allows up to two consecutive consonant phonemes as onsets. The sequences allowed include /p b t d k g f/ + liquid, and two consecutive consonants as codas which can only be in word internal position, as described below.

Spanish allows for thirteen consonant phonemes to be in coda position. The number of consonants allowed varies depending on the position of the syllable in the word. In word internal position / p t k b d g s f θ m n r l / can be single codas. In word final position / d s θ x r l n / can be single codas. As mentioned earlier, in Spanish codas can also have two consecutive consonants. In word internal position / k b n r l / + /s/ are possible Spanish codas. Hammond (2001) stated that in word final position Spanish does not allow two consecutive consonants (CC) as codas. Words that have CC codas in word final position are not originally from Spanish, for example: *unisex*. This and any other type of syllable can be acoustically analyzed in speech production.

### **1.3 Acoustic Phonetics: Physical Realization of Sounds**

When speech is produced, the air pressure changes. The vibration of the vocal folds changes the air pressure and perturbs air molecules, which results in sound waves. Sound waves can be visually inspected using speech analysis software. Software such as PRAAT (Boersma & Weenink, 2012) provides a visual display of sound waves (oscillogram) (see Figure 1.3). Another form of visual representation that PRAAT provides is called the spectrogram. In spectrograms, it is possible to see

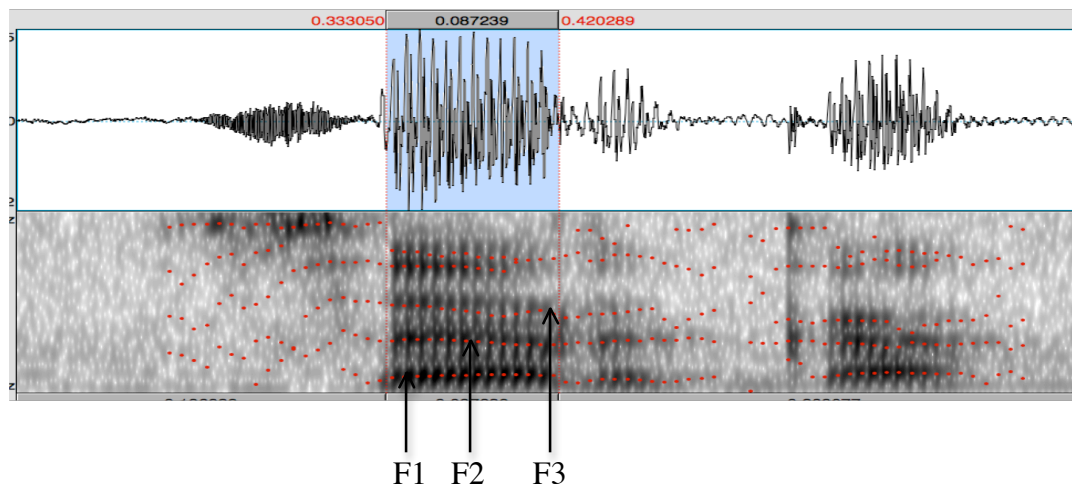
how energy is distributed at different frequencies (Hualde 2005). The horizontal darker bands in the spectrogram, called formants, reflect energy concentration at certain frequencies.



**Figure 1.3** Oscillogram (top) and spectrogram (bottom) of the word [lápiz] ‘lápiz’ (*pencil*).

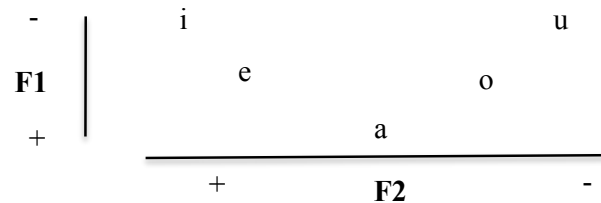
### 1.3.1 Vowel quality and formant analysis

In a spectrogram, vowels can be identified by their first three formants (see Figure 1.3.1 a). “Vowel height, vowel advancement and rounding are all reflected in vowel formant values” (Thomas 2011:145).



**Figure 1.3.1 a.** Vocalic formants of /e/ in the word [sérka] ‘cerca’ (*close*). The arrows point to F1, F2, and F3.

The first formant (henceforth F1) value is inversely correlated with vowel height; the higher the vowel the lower the formant value. On the other hand, the second formant (henceforth F2) value is directly correlated with frontness; the more fronted the vowel the higher the F2 value (see Figure 1.3.2 b).



**Figure 1.3.1 b.** F2 is on the *x*-axis, values increase from right to left. F1 is on the *y*-axis, values increase from top to bottom.

For example, an open (or lower) /e/ will have a higher F1 value; and a retracted /e/ will have a lower F2 value. The third formant (F3) is related to vowel rounding. In Spanish, rounding is redundant with respect to tongue advancement; back vowels are rounded, and non-back vowels are unrounded (Hualde, 2005).

### 1.3.2 Vowel onset and offset

The categorization of sounds as individual segments can be necessary when analyzing sounds. The onset (the “beginning”) and offset (the ‘end’) of sounds can be determined in different ways. As mentioned earlier, there is no clear division between speech sounds, but divisions have to be determined to measure sound characteristics such as duration. Thomas (2011) suggested that the boundaries of speech sounds have to be made consistently to obtain reliable results. The description of how the onset and offset of /e/ were determined for this study is in Chapter 3.

### **1.3.3 Measuring vowel formants on PRAAT**

Vowels have a steady state segment in the middle and unstable segments in the onset and offset. As Thomas (2011) states, vowel formants change from the preceding sound into a steady state, and then change again into the following sound. Vowels, and therefore, formants, are affected by the surrounding sounds. As stated earlier, the sounds that follow vowels are the ones that have a greater effect on formant variation.

Formants can be measured at several different points in time. Sometimes formants are measured at vowel mid-point. To do this, the onset and offset of the vowel have to be established (on the speech analysis software) first. Formants can also be measured at the beginning of the vowel, at several points in time, at their highest or lowest point, etc. Details about how vowel formants were measured for this study can be found in Chapter 3.



## **Chapter 2: Previous research on the allophones of the Spanish mid front vowel /e/**

### **2.0 Introduction**

For a long time, various authors who have looked at Spanish vowels have talked about vowel opening (Navarro, 1974; Matluck, 1963; Morrison (2004); among others). Most of the studies were done before speech analysis software was readily available; therefore, most authors did an impressionistic analysis of their data. Researchers also used different data collecting methodologies; but more importantly, the obtained results varied in important ways, as explained in the next section.

### **2.1 Previous Research on Spanish Vowels**

Some of the early analyses of vowels were those made by Delattre (1948, 1965, and 1954). His work focused mainly on French but he also studied other languages such as Spanish. Delattre (1946:34) investigated French vowel opening and Spanish vowel opening in the Spanish of New Mexico. One author who has studied Spanish Phonetics in depth is Navarro Tomás (1974). He studied the Spanish sound system, and discussed vowel opening in his “Manual de Pronunciación Española”. In this work, he described three allophones with different opening levels for the mid vowels, and the phonetic contexts in which the opening occurred (see Table 2.2). Similarly, other authors provided different phonetic contexts for the occurrence of these variants. Perissinotto (1975) studied Spanish vowels in Mexico City, where he outlined two allophones and the contexts in which they occurred. Likewise, Williams (1982) studied the sounds of Peruvian Spanish. Williams described two allophones of different heights and the contexts where they occurred, which also varied from earlier proposals. García Fajardo (1984) analyzed the sounds of Spanish in Valladolid, Yucatán (southern Mexico), where she found that /i u e/ tend to have open allophones. She provided a list of phonetic contexts that cause these vowels to open. Unfortunately, she did not specify if all the contexts affected all the vowels; therefore, it

is not possible to know which specific contexts affect /e/. Lipski (1987) studied the sound system of the Spanish of Honduras and, he discussed one open variant of /e/ to which he assigned the feature [-tense]. Quilis (1993:145) described the variation of Spanish vowels in general; however, as opposed to previous authors, he stated that Spanish vowels do not vary much and that the relative opening or closing of vowels is rather small. He also pointed out that the contexts of occurrence of the variants was not in complementary distribution, as other authors (Navarro Tomás 1974, Williams 1982, Perissinotto 1975) have pointed out. Therefore, according to Quilis, the contexts in which /e/ opening occurs are not responsible for triggering variation.

## **2.2 Previous Studies on Spanish Mid Vowel Opening**

Matluck (1963) conducted a study in which he focused on the opening of /e/ in closed syllables (CVC). According to him, the variables that have an effect on mid vowel opening are entirely phonetic. He suggested that some of the factors that open /e/ are: syllable structure, articulatory characteristics of the preceding and following sound, syllable position within a word (initial mid, or final), and stress. To analyze the opening of /e/, Matluck measured the F1 at vowel midpoint. Matluck suggested that there are six different allophones, distinguished by height; and he claimed that the contexts that cause /e/ to open are different than the ones proposed earlier by other authors (see table 2.2).

Most recently, Morrison (2004) conducted an investigation to replicate Navarro Tomás' (1974) findings regarding the contexts in which the different opening levels of /e/ occurred. He discovered some inaccuracies in the allophonic variation proposed by Navarro Tomás. For his study, Morrison tested two educated professionals from Madrid. Both participants were asked to repeat words using a carrier sentence. The words contained stressed /e/ in the contexts proposed by Navarro Tomás (1974). The allophones of /e/ that Morrison found were three: one that was open-retracted, one central, and one closed-fronted. Morrison also pointed out that the allophones are free variants; that is, they are not in complementary distribution, as suggested by Navarro Tomás (1974).

As this review suggests, there are many inconsistencies in the literature about the contexts in which the Spanish open variant of /e/ occurs and about the allophonic variants of this vowel. Table 2.2 summarizes the different proposals of authors regarding the contexts where /e/ occurs. The numbers in the last row show a summary of the different results obtained in different studies for the same context.

**Table 2.2:** Proposed context for regular mid, open, and closed /e/

Authors	CV	CVC	CVC Coda: anything except /mnsd/	CVC Coda: /mnsd/	In contact with /r/	___/x/	Before /tʃ,l,ɲ, y/	___/k/	Before /s t x/
Navarro, Tomás (1974)	Closed		Open	Closed	Open (except when coda /mnsd/)	Open	Closed		
Perissinotto (1975)	Mid	Open			Open	Open			
Matluck (1963)	Closed/Mid /Open		Open	Closed/Mid /Open	Open	Closed			
Williams (1982)	Closed		Open	Closed	Open (except when coda /mnsd/)	Open	Closed	Open (/_k./) Closed (/_ks./)	
Lipski (1987)		Open			Open				
Morrison (2004)					Open	Closed			Closed
<b>Summary</b>	<b>3 Closed</b>	<b>0 Closed</b>	<b>0 Closed</b>	<b>3 Closed</b>	<b>4 Open wo/e</b>	<b>2 Closed</b>	<b>2 Closed</b>	<b>1 Closed</b>	<b>1 Closed</b>
	<b>2 Mid</b>	<b>0 Mid</b>	<b>0 Mid</b>	<b>1 Mid</b>		<b>0 Mid</b>	<b>0 Mid</b>	<b>0 Mid</b>	<b>0 Mid</b>
	<b>1 Open</b>	<b>2 Open</b>	<b>3 Open</b>	<b>1 Open</b>	<b>2 Open w/e</b>	<b>3 Open</b>	<b>0 Open</b>	<b>1 Open</b>	<b>0 Open</b>
	<b>2 NA</b>	<b>4 NA</b>	<b>3 NA</b>	<b>3 NA</b>	<b>0 NA</b>	<b>1 NA</b>	<b>4 NA</b>	<b>5 NA</b>	<b>5 NA</b>

**Notes:** Empty spaces indicate that the author does not talk about that specific context.

**w/e:** with exceptions, **wo/e:** without exceptions

García Fajardo's (1984) work was not included since it is unknown which vowels their proposed contexts affect.

## 2.3 Limitations of Previous Studies

There are currently several problems in the literature regarding this particular phenomenon. One of them is the lack of consistency of the results regarding the contexts of occurrence of the variants of /e/. The number of allophones and the phonetic contexts in which they occur vary depending on the

author. The inconsistencies of the proposed contexts that cause this phenomenon are possibly due to the different methodologies used to analyze the data. Only three of the authors on Table 2.2 (Williams 1982, Matluck 1963, and Morrison 2004) actually measured vowel height, the rest did an impressionistic analysis of their data. Therefore, drawing a line in a continuum that goes from ‘open’ to ‘regular’ would be subject to the transcriber’s interpretation. Another problem is that, with the exception of the study conducted by Morrison (2004), most of the research on this topic was made at a time when no advanced technology was widely available to conduct more accurate acoustic analysis of the vowels under study. Another limitation of previous studies is the reduced number of participants from which the data was collected. This is particularly the case with Matluck (1963) and Morrison’s (2004) studies. One last problem is that the proposed, and generally accepted, notion that Spanish /e/ is more open when it is in a closed syllable has a list of exceptions. One of the exceptions is that the consonant in coda position has to be anything except /m n s d θ/. So, for example, from seventeen sounds that make the inventory of Mexican Spanish consonants (/p t k b d g f s j x tʃ m n ñ l r r /) only thirteen can follow a vowel as part of the same syllable /p t k b d g f s x m n l r/. From those thirteen, only five are frequent codas /d s n r l/. From these frequent codas /d s n/ are part of the list of exceptions, which means that /e/ opens when followed, in the same syllable, by /r l /; this list being smaller than the list of exceptions. Therefore, generalizing the phonetic context for the open variant as *when it occurs in a closed syllable* might not be adequate.

The issues discussed above generate a problem for L2 Spanish instructors since the description of the Spanish phoneme /e/ varies across authors. Macpherson (1975:44-45), Quilis and Fernandez (1975) use the contexts provided by Navarro (1974). In a more recent textbook, Hammond (2001) suggested that the phoneme /e/ had a more open variant that is also lax /ɛ/. Hammond did not provide a specific context other than /e/ happens in open syllables, and /ɛ/ in closed syllables. In contrast, Hualde

(2005:121-122) stated that “the vowel /e/ tends to be higher or closer before a palatal consonant, and it is especially open in contact with a trill and before /x/. But even in this context /e/ is not as open as the typical realization of the phoneme /ɛ/ of other Romance languages (or the lower-mid vowel in English *bed*)”. On the same token, there are also textbooks that do not mention any possible allophone for the vowels, such as Teschner’s (2000).

## **2.4 Previous Research summary**

As mentioned earlier, there are many inconsistencies in the literature with regards to the specific contexts that motivate the opening of /e/. Some of the questions left unanswered are the following: 1) Are the different variants of the Spanish vowel /e/ in complementary distribution? 2) Specifically, which of the several environments proposed in the literature (Navarro Tomás, 1974; Matluck, 1963; Morrison, 2004; etc.) cause this vowel to be more open than the regular mid /e/? 3) Since most studies were done several years ago, could an acoustic analysis provide different results? 4) How many different levels of opening/closing should be used? 5) Is the open variant of /e/ a lax vowel as Hammond (2001) suggested? 6) Is the description of the allophones correctly described as just “open” or should words like *fronted* and *retracted* also be used to describe them more accurately, as Morrison (2004) suggested?

## Chapter 3: The present study

### 3.0 Introduction

The purpose of this project is to provide a better description, and to clear up distribution discrepancies found on current literature, of the allophonic variants of the Spanish vowel /e/. When the allophones of /e/ are commonly described as “lower”, only vertical movement is considered. However, recent studies point toward the possibility of the movement to be diagonal, that is, the allophone is not only lower but also retracted. The distribution of the allophone(s) is commonly thought to be in complementary distribution, but recent studies suggest the possibility of free variation.

This study focuses on answering the following research questions:

- 1) Specifically, which of the several environments proposed in the literature (Navarro Tomás, 1974; Matluck, 1963; Morrison, 2004; Williams, 1982; Lipski, 1987; Perissinotto, 1975) cause /e/ to be more open than the regular mid /e/? If the same phonetic contexts consistently cause the mid front vowel to open, then we could say that the allophones occur in complementary distribution.
- 2) Are the allophones correctly described as “open” or should words like ‘fronted’ and ‘retracted’ be used to describe them more accurately, as Morrison (2004) suggested?

The findings of this study could benefit voice recognition technology as it could help computers recognize variations in the signal that are due to phonetic contexts such as the one under study. For example, an instance of vowel lowering could make voice recognition software confuse <menta> for <manta>. This study, however, provides acoustic information of the specific contexts when vowel lowering affecting /e/ is likely to happen and, therefore, it could be used to improve the quality of voice recognition software.

### **3.1 Participants**

The participants for this study were ten university students. The students were recruited from a beginners' ESOL (English for Speakers of Other Languages) class and an advanced Spanish class. All the participants were adult (18-32 years) native speakers of Mexican (Chihuahua) Spanish. Although they had some knowledge of English, Spanish was the participants' first and dominant language. Previous studies suggested that socioeconomic status and sex do not have an effect on vowel production of Spanish speakers (García Fajardo, 1984; Morrison, 2007), so these factors were not considered in the present study. All the participants in this study were females. Subjects voluntarily participated in the study.

The participants were asked to complete a linguistic questionnaire (Pérez-Leroux, Cuza, & Thomas, 2011) (Appendix 1). Participants were selected if they reported speaking only Spanish at home and having attended school in Spanish in Mexico (from kindergarten to high school). Eight subjects grew up in Juárez - México and went to school there. The other two subjects grew up in El Paso but went to school in Juarez also. At the time of testing, all the subjects were starting their college education, and were attending school in the US for the first time. Most participants were still living in Juarez and they commuted to attend UTEP.

### **3.2 Procedure**

The test was conducted in a sound treated room. Participants were tested one at a time. First, they were asked to complete the linguistic questionnaire (about their use of Spanish) (Pérez-Leroux, Cuza, Thomas, 2011). Each participant was seated in front of a laptop computer and a Snowball microphone. They were instructed to read a list of words (from a Power Point slide show) using the carrier phrase "*Digo ... para tí*" (I say ... for you) (see Appendix 2 for the list of words). To be sure that they used the carrier phrase, participants first read three practice words. Participants themselves changed

the slides as they read. Three different slide shows were created with the complete list of words in different randomized order (to avoid order effects). Each participant read the three slide shows. The researcher stayed in the room during the test. If participants read a word incorrectly, they were asked to repeat it (for example: when <esté> was presented and they read [éste] instead of [esté], using the carrier phrase: <Digo *esté* para tí>). Audacity 2.0.2 was used to record the data.

### **3.3 Stimuli**

Participants were presented with a list of 44 Spanish words. All the words contained a stressed /e/ in different contexts. /e/ was always stressed since unstressed vowels tend to weaken in Mexican Spanish (here vowel weakening refers to shortening or ‘dropping’ the vowel, especially when followed by /s/; for example, saying [entóns] instead of [entónses]) (Delforge, 2008). Thomas (2011) stated that the steady state of shortened vowels might be non-existent, leaving only the transitions of the surrounding sounds.

In the words used as stimuli, /e/ appears in different contexts. The contexts chosen include those studied by the authors on Table 2.2. The contexts are: closed syllable ((C)VC, the second consonant being all the possible Spanish single consonant codas), /e/ in contact with /r/ (preceding and following), /e/ before /x/, and /e/ in open syllables as a control.

Each word was read three times by the 10 speakers giving a total of approximately 1320 tokens. Words that were not read correctly were removed from the analysis.

### **3.4 Analysis**

In order to analyze formant values, the /e/ segment of each target word was first marked on a text grid on PRAAT 5.3.04. The onset and offset of the vowel were marked on a text grid depending on the surrounding sounds, taking into consideration both the oscillogram and the spectrograph.



The onset of /e/ after voiceless consonants was marked where the waves on the oscillogram became regular and the formants were clearly visible. After nasals and the lateral liquid, the onset was marked where the anti-formants ended and the formants began. After approximants, the onset was marked where the intensity increased and the preceding sound could no longer be heard. When a flap or a trill preceded /e/, the onset was marked where the intensity increased, where the preceding sound could no longer be heard, and where the formants became darker. When /e/ was in word initial position the word “es” (for example: <es hembra>) was inserted to avoid diphthongization caused by the /o/ of “digo” on the carrier phrase.

The offset of /e/ when a voiceless consonant followed was marked where the waves became irregular. Before nasals and the lateral liquid, the offset was set where the anti-formants began. Before approximants, the offset was marked where intensity decreased and the following sound could no longer be heard. When a flap or trill followed /e/, the offset was marked where intensity started to decrease and formants got lighter.

After the text grids of all the target words were completed, a script was run to get the formant values. The formants were measured at vowel midpoint because, as Morrison (2004) stated, this ensures “that any allophonic variation detected would be substantial in that it would not be due merely to minor coarticulatory effects at the periphery of the vowels”.

## Chapter 4: Results

### 4.0 Introduction

This chapter presents the results of several comparisons of /e/ in a variety of contexts. The results for each of the comparisons are presented independently. At least two contexts are contrasted in each section. In each section F1s and F2s are compared. The statistical analyses performed include 2 Sample t-test, One-way ANOVA, and post hoc Tukey HSD. Before the statistical analysis the normality of data on each group was tested. In some cases, outliers were deleted to obtain a normal distribution of the sample. The statistical analyses were done on Minitab 15.1.1.0.

In the contexts analyzed by the authors reviewed in chapter 2 some codas were omitted. In order to have a more complete understanding of the contexts that affect the realization of /e/, the present study considers all possible codas in the analysis. This includes, for instance, the analysis of /e/ in CV vs. CVC syllables with the following codas /m n s d p t k r l/.

Words were separated in different groups to contrast different contexts. The contexts analyzed include:

**i) Open syllable vs. closed syllable (any coda)**

For example: <zeta> vs. <celta>

**ii) Open syllable vs. Closed syllable (coda /m n s d/)**

For example: <meta> vs. <menta>

**iii) Closed syllable (onset: not /r/, coda /m n s d/) vs. Closed syllable (onset /r/, coda /m n s d/)**

For example: <menta> vs. <renta>

**iv) Open syllable (following onset: not /r/) vs. Open syllable (following onset: /r/)**

For example: <cero> vs. <cerro>

**v) /e/ in contact with /r/ (preceding in CV and CVC, and following)**

For example: <reza> vs. <renta> vs. <cerro>

**vi) /e/ followed by /x/ as the onset of the following syllable (e.x) vs. /e/ followed by any other consonant as the onset of the following syllable (e.C)**

For example: <ceja> vs. <zeta>

**vii) /e/ in /ek./ vs. /e/ in /eks./**

For example: <secta> vs. <sexta>

**viii) /e/ in CV vs. /e/ in CVC (codas: /m n s d p t k r l/)**

For example: <seca> vs. <hembra>, <menta>, <sesta>, <sed>, <pepto>, <etnia>, <secta>, <cerca>, <celta>

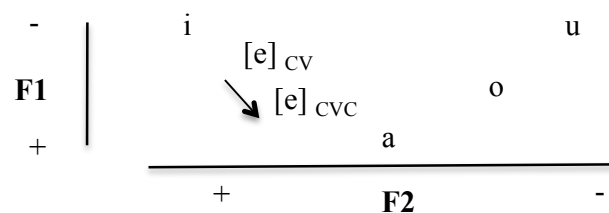
Before comparing linguistic variables, a one-way between subjects ANOVA was conducted to compare the effect of individual speakers (henceforth S#) on the F1 and F2 values in all the conditions together. There was a significant effect of speakers on F1 and F2 values. For F1  $f(9,1346) = 98.44, p < .01$ . Post hoc comparisons using the Tukey HSD test indicated that S4  $M=686.18, SD=118.10$ ; and S6  $M=463.47, SD=44.70$  significantly differed from the other speakers. For F2  $f(9,134) = 146.95, p=0.000$ . Post hoc comparisons using the Tukey HSD test indicated that S8  $M=1643.7, SD=322.7$  significantly differed from the rest of the speakers. Taken together, these results suggest that the speech of S4, S6, and S8 differ in one of the two measurements of interest. Their individual characteristics were reviewed and it was found that these three speakers were the youngest. Their recordings were heard again and

their voice quality sounded more adolescent than adult like. Data from these three speakers (S4, S6, and S8) were not included in further analysis.

#### 4.1 Open syllable vs. closed syllable (any coda)

Some researchers (Perissinotto 1975, and Lipski 1987) refer to the general context of “closed syllable” as one that causes /e/ to become a lower vowel, and “open syllable” as one that does not. In this comparison words with /e/ in an open syllable were compared to words with /e/ in a closed syllable. In this particular context, F1 data did not pass normality test; therefore, a non-parametric test was used. A Mann-Whitney test was used to analyze the effect of syllable structure on F1, in open and closed conditions. Results show that the F1 values of /e/ in closed syllables are significantly greater than F1 values of /e/ in open syllables  $U=130723$ , significant at  $p = .0106$ . A two-sample t-test was conducted to analyze the effect of CVC on F2 values. The results for the F2 show that the values of /e/ in a closed syllable are significantly lower than those in open syllables  $t(675) = -3.03$ ,  $p < .05$ .

In this comparison, the words that had /r/ were removed from both groups, that specific variable was studied independently (since it is also generally regarded as a sound that causes /e/ to open). In this particular analysis /e/ does not only move down vertically, but diagonally, as F1 gets higher values and F2 gets lower values when /e/ is in a closed syllable (see Figure 4.1<sup>1</sup>).

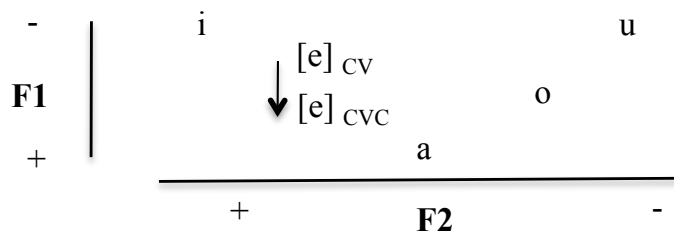


**Figure 4.1.** Position of the allophones in open vs. closed syllables.

<sup>1</sup> The minus (-) and plus (+) signs in these figures do not indicate absolute minus-plus but lower/higher values.

## 4.2 Open syllable vs. Closed syllable (coda /m n s d/)

These consonants, /m n s d/, have been pointed as exceptions to the analysis above (Navarro Tomás 1974, Matluck 1963, Williams 1982); in other words, it has been suggested that these consonants do not trigger the open allophone of /e/. If this is correct, than F1 and F2 of both groups should not be different. In this comparison words with /e/ in an open syllable were compared to words with /e/ in a syllable closed by /m n s d/. A two-sample t-test was conducted to compare the effect of the syllable structure on F1 and F2. For F1, there was a significant effect of syllable structure on F1 values  $t(254) = -3.41, p < .001$  with closed syllables receiving significantly higher values than open syllables. However, there was not a significant effect of this particular syllable structure on F2 values  $t(390) = -.88, p = .381$ .



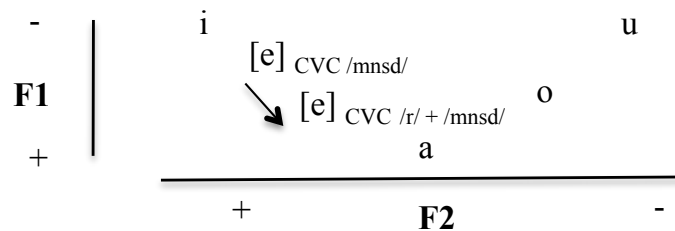
**Figure 4.2.** Position of the allophones in open vs. closed (/m n s d/) syllables.

These results suggest that when /e/ is in a syllable closed by /m n s d/ the allophone is lower, as F1 gets higher values than those of /e/ in open syllables. The F2 values of /e/ in syllables closed by /m n s d/ are not different from the F2 values of /e/ in open syllables, so the allophone is not retracted (see Figure 4.2). In this comparison also, the words that had /r/ were removed from both groups, as that specific variable was studied independently.

## 4.3 Closed syllable (coda /m n s d/) vs. Closed syllable (onset /r/, coda /m n s d/)

The contact of /e/ with /r/ is frequently pointed as resulting on an open /e/ (Perissinotto 1975, Matluck 1963); however, some authors suggest that /r/ loses its /e/ opening “powers” when the coda of

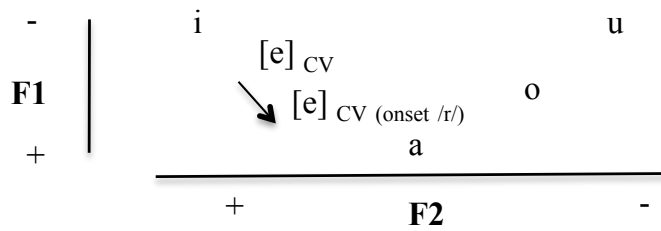
the syllable is /m n s d/ (Navarro Tomás 1974, and Williams 1982). A two-sample t-test was conducted to find which of the previous suggestions is true. For F1 there was a significant effect of /r/ on the formant values  $t(225) = -2.27, p = .024$ . The F1 values for the /e/ allophone that followed /r/ are significantly higher than the values for the /e/ allophone that did not follow /r/. For F2 there was also a significant effect of /r/ on the formant values  $t(228) = 9.34, p < .001$ . The F2 values for the /e/ allophone that followed /r/ were significantly lower than those that did not follow /r/ (see Figure 4.3).



**Figure 4.3.** Position of the allophones in closed syllables vs. closed syllables in contact with /r/.

#### 4.4 Open syllable (onset: not /r/) vs. Open syllable (onset: /r/)

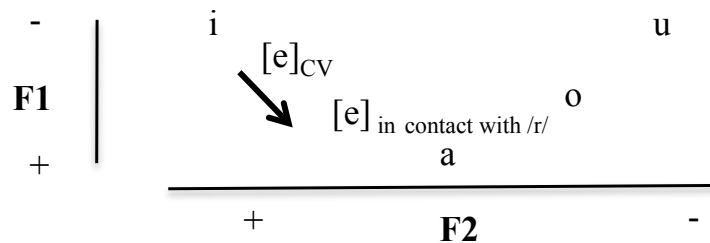
When it occurs in an open syllable, the /e/ allophone is suggested to be regular or closed (Navarro Tomás 1974, and Williams 1982). On the other hand, it is often suggested that /r/ causes the vowel to open. In this analysis, open syllables were contrasted, one group with /r/ and the other one without /r/. A two-sample t-test was conducted to compare the effect of /r/ in open syllables on F1 and F2 values. There was a significant effect of /r/ on F1 values  $t(34) = -2.58, p = .014$ . The F1 values of the /e/ allophone with /r/ in the onset got significantly higher values than those of open syllables that are not in contact with /r/. For F2 there was also a significant effect of /r/ on the formant values  $t(39) = 3.35, p = .002$ . The F2 values of the /e/ allophone with /r/ on the onset got significantly lower values than those of open syllables that are not in contact with /r/ (see Figure 4.4).



**Figure 4.4.** Position of the allophones in open syllables vs. open syllables in contact with /r/

#### 4.5 Open syllables in contact with /r/ (as the onset in CV and CVC, and as onset of a following syllable)

In 4.4, /r/ showed its /e/ opening “powers” against open syllables. In this analysis all the possible syllabic contexts with /r/ are compared between them to find if different positions of /r/ produce different allophones. A one-way ANOVA was conducted to compare the effect of different positions of /r/ on the formant values of /e/. For F1 there was no significant effect of /r/ position on the formant values  $f(2,125) = 1.15, p = .319$ . For F2, as well, there was no significant effect of /r/ position on the formant values  $f(2,121) = 2.26, p = .108$ .

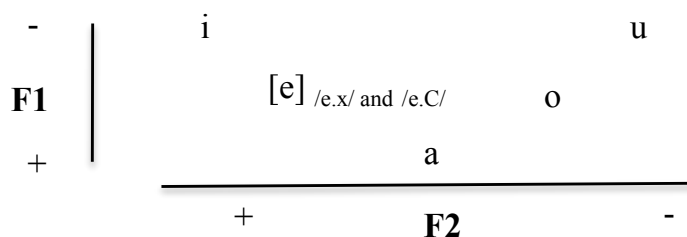


**Figure 4.5.** Position of the allophones in open and closed syllables in contact with /r/.

In this comparison it is shown that the F1 and F2 values when /e/ is in contact with /r/ in the three possible positions are equal (onset in CV, onset in CVC, and onset on a following syllable; in Spanish, /r/ is not a possible coda) (see Figure 4.5). Considering the previous analysis, the allophone of /e/ in contact with /r/ is not only open but also retracted.

#### 4.6 /e/ followed by /x/ as the onset of the following syllable (e.x) vs. /e/ followed by any other C as the onset of the following syllable (e.C)

This particular context has been said to cause the open allophone (Navarro Tomás 1974, Perissinotto 1975, and Williams 1982), but it has also been said to cause a closed, or regular, allophone (Matluck 1963, and Morrison 2004). In this analysis open syllables with /e/ followed by /x/ as the onset of the following syllable were compared to /e/ in an open syllable followed by any other consonant as the onset of the following syllable. The F1 values were compared with a 2-sample t-test and there was no significant effect of /x/ on the formant values  $t(79) = -.93, p = .357$ . Also, there was no significant effect of /x/ on F2  $t(81) = 1.64, p = .104$ .



**Figure 4.6.** Position of the allophones in /e.x/ and /e.C/ syllables.

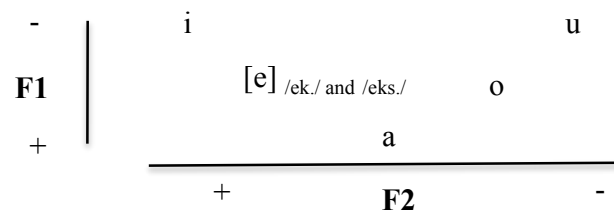
This analysis shows that the allophone of /e/ followed by /x/ (as part of a following syllable) is neither lower nor retracted (see Figure 4.6). /x/ was not tested in coda position since it is not a common



coda in Spanish; actually, <reloj> is the only word in which /x/ appears in coda position (Hammond 2001).

#### 4.7 /e/ in /ek./ vs. /e/ in /eks./

Williams (1982) suggested that when /k/ is the only consonant in coda position the open allophone of /e/ was produced, and not so when the coda was /ks/. Until now, all the closed syllables tested had single codas. In this contrast two closed syllables are compared, one with a single coda and one with a double coda. A two-sample t-test was conducted to compare the effect of /ks/ on the formant values of /e/. For F1 there was no significant effect of the double consonant coda on the formant values  $t(81) = .36, p = .717$ . For F2 also, there was no effect of the double consonant coda on the formant values either  $t(80) = -.73, p = .467$ .



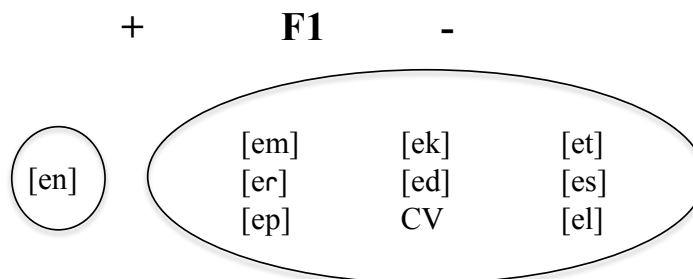
**Figure 4.7.** Position of the allophones in /ek./ and /eks./ syllables.

These results suggest that /k/ and /ks/ do not trigger different allophones of /e/ (see Figure 4.7).

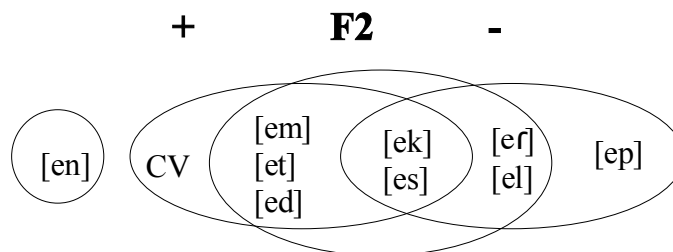
#### 4.8 /e/ in CV vs. /e/ in CVC (codas: /m n s d p t k r l/)

In the previous analyses the different contexts proposed in the literature were tested. In this analysis, the F1 and F2 values of /e/ are compared between the different groups (all the possible codas and CV). A one-way ANOVA was conducted to compare the effect of different codas on F1 and F2. There was a significant effect of the codas on both formants' values. For the F1  $f(9, 661) = 19.58, p <$

.001; and for F2  $f(9,668) = 10.36, p < .001$ . Post hoc comparisons using the Tukey HSD test indicated that for F1 /en/  $M = 668, SD = 154.13$  was significantly different to the rest of the conditions (see Figure 4.8 a). For F1, the rest of the conditions were not different. The results of the post hoc comparison of F2 also indicated that /en/  $M = 2278.8, SD = 136.3$  was significantly different from the rest of the conditions. However, for F2, the rest of the conditions were not all equal (see Figure 4.8 b).



**Figure 4.8 a.** F1 Tukey HSD results, the elements in one circle are significantly different to the elements in the other circle. The higher values on the left show the “lowest” allophone.



**Figure 4.8 b.** F2 Tukey HSD results, the elements in one circle are significantly different to the elements that are not in the same circle.

The higher values on the left show the least retracted allophones. As Figure 4.8 a and b show, F1 and F2 get affected by different phonetic contexts. These results suggest that /en/ is the only context in which the allophone of /e/ is significantly lower than the allophone in an open syllable. On the other hand, three different contexts /el/, /ep/, and /er/ produce an allophone of /e/ that is significantly more

retracted than the allophone in an open syllable. Also, the phonetic context /en/ produces a more advanced allophone than the allophone in an open syllable. Table 4.8 shows the description of the allophones with respect to /e/ in CV. The description only differs from CV if one of the means of a formant is significantly different from the formant in a CV syllable ( $p < .05$ ).

**Table 4.8** *Allophones in different syllabic contexts*

Syllabic context	Mean F1	Mean F2	Allophone description Mean difference to CV $p < .05$
CV	532	2139	mid front
/en/	668*	2278 *	lower advanced
/em/	558	2145	mid front
/er/	549	2043 *	mid retracted
/ep/	546	1989 *	mid retracted
/ek/	542	2054	mid front
/ed/	534	2127	mid front
/et/	531	2133	mid front
/es/	520	2066	mid front
/el/	516	2044*	mid retracted

**Note:** The \* indicates that the mean of that formant in that particular context is significantly different from the CV mean.

## **Chapter 5: Discussion and Conclusion**

### **5.0 Introduction**

The main purpose of this paper was to clarify current literature inconsistencies about the allophones of the Spanish mid front vowel. Speech production from ten native Spanish monolinguals was measured using speech analysis software. The results show that the allophones of /e/ are lower/open in two specific contexts: when followed by /n/ and when in contact with /r/. The results also show that the allophones of /e/ can also be more advanced or retracted than the “regular” mid front allophone when followed by /n/ (advanced), or by / p l r / (retracted).

### **5.1 Previous research and current findings**

In total, eight different contexts were tested to compare previous findings to the findings of this study. The findings for each section (4.1 – 4.8) will be summarized independently as some of the contexts are unrelated.

#### **5.1.1 Open syllable vs. closed syllable (any coda)**

In 4.1 all the tokens of /e/ in an open syllable were compared to all the tokens of /e/ in a closed syllable. In previous research, Perissinotto (1975) claimed that the allophone in a CV syllable was the “regular” mid allophone, and that the allophone in CVC syllable was the closed one. Likewise, Lipski (1987) suggested that the allophone of /e/ in CVC is an open one, but he did not provide a description for the allophone in CV. It should be noted that neither of them talk about the horizontal axis; that is, they did not talk about any change in vowel advancement (see table 2.2).

The first analysis showed agreement with the two authors that discussed these two contexts. In addition, the allophone was noted to be not only open but also retracted. However, when the data was

analyzed further (see section 4.8), it was found that from all the contexts included in CVC only one particular context, /en/, produced a lower allophone than the one in CV. Regarding the horizontal axis, the results of the first analysis suggest that the allophone in CVC is more retracted than the allophone in CV. Here too, further analysis showed that these results are specific to only a few contexts: /el/, /ep/, and /er/.

Taken together, the results of CV vs. CVC suggest that the context CVC should not be generalized as one that produces an open allophone. Furthermore, there is no relation between the x-axis and the y-axis since the allophone is not consistently affected on both axes by the same context(s).

### **5.1.2 Open syllable vs. Closed syllable (coda /m n s d/)**

Researchers have pointed that the allophone produced by a closed syllable is lower than the allophone produced in an open syllable as long as the coda in the closed syllable is not any of these: /m n s d/. Navarro Tomas (1974), Williams (1982), and Matluck (1963) suggested that the allophone produced when /e/ is in CV or in CVC (when the coda is /m n s d/) should be the same (not open). These authors did not discuss horizontal effects of the contexts.

The results of the first analysis (section 4.2) show that the allophone produced when /e/ is in CVC (coda: /m n s d/) is lower than the one produced in CV. There was no effect of these contexts on the horizontal axis. This result makes sense since the context /en/ is part of the analysis. Again, the results in 4.8 showed the effects of /en/ on the height of the vowel. Therefore, /en/ was responsible for getting a lower allophone in 4.2.

Regarding the vertical axis, the allophone of /e/ in CV is equal to the allophone in /em/, /es/, and /ed/; and it is only different from /en/. On the other hand, this analysis shows that a syllable closed by /m n s d/ has no effect on /e/ advancement when compared to an open syllable.

### **5.1.3 Closed syllable (onset: not /r/, coda /m n s d/) vs. Closed syllable (onset /r/, coda /m n s d/)**

In this analysis a new variable is introduced: the trill /r/. This new variable is one that all authors discussed in their research. Perissinotto (1975), Matluck (1963), Lipski (1987), and Morrison (2004) suggest that the allophone of /e/ in a syllable that has /r/ in the onset will always be open (no matter the coda). On the other hand, Navarro Tomás (1974), and Williams (1982), pointed that the allophone of /e/ of a syllable that has /r/ in the onset and is closed by /m n s d/ would not be open as the “closing effect” of those consonants is stronger than the “opening effect” of /r/.

Contrary to Navarro Tomás (1974) and Williams (1982) claims, the present analysis showed that the opening effect of /r/ was greater than the closing effect of /m n s d/. The allophone of /e/ in a syllable that had /r/ as onset and was closed by /m n s d/ was lower and more retracted compared to the allophone in a syllable that did not have /r/. This could not be a result of /en/ (as in the previous section) since /en/ has no effect on the horizontal axis. The analysis of the effects of /r/ in other contexts continues in the two following sections.

#### **5.1.4 Open syllable (onset: not /r/) vs. Open syllable (onset: /r/)**

In this analysis a syllable with /r/ in the onset was compared to one that had any other consonant in the onset, which is the control syllable. The results of this analysis show that the allophone of /e/ in an open syllable that has /r/ in the onset is lower and more retracted than an open syllable without /r/.

#### **5.1.5 /e/ in contact with /r/ (as the onset in CV and CVC, and as onset of a following syllable)**

In this last analysis of /r/, syllables with /r/ in all possible positions were compared to those without /r/. This was done to investigate if /r/ in any position equally affected /e/. Perissinotto (1975), Matluck (1963), Lipski (1987), and Morrison (2004) suggested that the allophone of /e/ should be open when in contact with /r/. Three different syllables were compared, /r/ as onset of an open syllable, /r/ as onset of a closed syllable, and /r/ as onset of a following syllable.

The results of the analysis show that the allophones produced by the three different contexts are equal. That is, the position of /r/ does not affect the quality of /e/. With this final analysis of /e/ in contact with /r/ it is clearer that the opening effect of /r/ is much greater than any “closing” effect of other variables. In addition, the results consistently show that /e/ in contact with /r/ produces an allophone that is not only open but also more retracted.

#### **5.1.6 /e/ followed by /x/ as the onset of the following syllable (/e.x/) vs. /e/ followed by any other consonant as the onset of the following syllable (/e.C/)**

Previous research by Navarro Tomas (1974), Perissinotto (1975), and Williams (1982) suggested that the allophone of /e/ when followed by /x/, as part of a following syllable, is open. However, Matluck (1963), and Morrison (2004) pointed that the allophone produced in that same context is not open.

The results of this analysis confirm Matluck (1963), and Morrison’s (2004) statement. When /e/ is followed by /x/ (as part of a following syllable) the allophone produced is not different from an allophone produced when /e/ is followed by any other consonant (also as part of a following syllable).

#### **5.1.7 /e/ in /ek./ vs. /e/ in /eks./**

This is the only comparison in which a double consonant coda was included. Williams (1982) suggested that the allophone produced in the syllable /ek./ was different from the one produced by the syllable /eks./. According to her, the allophone produced in the syllable with the single coda is open and the allophone produced in the syllable with /ks./ as coda was not open.

Contrary to Williams’ (1982) claims, the results of this analysis showed that the allophone produced by the two different contexts are not different. In 4.8 /ek/ was also part of the analysis. The result of comparing /ek/ to CV indicated that the allophone produced in this particular context was not different from the allophone of /e/ produced in CV.

### 5.1.8 /e/ in CV vs. /e/ in CVC (codas: /m n s d p t k r l/)

In the contexts proposed by other authors in Chapter 2 the effect of some codas on /e/ was not mentioned. In order to provide a more complete analysis of the contexts that affect /e/, a contrast of all the codas was made. In this analysis, /e/ with all the possible codas and CV were compared. The results show that the effect of the different codas over /e/ was not the same. Different contexts had different effects on /e/ height and advancement. From the allophones produced by the different contexts, only one of them was different in height from the rest: /en/. Interestingly, the allophone of /en/ was not only lower but it was also more advanced. This finding contradicts Morrison (2004) suggestion of categorizing allophones of /e/ as “open-retracted”. Aside from /en/, the height of the allophones for all the other contexts was not different from the height of the CV allophone. Similarly, /e/ advancement was not affected in all the allophones in the different contexts. Aside from the allophone of /en/ (that was more advanced) the other three allophones affected were /el/, /ep/, and /er/. These last allophones were different from the allophone produced in CV as they were all retracted. The fact that these three allophones were retracted but not open, also goes against Morrison’s (2004) suggestion of classifying /e/ allophones as open-retracted.

The allophones of /e/ produced by the contexts not mentioned in the previous paragraph did not vary in advancement or height from the allophone of /e/ in CV. The allophones that were not affected by the syllabic contexts: /em/, /ek/, /ed/, /et/, and /es/.

It is possible that the significant effects of some of the syllabic contexts are not perceptually different from those effects that were not significant. For example, the /e/ variant found in /en/ might not be triggered by the context /n/ but by noise in the signal. This could be further tested with a perception test. A person (that is not a trained phonetician) might or might not be able to note a difference between the /e/ variations found in this study.



## **5.2 Conclusion**

It has been suggested that the allophones of /e/ should be classified as open-retracted (Morrison 2004). The position of some of the allophones found in this study was not different from the “regular” mid-front allophone produced in an open syllable (/em/, /ek/, /ed/, /et/, and /es/). However, /e/ was affected in either its height or its advancement when followed by (/n/, /p/, /l/, and /r/). The variation of the allophones’ position in a single axis suggests that vowel height is independent from vowel advancement. On the other hand, when /e/ was in contact with /r/ both axes got affected; therefore, this particular allophone can be classified as open-retracted.

Quilis (1993) and Morrison (2004) suggested that the allophonic variation of /e/ is in free variation. However, the findings of this study suggest that the allophones of /e/ are in complementary distribution. This is compatible with the claims made by Navarro Tomás (1974), Williams (1982), and Perissinotto (1975). The findings of this study suggest that the allophone distribution is: the open allophone occurs in /en/, the open-retracted allophone occurs when /e/ is contact with /r/, and the retracted allophone occurs in /ep/, /el/, /er/.

## **5.3 Limitations of the present study**

During the process of completing this study some problems were encountered. One limitation was finding Spanish monolingual participants. The El Paso area is highly bilingual so recruiting was limited to beginner English classes for non-natives. When the recruiting took place there was only one beginner’s class being offered at UTEP. About 10 female students were registered, some of which did not speak Mexican (Chihuahua) Spanish so they could not be included. In the future, it would be interesting to investigate if the results obtained with monolinguals can be generalized to bilingual population such as the population of the El Paso area.

This study focuses on the effects of linguistic environments on vowel opening; therefore, social factors were not analyzed. In the future it would be interesting to find out if social factors do have an effect on the opening of /e/.

#### **5.4 Future directions of the present study**

The findings of this study make it possible to advance in the knowledge of related topics. One interesting topic to investigate is the possible different pronunciation of /e/ between Spanish monolinguals and Spanish-English/English-Spanish bilinguals (because of the existence of a lower- and lax- mid front vowel in English /ɛ/). The results of this study serve as a baseline to which bilinguals can be compared.

It would also be interesting to analyze whether social variables such as age, and socioeconomic status also have an effect on the variation of /e/. This would allow us to test whether the variation observed in this study is only related to phonetic contexts or whether it is also socially conditioned.

Further work on the present study includes converting data to a unit of perception, such as “Mel”. In this study, vowel formants were measured and compared in Hertz, however, Hertz do not show if significant differences can be perceived or not. Analyzing data with a Mel or Bark would provide further information about the perception of allophones of /e/.

More possible further research should be done with regards to /r/ in word final position. During the testing phase of this study it was noticed that the realization of /r/ in word final position is variable in Chihuahua Spanish. Three different allophones were perceived: flap [ɾ], trill [r], and assibilated flap [r̺]. Further acoustic study should be performed to test whether this is so. It would also be interesting to assess the effects of different allophones of /r/, particularly the trill, on /e/ allophones.

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# Appendix 1

## Cuestionario lingüístico

Código del participante: \_\_\_\_\_

\*\*\*\*\*

### Sección A: Información personal, educación y uso del lenguaje

- Sexo: ☐ Masculino ☐ Femenino
- Edad: \_\_\_\_\_
- País de nacimiento: \_\_\_\_\_  
Si no nació en US, ¿a qué edad llegó al país? \_\_\_\_\_ ¿Cuánto tiempo lleva aquí? \_\_\_\_\_
- Ocupación: \_\_\_\_\_
- Nivel de escolaridad más alto: ☐ Secundario ☐ Técnica/Profesional ☐ Universitaria
- ¿Cuál es su lengua primaria? \_\_\_\_\_
- ¿Cuál es la lengua nativa de sus padres? ☐ Español ☐ Inglés ☐ Otro (especifique) \_\_\_\_\_
- ¿Aprendió su lengua nativa desde la infancia? ☐ Sí ☐ No
- ¿Qué lengua(s) hablaba en la casa cuando niño? \_\_\_\_\_
- ¿En qué lengua se siente más cómodo en estos momentos? Español Inglés Ambas
- ¿En qué lengua(s) se educó formalmente? Y ¿dónde? (i.e. país)  
Escuela primaria o elemental \_\_\_\_\_  
Enseñanza media (preuniversitario) \_\_\_\_\_  
Instituto técnico profesional (college) \_\_\_\_\_  
Universidad \_\_\_\_\_

- Contacto actual con el español y el Inglés (por favor circule)

En la escuela:

Inglés solamente	Mayormente en Inglés	Un poco más en Inglés	Igual en los dos	Un poco más en español	Mayormente en español	Español solamente

En la casa:

Inglés solamente	Mayormente en Inglés	Un poco más en Inglés	Igual en los dos	Un poco más en español	Mayormente en español	Español solamente

En el trabajo:

Inglés solamente	Mayormente en Inglés	Un poco más en Inglés	Igual en los dos	Un poco más en español	Mayormente en español	Español solamente

En situaciones sociales:

Inglés solamente	Mayormente en Inglés	Un poco más en Inglés	Igual en los dos	Un poco más en español	Mayormente en español	Español solamente

- ¿Ha tomado cursos de español en la Universidad?

YES NO

Si ha tomado:

- ¿Cuántas horas ha tenido hasta ahora? \_\_\_\_\_
- ¿Cuántas horas de instrucción tiene en estos momentos por semana? \_\_\_\_\_

- ¿Cuán frecuente habla español por teléfono?

Muy frecuente Frecuentemente No Mucho Raramente Nunca

- ¿Cuán frecuente ve la televisión en español?

Muy frecuente Frecuentemente No Mucho Raramente Nunca

- ¿Cuán frecuente lee en español? (material impreso y en la computadora)

Muy frecuente Frecuentemente No Mucho Raramente Nunca

- ¿Cuánto chatea en español?

Muy frecuente Frecuentemente No Mucho Raramente Nunca

- ¿Con quién y cuán frecuente habla español?

	Muy frecuente	Frecuentemente	No Mucho	Raramente
En casa: _____	_____	_____	_____	_____
En la escuela: _____	_____	_____	_____	_____
Trabajo: _____	_____	_____	_____	_____
Situaciones sociales: _____	_____	_____	_____	_____
Por teléfono: _____	_____	_____	_____	_____
Por la computadora (e.g., Skype): _____	_____	_____	_____	_____

- Por favor diga en cada año cuántas veces visitó un país de habla hispana y el nivel de exposición a las dos lenguas.

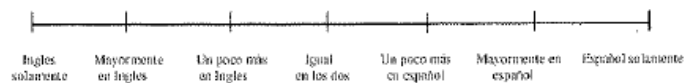
1) Year: \_\_\_\_\_ Estancia acumulativa: \_\_\_\_\_ meses \_\_\_\_\_ semanas \_\_\_\_\_ días

Nivel de exposición a las dos lenguas durante la visita

Inglés solamente Mayormente en Inglés Un poco más en inglés Igual en las dos Un poco más en español Mayormente en español Español solamente

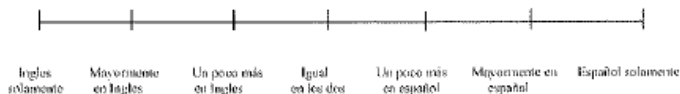
2) Year: \_\_\_\_\_ Estancia acumulativa: \_\_\_\_\_ meses \_\_\_\_\_ semanas \_\_\_\_\_ días

Nivel de exposición a las dos lenguas durante la visita



2) Year: \_\_\_\_\_ Estancia acumulativa: \_\_\_\_\_ meses \_\_\_\_\_ semanas \_\_\_\_\_ días

Nivel de exposición a las dos lenguas durante la visita



Por favor añada cualquier otra información que Ud piense es importante relacionada con el uso del español o el ingles.

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### Sección B: Nivel idiomático

- Por favor evalúe su nivel idiomático en cada una de las lenguas que habla dentro de las áreas siguientes

	Básico	Adecuado/No muy mal	Bueno/Fluido	Excelente	Nativo
<b>LECTURA</b>					
Español					
Ingles					
Otro (        )					
<b>ESCRITURA</b>					
Español					
Ingles					
Otro (        )					
<b>EXPRESION ORAL</b>					
Español					
Ingles					
Otro (        )					
<b>COMPRESION</b>					
Español					
Ingles					
Otro (        )					

**¡Gracias!**

## Appendix 2

aleja	es hembra	red
arresta	esté	renta
ayer	estén	resta
cebra	estés	reza
ceja	hallé	sé
celta	horrendo	seca
cerca	insecto	secta
cero	menta	sed
cerro	meta	sesta
chalet	pare	sexta
clavé	pared	temo
clavel	pena	tempo
concepo	pepo	unisex
concepto	pepto	zeta
es etnia	pesa	



## **Vita**

Raquel González de Anda was born in Ciudad Juarez, Mexico. After completing her high-school work in Preparatoria El Chamizal, she went to the University of Texas at El Paso. During her bachelors she worked as a coordinator of the Linguistics research laboratory. She received her Bachelors of Arts in Linguistics with a minor in Psychology. For her graduation she was named outstanding graduating senior in Linguistics. Afterwards, she entered graduate school, also at UTEP. During her masters she worked as tutor, and as a teaching and research assistant for the department of Languages and Linguistics. During this time she was also treasurer of a non-profitable student organization. She received her Master of Arts degree in Linguistics with a concentration in Hispanic Linguistics. For her graduation she was named Liberal Arts graduate student marshal and outstanding graduate student in Linguistics.

This thesis was typed by Raquel González de Anda