**The Dissertation Committee for Brandon Orrin Baird certifies that this is the approved version of the following dissertation:**

# An Acoustic Analysis of Contrastive Focus Marking in Spanish-K'ichee' (Mayan) Bilingual Intonation

**Committee:**

Almeida Jacqueline Toribio, Supervisor

Barbara E. Bullock

Nora C. England

Sergio Romero

Rajka Smiljanić

# An Acoustic Analysis of Contrastive Focus Marking in Spanish-K'ichee' (Mayan) Bilingual Intonation

**by**

**Brandon Orrin Baird, B.A.; M.A.**

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## Dedication

Chkee le mayiib’ taq winaq,

xuquje’ le je'lalaj wixoqil:

maltyox cheech alaq onojel alaq.

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# An Acoustic Analysis of Contrastive Focus Marking in Spanish-K'ichee' (Mayan) Bilingual Intonation

Brandon Orrin Baird, Ph.D.

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Supervisor: Almeida Jacqueline Toribio

Natural language enables speakers to organize and highlight the information they want to convey. The linguistic analysis of this organization, known as Information Structure (Lambrecht, 1994), investigates the different strategies used in various languages to mark important information, such as focus constituents, within larger utterances. Research on K'ichee' has predominantly documented the syntactic strategies used to mark constituents for focus and has yet to analyze the role of intonation (Can Pixabaj & England, 2011). While the use of intonation in focus marking in different varieties of Spanish has received more attention than in K'ichee', the consideration of its role within bilingual contexts is under documented (O'Rourke, 2005; Simonet, 2008).

This dissertation addresses these gaps in the literature by analyzing the intonational contours associated with contrastive focus constituents in both languages of Spanish-K'ichee' bilinguals and comparing these contours cross-linguistically. These analyses investigate different suprasegmental features of contrastive focus within different syntactic structures and their correlation with the individual level of language dominance of each bilingual. This study provides evidence that these bilinguals prosodically mark contrastive focus in both languages in similar ways. The first significant finding is that an earlier alignment of the intonational events, and not a greater

pitch span, is the most consistently used strategy in both languages. Additionally, while a greater pitch span is not consistently used to mark contrastive focus, it is the only suprasegmental feature that is correlated with bilingual language dominance in both Spanish and K'ichee'. Finally, while some dialect-specific phonological features provide evidence of transfer between the two languages, the features that are the most similar in both languages and possibly the most prone to convergence are the same that are consistently used to mark contrastive focus, i.e., the alignment of intonational events.

The present study contributes to the ongoing analyses of Information Structure, intonation, and bilingualism, and it is proposed that frameworks such as the Autosegmental-Metrical model of intonation (Pierrehumbert, 1980), Accomodation Theory (Giles & Powesland, 1975), and the Effort Code (Gussenhoven, 2004) can be extended to these findings on the role of the location of intonational events in both prosodic contrastive focus marking and convergence of intonational systems of bilinguals.

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# 1. Introduction

All languages have intonation: every utterance that is said, from a single sound to a large phrase, is produced with a distinct melodic contour. Intonation itself is a suprasegmental characteristic of language that pertains to features of speech above the levels of individual vowels and consonants. Changes to these melodic contours, or prosody, may be associated with certain grammatical and/or pragmatic meanings. Different locations and shapes of pitch accents may be used to signal changes within Information Structure (Lambrecht, 1994, 2001; Gussenhoven, 2004; O'Rourke, 2012a; Smiljanić, 2004); intonation can mark given and new information (Halliday, 1967) or mark the difference between foregrounded and backgrounded information (Bolinger, 1989). Numerous authors have claimed that intonation plays a critical role in helping listeners figure out 'what is going on' in a given speech context because it can provide some of the strongest grammatical and extragrammatical cues (Gumperz, 1982, 1992; Queen, 2001; Sperber & Wilson, 1986/1995). Languages that utilize pitch contours for such pragmatic purposes are known as 'intonational languages' and include English and Spanish, among others (Gussenhoven, 2004; Hualde, 2005; Prieto et al, 1995).

Acoustic analyses of intonational systems are relatively new in the field of phonetics and phonology and in recent decades these studies have seen an increase thanks in part to seminal works such as Pierrehumbert (1980) and Ladd (1996). From an acoustic perspective, the rate of vocal fold vibration produced by a speaker is perceived as pitch and may be higher or lower at different points in an utterance. The fundamental frequency, or $F_0$, is the basic repetition of this sound wave and one full repetition of a wave pattern is measured repeatedly in time as cycles per second, or Hertz (Hz). Studies on intonation have shown that fundamental frequency measured from the acoustic signal is a relevant and reliable physical correlate of pitch and that, phonologically, pitch accents tend to be anchored in tonic, i.e. stressed, syllables (Bruce, 1977; Gussenhoven, 2004; Hualde, 2005; Ladd, 1996; Pierrehumbert, 1980; Smiljanić, 2004). Within the Autosegmental-Metrical (AM) model (Pierrehumbert, 1980), $F_0$ contours are analyzed as smaller units of tones, such as High (H) tones and Low (L) tones, that are used to indicate the location of important intonational events, e.g., a rise or fall in pitch, relative to tonic syllables, utterance boundaries, etc., within an utterance. In different languages, different tonal accents and changes in the location of these accents can convey different pragmatic meanings, resulting in language-specific ToBI (Tones and Break Indices) models of analysis (Estebas & Prieto, 2008; Prieto & Roseano, 2010; Smiljanić, 2004; among others).

Even more recent are analyses of intonation in language contact situations and among bilinguals, an area described by Thomas as a fertile field for research (2011:215). Although few in number, McMahon (2004) notes that such studies demonstrate the importance of tracking changes in intonation in situations of language contact as well as in non-contact situations. Queen (2001) suggests that this overall lack of literature is due to methodological differences between intonational and sociolinguistic studies; studies on intonational phenomena are usually conducted in experimental, laboratory settings, where fine-grained acoustic analyses can be carried out due to the controlled manner of the data, while most studies of language contact and bilingualism rely on observational data from spontaneous speech that often attend to the social aspects of language that could be considered ‘uncontrolled’. Lab speech is vital to understanding intonation because there are so many interweaving factors in spontaneous speech that can affect the intonation of an utterance, that it can be impossible to determine what factor causes a particular intonational phenomenon. As Face (2003) states, "[b]y creating carefully constructed experiments to elicit lab speech, the researcher can control the many variables and determine how each affects the intonation pattern" (2003:116). However, he cautions that it cannot be assumed that the intonational patterns produced in lab speech are an accurate representation of the intonational patterns of naturalistic data produced in spontaneous speech and that both lab speech and naturalistic data are essential to fully understanding intonational systems.

The study of the intonational patterns of Spanish-K'ichee' bilinguals provides an opportunity to add to the literature of intonation in an understudied context. While Spanish and K'ichee' are quite different, one Indo-European and the other Mayan, these two languages have been in contact in Guatemala since the 16$^{th}$ century and, while both languages have received considerable attention from linguists, there are relatively few accounts of this contact situation and the bilinguals that are involved in it; there are even fewer studies of the acoustic consequences thereof. The languages themselves have been reasonably-well documented in terms of Information Structure, particularly in how they mark focus. However, the analyses of focus marking in K'ichee' have largely been syntactic and focus marking in Guatemalan Spanish has been ignored in favor of other varieties of Spanish. Thus, while both have been classified as 'intonational languages' (Baird, 2010; Hualde, 2005; Nielsen, 2005), little is known about the role of intonation in focus marking in K'ichee', Guatemalan Spanish, or among bilinguals of the two languages.

This dissertation examines the production of prosodic contrastive focus marking among Spanish-K'ichee' bilinguals. Specifically, this study seeks to acoustically analyze the intonational contours of bilinguals from two different Guatemalan communities in view of variables such as syntactic structure and bilingual language dominance in both spontaneous and lab speech. In other words, this project explores the effects of several linguistic and extralinguistic factors in order to determine if and how the bilinguals give any prosodic emphasis to a contrastive focus constituent in either language and if these intonational contours are prone to phonetic transfer or convergence. In the examining of these bilingual speech productions, the dissertation addresses the following goals: (i) a description of contrastive focus in K'ichee' among the population studied- is it marked via prosodic means along with the canonical syntactic movement described in the literature? (ii) a description of contrastive focus in Spanish among the population studied- is it similar to other documented varieties of Spanish? and (iii), an exploration of the individual factors implicated in broad and contrastive focus patterns- does language dominance affect the production of these intonational contours?

The remainder of this chapter reviews the literature on intonation in language contact and bilingual contexts and on the available theoretical models that address different aspects of focus marking. This is followed by an outline of the organization of this dissertation.

### 1.1. LANGUAGE CONTACT AND BILINGUALISM

Speech Accommodation Theory (Giles & Powesland, 1975) describes the various ways in which a person will modify his or her manner of speaking in response to contextual cues. Giles & Powesland noted that when two people are talking, they will often modify their speech so as to sound more, or alternatively less, like each other. These observations led Giles & Powesland to propose two opposing strategies: convergence and divergence. Convergence is a linguistic strategy in which a speaker modifies his or her style of speech to be more like that of the interlocutor; divergence, on the other hand, would be when a speaker modifies his or her style of speech to be less like the interlocutor (Thakerar et al., 1982:207). These strategies can be accomplished in a variety of ways, including language choice, pronunciation, vocabulary selection and speech rate (Hurley, 1995). While Giles & Powesland originally conceived the idea of language convergence as a temporary shift in language use by an individual speaker in a particular speech exchange, others have applied the idea of convergence to the more permanent changes in situations of language contact and bilingualism (Bullock & Toribio, 2004; Silva-Corvalán, 1990; among others). Such linguistic convergence can occur in the areas of phonology, morphology, semantics and/or syntax. Silva-Corvalán (1990:164) describes convergence as "the achievement of the structural similarity in a given aspect …of two or more languages." Language convergence in bilinguals would therefore be any process in which the languages of an individual or group become similar to each other in any of the aforementioned ways.

Convergence has often been associated with language attrition, the loss of language or process thereof. Several researchers in bilingualism have stated that in cases involving language attrition, convergence is frequently adduced as a mechanism of change, where a dominant language eventually exerts an influence on and provokes a change in the structure of a contracting language (see for example, Myers-Scotton, 2002). Within the field of Second Language Acquisition, the influence of the L1 on the L2 has been well documented (see Flege, 1995; for a review) and recent studies have shown that even early bilinguals tend to transfer the phonetic features of their dominant language to their non-dominant language, even with early and extensive exposure to native input (Bullock, 2009; Simonet, 2010).

Bullock & Toribio (2004:91) see convergence among bilinguals as "the enhancement of inherent structural similarities found between two linguistic systems… Here, the direction of influence between the languages is irrelevant; it may be mutual or unidirectional." In addition, they suggest that external influence does not necessarily induce convergence, but targets an area of grammar that is inherently unstable, accelerating the outcome of a change that is already in progress. Bullock & Gerfen (2004:96) argue that the term convergence "is best reserved for cases in which both languages change to become structurally more like one another; that is, in which there is a mutual influence between the languages." They contend that convergence in bilinguals is more profitably seen in the collapsing of differences in areas of the linguistic systems where the two languages already had similar features; meaning that a bilingual's two languages become uniform with respect to a property that was initially merely similar.

### 1.1.1. Bilingual language dominance

An important variable in phonetic production and perception among bilinguals is language dominance (Amengual, 2013; Baird, submitted; Simonet, 2008, 2011). Unfortunately, a common practice that arises when studying bilingual populations is the conflation of different kinds of bilinguals into a single participant group (Grosjean, 1998). However, as Amengual (2013:5) notes, "[b]ilingual speakers form a heterogeneous group due to multiple factors such as age of acquisition, daily language use and language environment, and their performance in each language likewise varies." The bilingual speaker has the ability to communicate in either language for a variety of purposes and contexts, but because the uses and needs of each of the languages are usually different, a bilingual is "rarely equally or completely fluent in both languages" (Grosjean, 1998:14). However, while the patterns of language use by a bilingual are likely to be associated with greater fluency, proficiency, and dominance, it should be noted that language dominance and language proficiency are not the same (Birdsong, 2006). Even simultaneous bilinguals, who continue to use both languages frequently, often have a preferred or dominant language that may influence their speech processing outcomes (Cutler et al., 1992). Though there exist multiple ways to evaluate it, we would expect bilinguals of different profiles to present different contact outcomes.

### 1.2. Intonation in contact

Bullock (2009:4) states that "prosodic changes have long been noted to occur in contact situations of all types, both contemporary and diachronic. Changes can impact any domain of suprasegmental phonology." Many linguists consider intonation to be the most susceptible aspect of cross-linguistic influence; Urban & Sherzer (1988:300) claim that prosodic features such as intonation are "the most readily diffusible form of influence from native languages" and Mackey (2000:48) notes that, of all phonological features, "intonation is often the most persistent in interference and the most subtle in influence."

Many descriptions of varieties of Latin American Spanish have included impressionistic claims that intonational features of indigenous languages have been borrowed into the local variety of Spanish. For example, the intonation of the Spanish of central Mexico has been attributed to Náhuatl origins: "The intonation, in the general population, is identical to that employed while speaking Náhuatl…The final cadence of a declarative phrase is characteristically very different from the usual cadence of Castile [Spanish]" (Henríquez Ureña, 1938:335).[1] In Chilean Spanish, Alonso (1940), who

[1] Author's translation, original: "La entonación, en las clases populares, es idéntica a la que se emplea al hablar náhuatl…Es característica la cadencia final de la frase enunciativa, muy distinta de la cadencia usual en Castilla" (Henríquez Ureña, 1938:335).

almost categorically refuted previous claims of Araucan influence in Spanish, still offered intonation as a viable point of possible convergence: "one must not discard the probability that Araucan, as a substratum or an adstratum, has left some trace in Chilean Spanish, above all in the melodies and in the plays of rhythm" (1940:289).[2] Finally, in the Yucatan Peninsula, contact with the Mayan language Yukateko has also been claimed to have resulted in intonational borrowing into Spanish: Barrera Vásquez (1945/1977:341) states that "what first draws the foreigner's attention while listening to Yucatan Spanish for the first time is the accent. That is where the Mayan influence is present in its most consistent form."[3] Mediz Bolio (1951:19) adds that "the Yucatan accent, so profoundly marked, is nothing more than a consequence of the original Mayan accent;"[4] and that this influence from Yukateko has also permeated the monolingual Spanish-speaking population: "even for a Yucatecan who cannot speak a word of Mayan, the intonation of his Spanish, as pure as it might be, has an inflexion and a style absolutely Mayan".[5]

### 1.2.1. Recent studies of bilingual intonation and intonation in contact contexts

According to Colantoni (2011), two constants emerge from recent acoustic studies of intonation in contact. First, bilingual speakers tend to associate patterns existing in each of their languages with different pragmatic meanings (Colantoni & Gurlekian 2004;

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[2] Author's translation, original: "No hay que descartar la probabilidad de que el araucano, ya como sustrato, ya como adstrato, haya dejado huella en el chileno, sobre todo en las melodías y en los juegos rítmicos" (Alonso, 1940:289).

[3] Author's translation, original: "Lo que primero llama la atención al extraño que por vez oye el español yucateco, es su acento. Es allí donde está presente la influencia maya en su forma más crónica" (Barrera Vásquez, 1945/1977:341).

[4] Author's translation, original: "El acento yucateco, tan profundamente señalado, no es sino una consecuencia del acento maya original" (Mediz Bolio, 1951:19).

[5] Author's translation, original: "Por más que un yucateco no sepa pronunciar una sola palabra del idioma nativo (Maya), la entonación de su castellano, por castizo que sea, es de una inflexión y un estilo absolutamente maya" (Mediz Bolio, 1951:19).

Queen, 2001). Second, contact may result in convergence of both languages, as in the Spanish-Catalan bilinguals studied by Simonet (2008, 2011), or in the transfer of features of one language the other, as in Nigerian English (Gut, 2005).

#### *1.2.1.1. Peak alignment in Spanish*

Recent work on intonation in Spanish has focused on the alignment of the pitch peak in declaratives. While pitch begins to rise in a tonic syllable of a content word in Spanish, the pitch peak often does not occur until a post-tonic syllable in a declarative utterance, a so-called 'late' or 'delayed' peak, that is labeled as L+>H* in Span_ToBI, as seen in Figure 1.1a (Estebas & Prieto, 2008). In view of these facts, Hualde (2005) states that stressed syllables function as anchoring points for intonational events in Spanish. In the case of the final stressed syllable in an utterance, the pitch rises within the stressed syllable and the peak occurs in that tonic syllable, due to interaction with boundary tones, rather than in a post-tonic syllable, thereby distinguishing final, or nuclear, $F_0$ rises and non-final, or pre-nuclear, $F_0$ rises. This pattern of late peak alignment in pre-nuclear tonic syllables has been found in several varieties of Spanish: Peninsular (Face, 2001, 2003), Mexican (Prieto et al., 1995), Western Peruvian (O'Rourke, 2004, 2005), Western Argentine (Colantoni, 2011) and other varieties of Latin American and Caribbean Spanish (McGory & Díaz-Campos, 2002). However, it should be noted that not all varieties of Spanish demonstrate late peaks (see, for example, Willis, 2003; on Dominican Spanish).

The study of peak alignment in contact Spanish has received considerable attention over the past decade. Results from these studies show that language contact can have an effect on pre-nuclear peak alignment as speakers tend to produce a peak within the tonic syllable: an 'early', or L+H*, peak (see Figure 1.1b). Early peak alignment has been found in Spanish in contact with Basque (Elordieta, 2003), Buenos Aires Spanish with Italian as a superstratum (Colantoni & Gurlekian, 2004), Peruvian Spanish among Spanish-Quechua bilinguals (O'Rourke, 2004, 2005), Yucatan Spanish in contact with Yukateko by both Spanish monolinguals and bilinguals (Michnowicz & Barnes, 2013) and Chipilo Spanish (Mexico) spoken by Spanish-Veneto bilinguals (Barnes & Michnowicz, 2013). Nevertheless, early peak alignment in Spanish is not simply a consequence of language contact, as not all varieties of contact Spanish demonstrate early peak alignment; it was not found in Miami Cuban Spanish in contact with American English (Alvord, 2010) or in Argentine Spanish in contact with Guaraní (Colantoni, 2011). It therefore seems more likely that, when it does occur, early peak alignment is due to transfer from the language with which Spanish is in contact; for instance, O'Rourke (2004, 2005) reports that early peak alignment is also a characteristic of Quechua intonation and Barnes & Michnowicz (2013) state the same for Veneto.

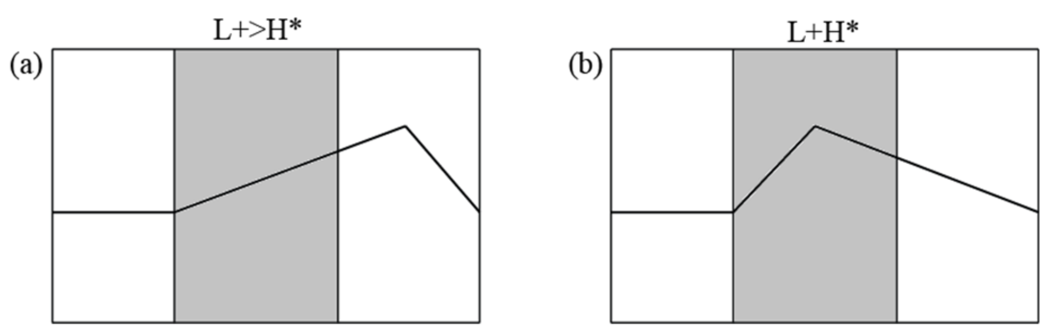


Figure 1.1: Diagrams of (a) a 'late' or 'delayed' L+>H* peak occurring in a post-tonic syllable and (b) an 'early' L+H* peak occurring within the tonic syllable. The line represents the movement of the $F_0$ contour, the gray box represents the tonic syllable, and the white boxes represent pre- and post-tonic syllables (adapted from Estebas & Prieto 2008).

#### *1.2.1.2. Convergence of other intonational contours*

While the alignment of the pitch peak has received considerable attention, other features of bilingual intonation demonstrate contact effects as well. For example, in a study of Turkish-German bilingual intonation, Queen (2001) demonstrated that while German and Turkish monolinguals use two distinct phrase-final rises, bilingual children use both contours in both languages for different pragmatic means. Among heritage speakers of French in Pennsylvania, Bullock (2009) offers three possible cases of the convergence of the minority language closer to that of American English, the dominant language: (i) penultimate, rather than final, prominence (though she admits that this also occurs in several regional varieties of French); (ii) prosodic prominence through a pitch accent to express focus, including on elements presumed to be clitics; (iii) and a boundary intonation in left-dislocated constructions that converges with a similar contour in American English left dislocations, the latter two never having been reported in any variety of French. Simonet (2011) explored utterance-final contours in Spanish-Catalan bilinguals and found that Catalan-dominant bilinguals produced concave-falling contours in Spanish that were similar to their Catalan. On the other hand, Spanish-dominant males produced a Spanish-like convex-falling contour in both languages while Spanish-dominant females produced contours that were somewhere between those produced by Spanish-dominant males and Catalan-dominant bilinguals. Simonet conjectures that interference from the less-dominant language could be causing the change among the Spanish-dominant females and that, if this is the case, these females are the leaders in a convergence process.

## 1.3. Information structure: focus and focus marking

Linguists have often studied the ways in which natural language enables speakers to organize and highlight the information they want to convey. This organization is fulfilled through the syntax, morphology, prosody, or any combination thereof with the goal of facilitating comprehension for the listeners. In the study of Information Structure, the syntactic arrangements of constituents are divided by their underlying sentence structure. This division is between the more informative and the less informative parts; the latter forms a sort of frame for the introduction of the former. The more informative part can be described in terms of different variations of topic and focus and reflects the speaker's beliefs about how the information fits the hearer's knowledge (Vallduví, 1992:10).

Within Information Structure, focus is described as "that portion of a proposition which cannot be taken for granted at the time of speech. It is the UNPREDICTABLE or pragmatically NONRECOVERABLE element in an utterance" (Lambrecht, 1994:207, his emphasis). In other words, the focus constituent is the part of an utterance that is not presupposed in a speech act. Labastía (2006:1679) states that the focus of an utterance is the smallest constituent whose replacement by a variable yields a background implication and that it is this constituent which dominates all the information that contributes directly to relevance. Ocampo (2003) simply describes focus as the speaker's marking of what is to be the 'center of attention,' as seen in (1.1).

(1.1) a. Red is not his favorite color.

b. *Blue* is his favorite color.

In (1.1b), the word *blue* is the focus constituent, it being new information, while the rest of the utterance is considered old, or presupposed, information because the topic of favorite colors had already be introduced in (1.1a) and forms a frame for *blue* in (1.1b).

In focus contexts, the size of the significant part of the sentence, the focus constituent, may vary. Ladd (1980:75) refers to this variation as the difference between 'broad focus', which is expression-wide focus and 'narrow focus', which is any constituent that is smaller than the whole expression. Furthermore, contrastive focus is defined as a focus constituent that is "contrary to some predicted or stated alternative" (Halliday, 1967:206). It is often used when a speaker is clarifying or correcting an utterance that was not felicitous, as in the hypothetical conversation between speaker A and B seen in (1.2).

(1.2) a. speaker A: What happened?

b. speaker B: John parked his car on the back road last night.

c. speaker A: John wrecked his car on the back road last night?

d. speaker B: No, John *parked* his car on the back road last night.

In (1.2c) speaker A reacts to the new information about John and his car but misinterprets *parked* for *wrecked*. Consequently, speaker B corrects speaker A in (1.2d), by contrasting *parked* from *wrecked* within the same frame used before, or in situ focus. In this example we might do well to suppose that speaker B has placed some sort of emphasis on *parked* in order to make it more obvious to speaker A that this was the constituent of the first utterance that was misunderstood, or, in other words, to make it more salient.

It has been hypothesized that all interactions between syntax and focus are mediated by prosodic constraints on the realization of focus; either constraints require focused constituents to be prosodically prominent (Búring, 2003) or constraints require focused constituents to be prosodically aligned (Féry, 2013). Work on word order in Spanish demonstrates that, within an utterance, the new information, as opposed to presupposed information, can be indicated by both the placement of the focused constituent and the presence of prosodic prominence (Contreras, 1978; Hernanz & Brucart, 1987). Specifically, there is a correlation between syntax and prosody within Information Structure and several authors have proposed that syntax and prosody are interconnected by specific prosodic constraints: the most important constituent is often found in the syntactic location where the most prosodic prominence, the nuclear accent, generally occurs (Mora-Bustos, 2010; Zubizarreta, 1998, 1999).

### 1.3.1. Relevance Theory

Relevance Theory is a cognitive pragmatic theory proposed by Sperber & Wilson (1986/1995) which has often been applied to the treatment of focus within Information Structure. It states that both human cognition and communication are guided by considerations of relevance. Information is relevant to a listener when it is able to yield large cognitive effects in exchange for a small cognitive effort. The cognitive effects in a conversation are derived when new information is processed by the listener in the context of presupposition, or existing information, and this new information yields improvements of the listener's ability to comprehend the speaker's intended message. The cognitive effort is consequently needed by the listener to decode the content of the message in the context of the old information. In its simplest terms, Relevance Theory states that the greater the cognitive effects of a message are, the more relevant it will be to the listener, and the greater the cognitive effort needed to decode the message, the less relevant it will be. In terms of contrastive focus marking, the more the focus constituent stands out to the listener, the easier it will be to pay attention to that particular constituent and make any necessary corrections to the information being perceived.

### 1.3.2. The Effort Code

While many studies have explored how languages mark focus syntactically or morphologically, recent studies have begun to examine the role of prosodic prominence within Information Structure and, in particular, focus marking. These studies of the prosodic treatment of focus constituents have been concerned with issues such as the scope of focus, given and new information, and the relationship between the focus constituent and the location and possible shift of the pitch accent from nuclear position and to a pre-nuclear position within the intonational phrase.

Many of these studies have demonstrated that in multiple languages certain prosodic features may be realized differently in utterances with narrow or contrastive focus compared to more neutral, broad focus utterances. According to the Effort Code (Gussenhoven, 2004), increases in the effort expended on speech production lead to greater articulatory precision and wider excursions of pitch movement. Speakers exploit these features by using variation in their pitch movement to signal pragmatic meanings. In other words, speakers will add emphasis to a constituent to make it more salient than the rest of the utterance and to draw the listeners' attention to that particular constituent. This emphasis may include increases in duration at the syllable, word, or sentence level (Ito, 2002; Shih, 1997, 2000; Sityaev & House, 2003; Smiljanić, 2004; Smiljanić & Hualde, 2000, Xu & Xu, 2005), an earlier alignment of the pitch peak (Frota, 1998, 2000; Ito, 2002; Smiljanić & Hualde 2000) and an overall higher pitch peak (D'Imperio, 2001;

García Lecumberri, 1995; Ito, 2002; Shih, 1997, 2000; Smiljanić 2004; Xu, 1999; Xu & Xu, 2005).

It should be noted that there are differences between the roles of pitch-register variation and pitch-span variation. Perceived prominence is not simply a correlate of peak height; it is an estimate of how wide the pitch excursion is based on what the listener's impressions of the normal pitch-register of the speaker are. For example, in a perception study by Gussenhoven & Rietveld (1998), listeners judged the prominence of peaks in identical pitch contours superimposed on a male and a female speaker. According to the authors, the female had a 'particularly deep' voice and as a result the listeners judged the male voice as having more prominent pitch peaks, even though the pitch contours were in fact identical. This finding was attributed to the listeners' hypothesizing an $F_0$ reference line for the male and the female voices, and, since the pitch-register of the female voice would be expected to be higher than that of the male's voice, the listeners perceived the peaks as less prominent in the female voice because they were not perceived as sufficiently extreme pitch excursions when compared to the expected height for a 'normal' female voice.[6] Nonetheless, Gussenhoven's Effort Code states that speakers will use these pitch excursions to emphasize such things as a focus constituent within an utterance. He postulates that "[p]robably all languages, even those with many tone contrasts, will have sufficient phonetic space left for expressing degrees of emphasis of this kind" (Gussenhoven, 2004:85).

It is in the speaker-listener exchange that the interaction between the Effort Code and Relevance Theory is seen. As Labastía (2006) summarizes, the Effort Code involves

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[6] Similar results have also been reported within the same speaker; see Gussenhoven et al. (1997) for an example.

the speaker's effort to mark the important constituent with focus within an utterance, while Relevance Theory discusses the hearer's effort to perceive that focus constituent.

### 1.4. THIS DISSERTATION

The series of experiments in this dissertation examine the role of prosody in contrastive focus marking among Spanish-K'ichee' bilinguals. Specifically, the experiments draw on both spontaneous and laboratory speech to describe and analyze focus marking in K'ichee' and Guatemalan Spanish and to explore possible cases of transfer and convergence between the two languages. Furthermore, the experiments seek to evaluate the role of bilingual language dominance, determined by language history, language use, language competence and language attitudes, in the production of contrastive focus constituents between two dialects of K'ichee'; one that is geographically close to a Spanish-speaking urban center and another that is further removed.

While the study of Spanish-K'ichee' language contact and bilingualism has received little attention, it provides a noteworthy context in which to explore the aforementioned theoretical frameworks of Information Structure and bilingualism. The experiments in this dissertation test both the Effort Code (Gussenhoven, 2004) and Relevance Theory (Sperber & Wilson 1986/1995). The Effort Code, which states that languages should have enough phonetic space to express contrastive focus, predicts that focus constituents in both languages should be produced with some sort of prosodic emphasis. On the other hand, Relevance Theory would claim that contrastive focus constituents that are syntactically marked may not need the same amount of prosodic emphasis as in situ foci. In other words, a change in word order would already cause the focus constituent to stand out and prosodic emphasis might not be necessary as a decrease in cognitive effort on the part of the listener has already occurred.

As noted above, previous research has shown the tendency for the structure of the dominant language of a bilingual to influence that of the non-dominant language (Bullock, 2009; Flege, 1995; Myers-Scotton, 2002; Simonet, 2010, 2011), though this is not always the case (Guion, 2003; Simonet, 2011). The intonational contours of Spanish-K'ichee' bilinguals in this study provide an opportunity to explore the interaction between bilingual language dominance and possible cases of phonetic transfer and/or convergence.

Chapter 2 describes the linguistic situation in Guatemala, including the historical, political and demographic overviews of Spanish-Mayan contact. The two bilingual speech communities to be compared are introduced and previous studies of Spanish-Mayan contact are reviewed. Chapter 3 describes focus marking in K'ichee' and Spanish and discusses previous research, both syntactic and phonological, of focus marking in Mayan languages and other varieties of Spanish, including contact varieties. The remainder of the chapter introduces the research questions and hypotheses, the methodology, and an overview of the language dominance of the participants. Chapters 4-6 are devoted to the experiments. Chapter 4 provides an analysis of both the spontaneous and lab speech of contrastive focus in K'ichee', including dialectal and syntactic variables, while the same is done for Spanish in Chapter 5. Chapter 6 explores possible cases of phonetic transfer and/or convergence in the intonational contours of the bilinguals. Finally, Chapter 7 discusses the results in light of the theoretical frameworks and research questions discussed in the present chapter. It concludes with the limitations of this dissertation and directions for future research.

# 2. K'ichee' and Spanish contact in Guatemala

According to Thomason & Kaufman (1988:35), it is "the sociolinguistic history of the speakers, and not the structure of their language, that is the primary determinant of the linguistic outcome of language contact." The case of Spanish and K'ichee' contact in Guatemala (and contact between Spanish and Mayan languages in general) provides a noteworthy context in which to study individual and societal bilingualism. Like other indigenous languages in the Americas, Mayan languages were oppressed by suffered attempts of extermination before finally being recognized on some level as legitimate languages. As a result, sociopolitical factors have played an important role in the development of the current sociolinguistic context in Guatemala.

This chapter describes the situation of Spanish and Mayan languages in Guatemala, recounting the widespread contact between the languages and language policies dating back to the $16^{th}$ century and discussing their current state. Section 1 presents a historical overview of the extended contact between Spanish and Mayan languages in Guatemala, including changes in the Guatemalan educational system and orthographic reforms. It is not an exhaustive overview but highlights key points that have helped shape the sociolinguistic context of Spanish-K'ichee' bilinguals. Section 2 describes the current situation and provides an overview of the studies of Spanish-Mayan contact and bilingualism. Section 3 describes the two communities that are the focus of the current study both socially and linguistically, with a specific focus on recent acoustic studies, and the chapter is then concluded in Section 4.

## 2.1. Historical overview: contact between Spanish and Mayan

K'ichee' is one of approximately 32 Mayan languages that are said to derive from a common linguistic ancestor called Proto-Mayan, 30 are still spoken today (Figure 2.1).[7]

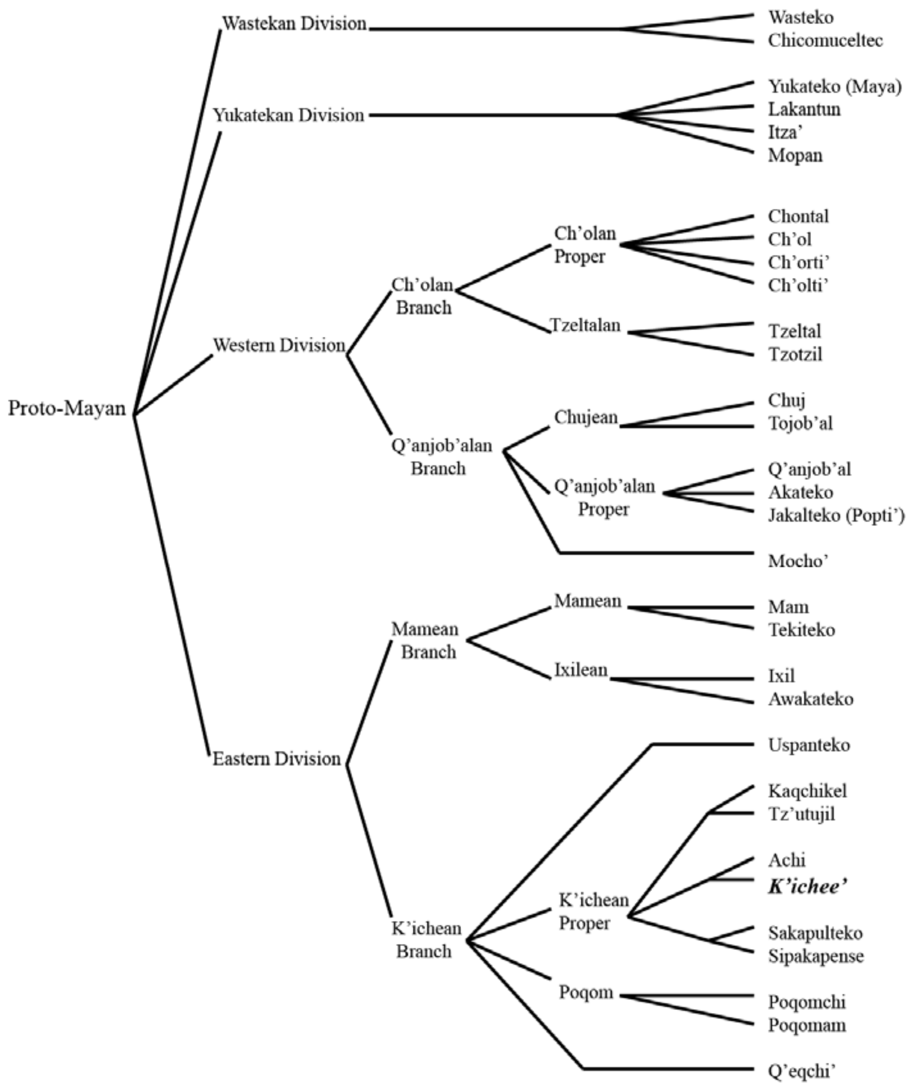


Figure 2.1: The Mayan family tree according to Kaufman (1976), spellings modernized.

[7] The exact number of Mayan languages is disputable since there are languages that several linguists claim to be dialects of each other, such as Achi and K'ichee' (England, 2003).

### 2.1.1. Pre-conquest and conquest

Kaufman (personal communication) hypothesizes that Proto-Mayan was in the area of Uspantán around 2200 BC.[8] According to Campbell (1977), the K'ichean groups expanded into eastern and southern Guatemala, the highlands, quite late, around AD 1200. The large K'ichee' kingdom of Q'umarkaj, located near modern day Santa Cruz del Quiché, was founded in the 13th century and the Kaqchikel, Rabinal (Achi), Poqomam and Tz'utujil were allies of the K'ichee' and subordinate to K'ichee' rule at one time or another (Carmack, 1981). In 1523 the Spanish conquistador Pedro de Alvarado arrived in Central America and on February 20, 1524, and with the aide of the Kaqchikel, defeated Tecun Umam and his K'ichee' armies in the battle of the Valley of Xelajú Noj (modern day Quetzaltenango).[9] After several more defeats at the hands of the Spaniards, the K'ichee' surrendered and the city of Q'umarkaj was burned (Bancroft, 1883; Carmack, 1981).

### 2.1.2. Spanish rule (1524-1821)

The period following the conquest was marked by oppression of the indigenous people, with the advantages of education being offered only to the sons of Spanish nobility and only in Spanish and Latin. Heath (1972:7) has noted that,

> the general policy of the Spanish crown was to work towards the elimination of the indigenous languages in the colonies out of concern for the efficient administration of colonial affairs…the goal of the policy was to eliminate the need to deal with the indigenous peoples through any language other than Spanish.

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[8] Kaufman (1976) originally hypothesized that Proto-Mayan was spoken in the Cuchumatanes Mountains of Guatemala, around Soloma, Huehuetenango. However, in the early 1980s he changed his opinion to the current one, that the Proto-Mayan homeland was located at Uspantán due to that fact that "2000 BC agriculture was just starting, the population was not great, and people did not have to compete for the most favorable environment, so they lived in the most favorable environment. The language distributions show us that the homeland was in the highlands" (personal communication).

[9] Local tradition states that Tecun Umam was killed near modern day Cantel (Cornejo Sam, 2009:269-270).

The Spaniards consistently resisted any effort to teach Spanish to the Maya, believing that, "as long as they could be kept speaking their own language, they would be more humble" (Heath 1972:34-5).[10]

Romero (in press: 53-59) states that Spanish influence brought about the following substantial changes in linguistic practices and language ideology during this period:

- Spanish was incorporated into the economy of the highlands. Coveted for its benefits and detested for threatening the cultural values of the K'ichee', Spanish proficiency was a privilege of only a few for centuries. Loanwords however, were widely adopted in several lexical categories.
- European language ideologies were introduced, shaping language policies and writing practices. Varieties of language spoken in large urban centers were considered more proper than those of smaller towns and rural areas.
- Proselytism and conversion to Christianity were made possible by the creation of new registers by priests in order to eradicate practices perceived as pagan or inconsistent with Spanish norms. For example *Xib'alb'a*, a place denoting the realm of the dead in Late Post-classic Maya religion, was redefined as the Christian concept of 'hell'.

### 2.1.3. Independence to the civil war (1821-1980s)

The next period of language policy in Guatemala began after independence from Spain in 1821 and consisted of one of extermination. According to Lewis (2001), the goal of the government was to exterminate the indigenous languages through a series of

[10] Hawkins (1984) also concludes that the linguistic diversity among the Maya groups assisted the Spaniards in maintaining control by keeping them divided among themselves.

repressive legislation and harsh social policies. The *Decreto del Congreso Constituyente* of October 1824 mandated "the 'extinction' of the indigenous languages due to the fact that they were so 'diverse, incomplete, and imperfect' and 'for enlightening the people or perfecting civilization'."[11] Lewis (2001:8) states that this language policy

> reflects the general problem faced by the newly independent Guatemala and which continued for many years following independence. With an economy based on cheap manual labor there existed strong incentives to maintain a situation which would keep the Mayans subservient and available for use. On the other hand, the promoters of independence and the liberals to follow could not envision a civilized and enlightened society without the assimilation (or elimination) of the indigenous cultures.

This double standard resulted in punishing the Maya for retaining their languages and cultural norms while at the same time denying them access to the means of assimilation marked a rapid decline in the use of Mayan languages in civil administration and in church, and Maya literacy and writing almost disappeared. Various reforms led to the loss of communal lands by thousands of Maya in the highlands that forced them to migrate to Spanish-speaking urban centers where many became merchants, teachers and professionals and "Spanish became the dominant and sometimes the only language spoken by educated Maya" (Romero, in press:63).[12]

The creation of the *Instituto Indigenista Nacional* (IIN) by the Guatemalan government in 1940 gave initiation to another period of language policy in the country as the IIN was given responsibility for overseeing Maya affairs. Stewart (1984:23) characterizes this time period as one of "new initiatives in all areas of public life and oriented towards balancing to some degree the inequities that burdened the masses in the past in interests of a small group." It was during this time that the policy of *indigenismo*

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[11] The translation is prepared by Skinner-Klee (1954:20).
[12] See also Saenz de Santa María (1972).

was adopted, which reflected the growing trend in Latin America begun at the Congress of Interamerican Indianists held in Mexico in 1940 (Whetten, 1961). The movement connected with this congress led to a view of acceptance of indigenous languages and cultures while at the same time promoting integration of the Maya into the 'national society' or to 'Castilianize' them (Lewis, 2001).

This period was followed by the Guatemalan civil war in the late 1970s and early 1980s in which numerous Maya highland communities were affected by political violence and genocide and countless K'ichee' were displaced throughout Guatemala and Mexico (Bastos & Camus, 2003; Carmack, 1988; Romero, in press).

#### 2.1.4. The Maya movement (1980s-today)

Since the end of the Guatemalan civil war in the mid-1980s Guatemalan Mayas have been involved in a significant movement of cultural reaffirmation, in which language has been a central theme, known as the 'Maya movement' (England, 1996, 2003; Fischer & Brown, 1996). According to England (2003), the principal actors in this movement have been native speakers of Mayan languages who have received a fair amount of education, several hundred of whom have received some sort of training in linguistics, either from the *Proyecto Lingüístico Francisco Marroquín* (PLFM), founded in 1971 under the supervision of the linguist Terrence Kaufman, or *Oxlajuuj Keej Maya' Ajtziib'* (OKMA), founded in 1990 under the supervision of the linguist Nora England, and many have worked with the *Academia de Lenguas Mayas de Guatemala* (ALMG), founded in 1986. This movement has been a key factor in language rights and revitalization and, as England (2003:735) states, it "has been quite effective in forcing national society to recognize the Maya population… rather than… ignoring it entirely or at best considering it to be a 'problem' that must be resolved".

As part of the 1996 Peace Accords, 21 Mayan languages were formally recognized by name by the Guatemalan government, though they were not made official languages along with Spanish (López Ixcoy, 1997), and as recently as May 2003, the "Law of National Languages", which states that while Spanish is still the official language of Guatemala indigenous languages are essential to the national identity and must be promoted, was passed by congress (England, 2003).[13] Mayan languages are still actively spoken by the majority of people in Maya communities today (Richards, 2003) and England states that the Maya widely consider the ability to speak a Mayan language as the single most important symbol of Maya identity because they consider the languages to be "unequivocally authentic" (2003:735).

While the attrition and loss of Mayan languages in favor of Spanish has slowed down during the Maya movement, it has not completely stopped (Richards, 2003); according to Lewis (2001), K'ichee' continues to be in an 'unstable diglossia' with Spanish. There are still many Maya children that are only learning Spanish and Romero (in press) states that while many Maya continue to speak their Mayan language, Spanish has increasingly become more common in urban areas and for many Maya it is now their primary language.

### 2.1.5. Bilingual education in Guatemala

The first efforts to teach Spanish to the Maya began in 1935 and in 1941 the first educational system was set up for them. This system entailed sending Spanish-speaking monolinguals to Maya villages to teach children how to read and write in Spanish before

[13] Article 8 of the Law of National Languages states: "In Guatemalan territories Mayan languages, Garífuna and Xinca can be used in the corresponding linguistic communities in all of their forms without restrictions in both public and private, in educational, academic, social, economic, political and cultural activities" (Author's translation).

they entered Spanish primary schools. The classes were taught solely in Spanish and many considered them to be a failure because of this monolingual methodology (Richards, 1989). In 1965 the educational systems changed to a bilingual program with bilingual methodology. Stewart (1984), among others, considers this a successful change, and Morren (1988:354) also comments that "using bilingual promoters, who are usually native speakers of Mayan vernacular and speak Spanish as a second language…proved to be much more successful than anything previously attempted." Nevertheless, the purpose of the reforms in bilingual education in Guatemala continued to be to assimilate the Maya.

As part of the Maya movement, the decade of 1980s marked the beginning of the first true bilingual program with fully bilingual curricula for elementary grades in the four major Mayan languages: K'ichee', Mam, Kaqchikel and Q'eqchi'. In 1985 the constitution was amended to have "the intention to recognize, respect and promote the multicultural and plurilinguistic nature of Guatemalan society and, furthermore, mandate that communities that have a majority population of Mayan language speakers schooling be imparted bilingually" (Richards, 1989:101). As the constitution was amended in 1985, new laws were subsequently created, such as the 'Literacy Law' of 1986, which stated that all children throughout Guatemala must complete the sixth grade, and the 'Program of Bilingual Education' in the same year, which was designed to improve literacy and promote native cultures and languages (Christenson, 2004).

### 2.2. MAYAN LANGUAGES TODAY

The efforts by both native and non-native linguists have made Mayan languages such as K'ichee' some of the most well-documented indigenous languages of Mesoamerica. However, this documentation has largely been focused on historical and syntactic aspects of the languages and a considerable gap has subsequently been the lack of studies on the phonetic features of these languages, or, as Frazier (2008:6) has stated, “in Mayan linguistics, documentation of sound lags behind documentation of text[s]”.

Only recently has phonetic documentation and analysis of Mayan languages begun, with the majority of it concerning Yukatek-Mayan (Gussenhoven & Teeuw, 2008; Frazier, 2009; among many others). Phonetic documentation in other Mayan languages is scarce: Kaqchikel (Berinstein, 1979), Q’anjob’al (Baird & Pascual, 2012; Shosted, 2011), Tz’utujil (Bennett, 2010), Q’eqchi’ (Berinstein, 1979) Uspanteko, (Bennett & Henderson, 2013), among others. Acoustic documentation of K’ichee’ has increased recently but much work is still needed. This documentation includes ejective stops (Pinkerton, 1986), vowels (Baird, 2010), glottalization (Baird, 2011), stress (Baird, in press) and intonational features (Baird, 2010, in press; Nielsen, 2005; Yasavul, 2013).

Today, K’ichee’ is spoken in the highlands of western Guatemala by over one million speakers, the most of any Mayan language (England, 2003; Richards, 2003). With the exception of the area in and around Quetzaltenango, the second largest city in Guatemala, K’ichee’ continues to be the dominant language in K’ichee’ communities (Romero, in press). Both England (2003) and Romero (in press) agree that while widespread Spanish-K’ichee’ bilingualism is a relatively recent phenomenon in comparison to Spanish and other indigenous languages of Latin America, it has significantly increased in the last 30 years. This contact and bilingualism between Spanish and K’ichee’, and Mayan languages in general, has resulted in possible cases of linguistic transfer and convergence. Though this facet has not received as much attention as other linguistic features of Spanish and Mayan languages, several of the studies that do exist will be reviewed in the following subsections.

### 2.2.1. Spanish influence on K'ichee'

Both anthropologists and linguists have noted the substantial lexical influence of Spanish on Mayan languages (Buscher-Grotehussman, 1999; Brody, 1987, 1995; Choi, 2003; Furbee, 1988; as cited in Romero, in press:100). These loan words have been subject to various phonological adjustments, such as when the Spanish phoneme did not exist in K'ichee', e.g. /ka.ˈfe/ → /ka.ˈpe/ 'coffee'. Most notably, stress in K'ichee' is fixed in word-final position and Spanish paroxytone loan words used one of two strategies to adapt: they either moved the stress to the final syllable, e.g. /ˈme.sa/ → /me.ˈʃa/ 'table', /ˈba.kas/ → /wa.ˈkaʃ/ 'cow(s)' or they apocopated the final, atonic vowel in order to move stress into word-final position, e.g. /du.ˈɾas.no/ → /du.ˈɾas/ 'peach', /ˈfɾu.ta/ → /ˈpɾut/ 'fruit'. The latter strategy continues to be used today for more recent borrowings, e.g. /mo.to.ˈsje.ra/ → /mo.to.ˈsjer/ 'chainsaw' (Isaacs & Wolter, 2003, as cited in Broselow, 2009; López Ixcoy, 1997).

Interlingual influence has also been noted at the level of phonetics. In one of the few acoustic studies of Spanish-K'ichee' bilingualism, Baird (2010) analyzed the production and perception of intonational boundary tones in the Cantel dialect of K'ichee'. A production task showed that speakers of K'ichee' seldom used the syntactic question marking particle *la* in Yes/No interrogatives but almost always marked them with a rising boundary tone. The results of a perception task demonstrated that listeners perceived tokens according to the boundary tone: rising boundary tones were perceived as interrogatives and falling boundary tones as declaratives, regardless of the presence of the syntactic question marker *la*. Since little was known about K'ichee' intonation before the study, it could not be claimed that K'ichee' did not have a rising boundary tone in interrogatives before contact with Spanish. However, it was postulated that the apparent loss of meaning, and consequential lack of use, of the syntactic question marking particle *la* in the production and perception of interrogatives was evidence that K'ichee' intonation was becoming parallel to Spanish, at least in terms of Yes/No questions, since Spanish can differentiate between syntactically identical declaratives and interrogatives with rising and falling boundary tones.

Finally, Romero notes that code switching has become a widespread linguistic practice with important discourse functions, stating that "[s]o many Spanish words, idioms, interjections, and speech genres are used in K'ichee'… that seldom does one hear an utterance without at least one word of Spanish origin" and that this even occurs among monolingual speakers of K'ichee' (in press: 99).[14] Additionally, lexical gaps exist in the K'ichee' of several communities; for instance, in the author's own field work it has been noted that even those who cannot or will not speak Spanish seldom use numbers higher than *three, four* or *five* in K'ichee' and revert to Spanish numbers for anything higher, though these Spanish numbers are often phonologically adjusted into K'ichee' as well (cf. ALMG, 2005).

### 2.2.2. Mayan and K'ichee' influence on Spanish

While Spanish may be one of the most analyzed languages in the field of linguistics, the study of Guatemalan Spanish lacks any regional studies of any dialect and "[w]hat is normally described as 'Guatemalan Spanish' represents the middle and upper class, monolingual Spanish speech of Guatemala City" (Lipski, 2008:183). Consequently, the study of the influence of Mayan languages on Guatemalan Spanish has

[14] Such as the following utterance heard in a church in Nahualá by the author, italic words are in K'ichee': '*K'o* más protección *chee* cualquier *jastaq'*, 'There is more protection against anything (that may come)'.

not received a lot of attention either, even though it has received more than the study of Spanish influences in Mayan.

Perhaps one of the most striking aspects of Guatemalan Spanish is the preservation of the syntactic construction *indefinite article + possessive*, known as the pleonastic possessive, e.g. *tengo un mi caballo* 'I have a (my) horse'. While it is clear that this construction existed in Medieval Spanish, it has been lost in the majority of varieties of Spanish today, and Martin (1978, 1985) proposes that it has been preserved in Guatemalan Spanish due to a parallel structure in Mayan languages, e.g. *k'o jun nu-kyej* 'I have one my horse, (Lit. exists one my horse)'. This structure is common even among monolingual Spanish speakers and research by Pato (2002) suggests that it is not stigmatized in spoken speech, though it rarely occurs in formal registers.

In a series of studies on the pronominal systems of Guatemalan Spanish García Tesoro (2002a, 2002b, 2005) finds the following features, which she attributes to contact with Mayan languages:

- The lack of gender and number agreement in Spanish is due to the fact that Mayan languages do not express gender and that number agreement is not always necessary, e.g. *es muy notoria el cambio que está sucediendo en la sociedad* , 'the change that is happening in the society is very noticeable' (2002a:34).
- The simplification of the pronominal paradigm to the form *lo* due to the same reasons mentioned above, e.g. *hay que usar faldas y lo usan* 'one must use skirts and they use it (them)' (2002b:84).
- The absence of the direct object pronoun due to the ergativity of Mayan languages in which the 3rd person object marker is null, e.g. *¿Has traído los libros? Sí, he traído.* 'Have you brought the books? Yes, I have brought (them)' (2002a:45).

- The extension of the duplication of direct objects as a phenomenon that occurs in several varieties of contact Spanish, e.g. *Vino un hombre que tenía un arma y* *lo* *mataron* *el león*. “A man that had a gun came and they killed it the lion” (2002a:48)

Phonological aspects of what Romero (in press) calls ‘K’ichee’-accented Spanish’ include vowel reduction of atonic syllables and the of the apocopated forms of paroxytone words mentioned in Section 2.2.1 in Spanish, e.g. *semán(a)* ‘week’ and *minút(o)* ‘minute’.[15] Lipski (2008) states that in central Guatemala /r/ assibilates or devoices in syllable and word-final positions; though he doesn’t specifically state so, it does present a possible case of Mayan influence as consonants such as /r/ devoice in word-final position in a number of Mayan languages.

In a series of studies that are foundational for this dissertation project, Baird (2010) analyzed the vowels of several K’ichee’ dialects and found that those that no longer have phonemic vowel length had a significantly more centralized vowel space than those that preserve length. These dialectal differences were reflected in the Spanish vowels produced by the bilinguals, particularly in the point vowels /i, a, u/. Additionally, Baird (submitted) investigated peak alignment in pre-nuclear stressed syllables produced by Spanish-K’ichee’ bilinguals and Spanish monolinguals. Unlike most of the studies of contact-Spanish peak alignment mentioned in Section 1.2.1.1, the majority of the bilinguals analyzed in this study did not produce early peaks; instead, their peak alignment was similar to the late peaks produced by monolingual speakers of Guatemalan Spanish. However, some bilinguals did produce early peaks, and the data demonstrated a

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[15] Romero states that the use of this apocopated stress pattern in Spanish is commonly used in Ladino jokes about the Maya (personal communication).

correlation between peak alignment and bilingual language dominance, as interpreted by the Bilingual Language Profile (Birdsong et al., 2012; see section 3.5.1): the more Spanish dominant a bilingual was the later the peak tended to be aligned.

### 2.3. The communities analyzed in this dissertation

Previous research has shown that K'ichee' has profuse dialectal variation (Par Sapón & Can Pixabaj, 2000) and that these dialectal differences can even affect the Spanish spoken in the different communities (Baird, 2010, submitted). It is for this reason that this dissertation analyzes Spanish-K'ichee' bilinguals from two distinct K'ichee' communities: one that is close to the urban center of Quetzaltenango: Cantel, and one that is further removed: Nahualá (see Fig. 2.2); both are considered separate dialects within the Western Division of K'ichee' by Kaufman (1977; as cited in Romero, in press).

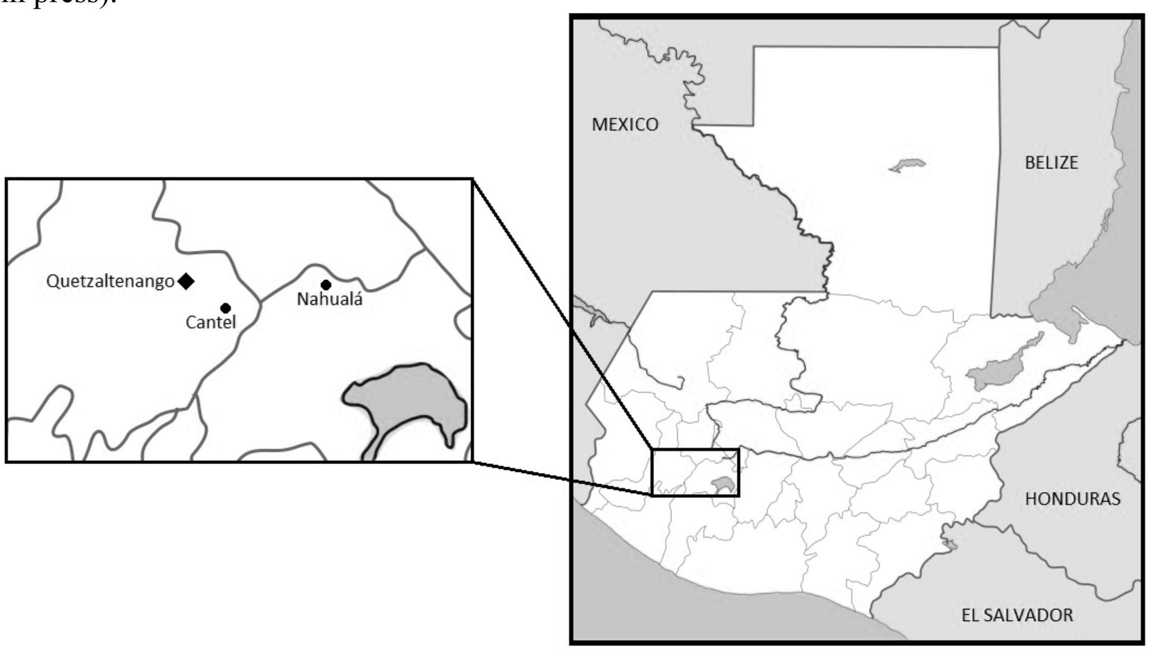


Figure 2.2: Map of Guatemala with Nahualá, Cantel, and their proximity to Quetzaltenango shown (adapted from <commons.wikimedia.org>).

### 2.3.1. Nahualá

Though there are varying accounts of the historical origin of Nahualá, it is generally agreed upon that a group of citizens led by Governor Manuel Tzoc broke off from Santa Catarina Ixtahuacán around the 1860s to form Nahualá, which achieved municipal status in the 1890s (Hawkins & Adams, 2005; Proyecto Salquil, 1992). Today, the municipal center of Nahualá is located on the Pan American Highway in the department of Sololá.[16] Like most municipalities in Guatemala, Nahualá consists of a single nucleated municipal town center surrounded by numerous rural hamlets. The municipal center of Nahualá is approximately 45 km from Quetzaltenango and, although further from Quetzaltenango than Cantel, travel between the two for commercial and other undertakings is common. According to estimates in 2010, the population of the entire municipality of Nahualá is around 64,000 and that 80.2% of males were literate in Spanish while only 68.8% of females were (UNPD, 2011a): several studies have reported that males tend to have more access to learning and using Spanish than females in Nahualá (Hanamaikai & Thompson, 2005; Semus, 2005). A 1994 census claims that only 0.61% of the population identifies themselves as non-Maya (Adams & Hawkins, 2005).

Though knowledge of Spanish has increased, it is K'ichee' that is most often heard on the streets of Nahualá and in churches and shops and continues to be the first language of most inhabitants; in Baird (submitted), all ten bilinguals from Nahualá were interpreted as K'ichee'-dominant bilinguals by the Bilingual Language Profile. The Nahualá dialect of K'ichee' is often considered by many linguists to be conservative and it is generally acknowledged to be a prestige dialect of K'ichee' by speakers from various

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[16] Guatemalan departments are similar to states in the United States and Mexico and provinces in Canada.

towns. Due in part to its accessible location and its conservation of Maya culture and language, Nahualá has been the focus of a considerable amount of anthropological and linguistic studies (see, for example, Hawkins & Adams, 2005; Romero, in press, Velleman, in press).

Linguistically, Nahualá K'ichee' is unlike most dialects because it is said to maintain the Proto-Mayan phoneme /h/, though it only occurs in word-final position and almost exclusively after short vowels (Par Sapón & Can Pixabaj, 2000). Furthermore, it maintains the ten-vowel system of Proto-Mayan, /i, e, a, o, u/ with phonemic vowel length, though vowel length is now restricted to tonic syllables in word-final position (Baird, 2010, 2014; England, 1992; López Ixcoy, 1994, 1997; Par Sapón & Can Pixabaj, 2000). Recent research has shown that stress in Nahualá K'ichee' is marked by intonation alone; no other correlates, such as duration, appear to have any role in acoustically highlighting tonic syllables (Baird, in press).

Nahualá Spanish has received considerably less attention than K'ichee', though recent studies demonstrate convergence with K'ichee' in vowel systems and in peak alignment; both early and late peak alignment in pre-nuclear syllables that appear to be correlated with bilingual language dominance have been found (Baird, 2010, submitted).

#### 2.3.2. Cantel

Cantel was founded in 1551 when several Maya lost a legal battle with Spaniards over a piece of land previously granted to them via a verbal agreement after the conquest; because the Spaniards now demanded legal documentation of the agreement, and none could be provided, the Maya were forced to leave the land and subsequently settled the current municipal center of Cantel (Cornejo Sam, 2009:23). Cantel is located within the department of Quetzaltenango, approximately 12 km southeast of the city, and travel between to two is very common, with many people from Cantel commuting to and from Quetzaltenango for work and other endeavors every day and Cantel has become more industrialized than other Mayan communities over the past century due to different textile factories throughout the community (Nash, 1955). In contrast to Nahualá K'ichee', Cantel K'ichee' displays several linguistic innovations and it is not considered a prestigious dialect by native speakers and linguists alike. Though K'ichee' is still used, Spanish is heard the in the streets of Cantel far more frequently than in Nahualá (Van Sistine & Levi, 2008); all ten Cantel speakers analyzed in Baird (submitted) were recognized as Spanish-dominant bilinguals by the Bilingual Language Profile. Estimates in 2010 place the population of the municipality at 40,300 and Spanish literacy rates at 93.3% for men and 93.9% for women (UNPD, 2011b) and 1997 statistics state that 5-10% are literate in K'ichee'.[17]

From both an anthropological and linguistic sense, Cantel has not received nearly as much attention as Nahualá. Phonemically, Cantel does not maintain the phoneme /h/ (Par Sapón & Can Pixabaj, 2000) and the ten-vowel system of Proto-Mayan has been reduced to a six-vowel system, /i, e, a, ə, o, u/, without phonemic vowel length, though it is unclear why this change has occurred, as Cantel is surrounded by other K'ichee' dialects that, for the most part, continue to distinguish between long and short vowels, such as Almolonga and Zunil (Baird, 2010, 2014; England, 1992; López Ixcoy, 1994, 1997; Par Sapón & Can Pixabaj, 2000). Furthermore, acoustic data has shown that within this dialect glottal stops are canonically reduced to creaky voice except where this would be phonologically restricted: in word-final position and between vowels (Baird,

[17] Consult the 1997 information published by Dictionary Grammar NT, available at <http://www.ethnologue.org/show_language.asp?code=qut>, retrieved 2009-12-03.

2011). As mentioned in Section 2.2.1, Baird (2010) also noted the lack of use and possible loss of meaning of the question marking particle *la* in intonational boundary tones in Cantel K'ichee', and Nielsen (2005) analyzed the intonation of one speaker of Cantel K'ichee' and provided an initial ToBI analysis. Finally, according to Baird (forthcoming), stress in Cantel K'ichee' is acoustically marked by both a higher intonation and longer duration, unlike Nahualá K'ichee'.

Studies on the acoustic characteristics of Cantel Spanish have demonstrated that Spanish vowels converged to the centralized six-vowel system of Cantel K'ichee' and that these vowels were significantly more centralized than in the vowel systems of Spanish-K'ichee' bilinguals in nearby dialects of Almolonga and Zunil (Baird, 2010). Furthermore, studies on peak alignment in Cantel Spanish intonation have shown that a late peak pattern, that paralleled peak alignment of Spanish monolinguals from Quetzaltenango, was found among Cantel bilinguals, though there was a correlation with how late the peak was aligned and bilingual language dominance (Baird, submitted).

### 2.4. SUMMARY

The sociolinguistic context of Guatemala is undoubtedly a result of various discriminatory language policies toward the Maya and their subsequential efforts at both cultural and language revitalization. The various policies immediately following the conquest and continuing well past independence from Spain placed the Maya and their languages at a disadvantage and rarely offered opportunities to learn Spanish (Lewis, 2001; Romero, in press). Modifications of linguistic policy due to cultural changes such as the Maya movement and the ALMG have led to a stronger presence of Mayan languages on a local and national level and the death and attrition of Mayan languages in several communities has stopped altogether (England, 2003; Richards, 2003). Moreover, Spanish-K'ichee' bilingualism has begun to flourish in the past 30 years and is now the norm in multiple K'ichee' communities (Romero, in press).

Due to its history and despite efforts by the ALMG, K'ichee' continues to be an unstandardized language. Several recent studies reviewed in this chapter detailed various acoustic differences in both the K'ichee' and Spanish spoken in the communities of Nahualá and Cantel, though most differences in Spanish seem to be correlated with the respective dialects of K'ichee'. Additionally, these studies have begun to examine sociolinguistic and language use differences between the two communities, though they are just the beginning and future work is obviously essential. As discussed in this chapter, the communities of Nahualá and Cantel demonstrate distinct profiles correlated with factors such as, but not limited to, language use and geographical proximity to the urban center of Quetzaltenango. Consequently, they provide a unique context in which to study both the individual and societal bilingualism of Spanish and K'ichee' in Guatemala.

This chapter has summarized the sociopolitical context that has shaped the current situation of language contact in Guatemala and reviewed several of the recent acoustic studies that have investigated the communities under review in this dissertation. In view of the relatively recent phenomenon of Spanish-K'ichee' bilingualism in the highlands of western Guatemala, convergence of intonational contours with certain pragmatic functions may be present in either dialect and in either language.

# 3. The present study: focus marking in K'ichee' and Spanish

This chapter discusses the previous literature on focus marking in both K'ichee' and Spanish and describes the design of the experiments in the present dissertation, including the research questions, methodological components, and a description of the research assistants and participants. Section 3.1 discusses focus marking in Mayan languages with particular emphasis on changes in word order and in situ focus in K'ichee' (Section 3.1.1) and comments on the need for an anlysis of the role of prosody in focus marking, including a description of intonation and stress in K'ichee' (Section 3.1.2). Section 3.2 describes syntactic and prosodic focus marking in Spanish and, in particular, some recent studies of prosodic focus marking among Spanish bilinguals (Section 3.2.1.1). Section 3.3 outlines the research questions and hypotheses of the present study and Section 3.4 delineates the experimental design, procedure, and methods of analysis that are used in this dissertation. Section 3.5 describes the bilinguals analyzed in this study and the breakdown of their BLP language dominance scores and the chapter is then summarized in Section 3.6. The overall goal of this chapter is to introduce the present study, including the research questions and hypotheses, and to describe the experimental design and the participants' linguistic background and language dominance.

## 3.1. FOCUS MARKING IN MAYAN LANGUAGES

Mayan languages are generally assumed to be predicate-initial languages. Most, if not all of them, have a VOS constituent order. This prevailing view of word order in Mayan languages dates back to important work by Norman (1977) and England (1991), who proposed that these languages that are generally verb-initial have two positions before the verb to which nouns can move: topic position and focus position.

Aissen (1992) proposed an elaborate account of the syntax of Mayan topic and focus based on the framework of Chomsky (1986) for Tzotzil, Jakalteko, and Tz'utujil. She claimed that in these Mayan languages topic structures are sentence initial while focus structures are merely pre-verbal, meaning that when both are present, the topic structure always occurs before the focus structure in an utterance. At the center of this claim is an account of intonational phrasing: the topic does not form part of the same clause as the rest of the phrase while focus is always part of the same clause.

### 3.1.1. Syntactic focus marking in K'ichee'

K'ichee' has a basic constituent order of VOS, as seen in (3.1), and permits other orders of constituents according to different pragmatic conditions (England, 1991).

| | | | | | |
|---|---|---|---|---|---|
| (3.1) | X-ø-r-il | le | me's | le | nu-naan |
| | CPL-B3s-A3s-see | DET | cat | DET | A1s-mother[18] |
| | 'My mother saw the cat' | | | | |

Like other Mayan languages, K'ichee' is ergative and marks transitive subjects with one set of morphemes (Set A) and transitive objects, intransitive subjects, and subjects of non-verbal predicates with another (Set B), as in (3.2). Possessors of nouns are also marked with Set A (3.2e); K'ichee' does not demonstrate split ergativity.

[18] The alphabet used here is the practical Mayan alphabet. Symbols have their expected phonetic values except b' = [ɓ], ch =[tʃ], j = [χ], tz = [ts], x = [ʃ], y = [j], VV = [V:], ' = [ʔ]. Abbreviations: 1 1st person, 2 2nd person, 3 3rd person, A Set A, AFF affectionate, AGT agentive, AP antipassive, B Set B, CL classifier, COM comitative, CPL completive, DAT dative, DEM demonstrative, DET determiner, DIR directional, ENC enclitic, EMPH emphatic, EXIST existential, FOC focus, INC incompletive, INTS intensifier, IRR irrealis, IV intransitive verb, MOV movement, NEG negative, p plural, P>I intransitive derived from positional, P>T transitive derived from positional, PART particle, PAS passive, PAT patient, PERF perfect, PL plural, PREP preposition, PRO pronoun, PSL positional predicate, Q interrogative RN relational noun, s singular, SS status suffix, TOP topic.

(3.2) a. Intransitive Subject (Set B)
X-ee-wa'-ik.
CPL-B3p-eat-SS
'They ate.' (Can Pixabaj, 2004:28)

b. Transitive Object (Set B)
X-ee-qa-riq-o.
CPL-B3p-A1p-meet-SS
'We met them.' (Can Pixabaj, 2004:28)

c. Transitive Subject (Set A)
X-in-ki-ch'ab'ee-j.
CPL-B1s-A3p-speak.to-SS
'They spoke to me.' (Can Pixabaj, 2004:28)

d. Subject of Nonverbal Predicate (Set B)
Ee k'oo-l-ik.
B3p EXIST-PSL-SS
'They are (in a place).' (Can Pixabaj, 2004:33)

e. Possessor of noun (Set A)
ki-q'ab'
A3p-hand
'their hands' (Can Pixabaj & England, 2011:18)

In K'ichee', focused constituents appear before the predicate and are often preceded by emphatic particles, such as *are*, as in (3.3) (Par Sapón & Can Pixabaj, 2000:189). Throughout these examples the portion relative to the discussion at hand is in bold.

(3.3) a. Non-focused
X-tze'n ri ixoq
CPL-B3s-laugh DET woman
"The woman laughed"

b. Focused
**Are ri ixoq** x-tze'n-ik
EMPH DET woman CPL-B3s-laugh-SS
"It was the woman that laughed"

Can Pixabaj & England (2011) present one of the most recent analyses of nominal focus in K'ichee', based on five texts of natural speech with more than 1,800 clauses.[19] They indicate that there is a pause after the fronted nominal in topicalization, but not in focus constructions such as (3.4) (Can Pixabaj & England, 2011:18).

(3.4) **Are r-in-taat** x-i'l-ow-ik, in, na x-ø-inw-il taj
EMPH DET-A1s-father CPL-B3p-see-AP-SS 1sPRO NEG CPL-B3s-A1s-see IRR
'It was my parents who saw it, I didn't see it'.

As originally noted in Aissen (1992), if there is topicalization and focus in the same clause, the topic comes before the focus, as in (3.5) (Can Pixabaj & England, 2011:19). In (3.5a), *Juan* is the topic and *María* is the focus.

(3.5) a. Le a Xwan, **are le al Mari'y** x-ø-u-ch'ab'ee-j.
DET CL Juan EMPH DET CL Maria CPL-B3s-A3s-speak.to-SS
'It was Maria that Juan spoke to (and not anyone else)'

b. ***Are le al Mari'y** le a Xwan, x-ø-u-ch'ab'ee-j.
EMPH DET CL Maria DET CL Juan CPL-B3s-A3s-speak.to-SS
Intended: 'It was Maria (and not anyone else) that Juan spoke to.'

K'ichee' has two types of focus: contrastive focus and focus of new information. Contrastive focus of definite nominals, termed 'Focus I' by Can Pixabaj & England, requires the presence of the emphatic particles *are* or *xow* before the nominal (or some similar mechanism that indicates focus) as in (3.6) (Can Pixabaj & England, 2011:21).

(3.6) **Are ri achi** x-ø-war kan-oq.
EMPH DET man CPL-B3s-sleep DIR:remaining-SS
'It was the man who stayed sleeping.'

[19] Four of the texts were collected in Santa Lucía Utatlán; the other text (Text 10) is from Nahualá. Texts 1 and 2 were collected by OKMA; texts 9, 10 and 20 were collected by Can Pixabaj; text 10 is included in Can Pixabaj (2004).

Contrastive focus also has a special verb form for focusing the subject of a transitive verb; the verb must be converted into an antipassive or agent focus verb, and the object is reintroduced by an oblique as in (3.7) (Can Pixabaj & England 2011:21).

(3.7) a. Are le al Ixkaaj **x-ø-loq'-ow** r-eech le ja.
EMPH DET CL Ixkaaj CPL-B3s-buy-AP A3s-RN:PAT DET house
'It was Ixkaaj who bought the house.'

b. *Are le al Ixkaaj **x-ø-u-loq'** le ja[20]
EMPH DET CL Ixkaaj CPL-B3s-A3s-buy DET house
Intended: 'It was Ixkaaj who bought the house.'

When the object of a transitive verb is focused it is also moved before the verb and the verb may be in the passive voice (Par Sapón & Can Pixabaj 2000:189).

(3.8) a. X-ø-r-il ri ak'aal ri ixoq
CPL-B3s-A3s-see DET child DET woman
'The woman saw the child'

b. Are ri ak'aal **x'-ø-iil** r-umaal ri ixoq
EMPH DET child CPL-B3s-see-PAS A3s-SR DET woman
'The child was seen by the woman'

According to Can Pixabaj & England, there is another kind of focus in K'ichee', in which the contrast is more implicit. They term this 'Focus II': "The use of this kind of emphasis is principally to give new information, mention a participant for the first time, or reintroduce information. That is, it is not used for explicit contrast of old information"

[20] In the dialect of K'ichee' spoken by Can Pixabaj, this is ungrammatical without the antipassive/agentive or the use of *are k'u* instead of *are.*

(Can Pixabaj & England, 2011:23). Unlike contrastive focus, this focus does not use any marker, such as the particles *are* or *xow*, as in (3.9).

(3.9) Focus for first mention of a participant:
Chanim, **le don Santiago** k-ø-u-tzijoj cha-q-e jas le
now DET don Santiago INC-B3s-A3s-tell PREP-A1p-RN:DAT what DET
u-'istoria r-ech we jun tinamit Santa Lu's
A3s-history A3s-RN:POS DET a town Santa Lucía
'Now don Santiago will recount the history of the town of Santa Lucía'.

Recent work has noted that the fronting of focused nominatives is optional in several Mayan languages and that focus may be realized within the exact same frame used in non-focus contexts, i.e., in situ focus. Work on K'ichee' by Velleman (in press) has demonstrated that neither subjects of intransitive verbs (3.10) nor objects of transitive verbs (3.11) require overt movement to preverbal position when marked for focus.[21]

(3.10) *Context*: Who is singing?
Ka-b'ixon **jun w-atz**
A3s-sing DET A1s-brother
'One of my brothers is singing' (Velleman, in press:5)

(3.11) *Context:* What is the man carrying?
U-q'alu-m b'i **jun kotz'ij**
A3s-carry-PERF DIR:away DET flower
'He's carrying a flower (Lit. He's going having picked up a flower)' (Velleman, in press:2)

However, according to Velleman, focus movement is not optional with agents of transitive verbs, it is necessary (see 3.12; as opposed to agent focus constructions in 3.7).

[21] Though Velleman (in press) only provides examples of narrow focus constituents, he states that this optional fronting is also true of contrastive focus constituents in K'ichee'.

(3.12) *Context*: Who is carrying the flower away?
*U'q'alu-m b'i **jun achi**
A3s-carry-PERF DIR:away DET man
Intended: 'A man is carrying it away (Velleman, in press:3)

A third option also exists in K'ichee' in which the emphatic particle *are* is used at the beginning of a phrase but the focused nominal is not moved to a pre-verbal position (3.13). Velleman (personal communication) states that the use of *are* indicates to the listener that the upcoming nominal is being marked for focus.

(3.13) Are ka-b'ixon **jun w-atz**
EMPH A3s-sing DET A1s-brother
'It is one of my brothers that is singing'

Finally, Velleman suggests that in situ focus in K'ichee' should be viewed as covert movement and fronting of nominals such as agents of transitive verbs as overt movement. In this proposal, covert movement is affected by the same syntactic configurations that cause restrictions on overt movement in K'ichee' whereas agent focus constructions block these restrictions and mandate overt movement while preventing covert movement.

### 3.1.2. Prosodic focus marking in K'ichee'

As mentioned in Section 2.1.6, acoustic analyses of Mayan languages are limited. The majority of work on the role of prosody in Information Structure has taken place in Yukateko, which, like K'ichee', has a neutral word order of VOS and marks focus via changes in this word order (Bricker, 1979). Researchers have generally agreed that in Yukateko, "[t]here is no phonological or phonetic expression of information structure" (Gussenhoven, 2006:1; see also Gussenhoven & Teeuw, 2008; Kügler et al., 2007).

While acoustic data of Information Structure in K'ichee' is rare, Yasavul (2013) does offer some data from the K'ichee' dialect of Santa María Tzejá, Ixcán: near the border with Mexico in the department of El Quiché. Yasavul analyzed the difference between pre-verbal focus and contrastive-topic constituents and only found significant acoustic differences between the two in terms of range of the $F_0$ rise, which only demonstrated a mean difference of 6 Hz. As Yasavul states, this may not be enough of a perceptual difference for listeners. However, it should be noted that the data in this study was elicited by recordings of non-native speakers and only analyzed prosodic emphasis on non-K'ichee' words: Spanish proper names with a paroxytone stress pattern such as María.

Reiterating Gussenhoven's Effort Code (2004), all languages should have enough extra phonetic space for emphasizing things such as focus constituents; nonetheless, this 'extra phonetic space' remains understudied in most Mayan languages. For example, Aissen (1992) includes remarks about intonational phrasing in her investigation of the syntax of fronted topic and focus constituents in several Mayan languages but falls short of including any analysis thereof. Can Pixabaj & England state that "[w]hat we are adding to the previous studies of K'ichee' is … a consideration of the role of intonation in these structures. We have not been able to do a complete study of intonation, but we have analyzed the data in terms of the presence of a pause after each fronted [topicalized] nominal" (2011:16). Finally, Velleman (in press) agrees that our current knowledge of K'ichee' intonation is not enough to fully understand its role in Information Structure.

#### *3.1.2.1. K'ichee' stress & intonation*

Speakers will exploit features already employed in their language to mark phonetic prominence, such as acoustic correlates of stress, in order to further emphasize a constituent for pragmatic means. K'ichee' is a non-tonal language in which stress is non-phonemic and fixed in word-final position (Larsen, 1988; López Ixcoy, 1997; Mondloch, 1978) and recent studies have shown that pitch is the most prominent and constant acoustic correlate of stress (Baird, in press).[22] In prenuclear tonic syllables, stress is marked by a rise in pitch that peaks near the end of the stressed syllable while in nuclear tonic syllables the pitch peak occurs earlier (Nielsen, 2005; Baird, 2010, in press). Duration may also be a prominent acoustic correlate of stress as well, but this differs across dialects; Baird (in press) found that duration was a prominent acoustic correlate of stress and that utterance-final lengthening of tonic syllables was common in the dialect of Cantel, where vowel length is non-phonemic, while it wasn't a prominent acoustic correlate nor did utterance-final tonic syllables lengthen in dialects where vowel length is phonemic: Nahualá and Zunil. It was proposed that, similar to findings in Kaqchikel and Q'eqchi by Bernstein (1979), duration is only a prominent correlate of stress and subject to phonological processes such as utterance-final lengthening in dialects that don't employ it for other purposes, such as phonemically contrasting long and short vowels.

While several have described characteristics of intonational phrases in K'ichee' in terms of morphology and syntax (see, for example, Henderson, 2012), few have actually analyzed them acoustically. In one of the first acoustic studies of K'ichee' intonation, Nielsen (2005) classified it as an edge language with stress-driven pitch accents.[23] Baird

[22] According to Romero (2009), primary stress in K'ichee' falls on the last syllable of a word and secondary stress falls on every other syllable from right to left. Furthermore, syllables that don't receive either primary or secondary stress are subject to vowel reduction and deletion. Henderson (2012) states that stress falls on the final syllable of a word in K'ichee' unless it is light and not part of the root. In these rare cases it falls on the last syllable of the root. Nielsen (2005) claims that stress is lexical in K'ichee'; however, this claim is based on the observation that some enclitics, like those mentioned in Henderson (2012), don't receive stress and that some recent Spanish loanwords in K'ichee' can keep their non-final stress pattern.

[23] It should be noted that Nielsen's (2005) analysis of K'ichee' intonation is based on one native speaker from Cantel that was analyzed during a field method's course at UCLA.

(2010) analyzed the production and perception of intonational boundary tones in declaratives and Yes/No interrogatives in the dialect spoken in Cantel. Finally, as mentioned in the previous section, Yasavul (2013) found no prosodic differences between topicalized and focus constituents in Santa María Tzejá, Ixcán. Apart from these studies, little is known about intonation in K'ichee'.

### 3.2. Focus marking in Spanish

Compared to K'ichee', Spanish has less restrictions in word order and it is through changes in word order that Information Structure can be expressed. It has been claimed that Spanish tends to keep focal prominence, or the nuclear accent, at the end of the intonational phrase: a combination of word order and prosodic prominence where the focus constituent is moved to the natural position of the nuclear accent (Cruttenden, 1977; Mora-Bustos, 2010; Zubizarreta, 1998, 1999), as in *el periódoco* in (3.14a) or *Pedro* in (3.14b) (from Mora-Bustos, 2010:220).

(3.14) a. Pedro compró **el periódico**
Pedro bought the newspaper
'Pedro bought the newspaper' (*the newspaper* is focused).

b. El periódico lo compró **Pedro**
the newspaper bought Pedro
'Pedro bought the newspaper' (*Pedro* is focused).

Several researchers have even stated that a change in the location of the nuclear accent in Spanish is only possible in contrastive focus (Domínguez, 2004; Zubizarreta, 1999); see Martín Butragueño (2004) for a counterclaim. According to Camacho (2006), Spanish has two basic strategies for marking contrastive focus: clefting with a copular verb and marking a constituent prosodically.[24] The first of these includes three different types: a true cleft, a pseudo-cleft and an inverted pseudo-cleft as seen in (3.15a-c) (from Camacho, 2006:13).

(3.15) a. **Fue Marta** la que trajo los regalos
Was Marta that brought the gifts
'It was Marta that brought the gifts'.

b. Quien trajo los regalos **fue Marta**
Who brought the gifts was Marta
'The one who brought the gifts was Marta'.

c. **Marta fue** quien trajo los regalos
Marta was who brought the gifts
'It was Marta who brought the gifts'.

Zubizarreta (1999) proposes that, within these structures, only the focus constituent can receive prosodic emphasis and Mora-Bustos (2010) noted that there is acoustic prominence given to a clefted focus constituent.

### 3.2.1. Prosodic focus marking in Spanish

While syntax plays a key role in marking focus in Spanish, recent studies have been devoted to the role of prosody in contrastive focus marking, especially in in situ focus structures. These studies have demonstrated that speakers are able to mark focus constituents prosodically and that the focus constituent does not necessarily have to be in phrase-final position to be prosodically emphasized.

Studies on several varieties of Spanish have shown that in identical utterances, speakers prosodically emphasize a focus constituent to make it more salient than other

[24] See Roggia (2011:71-72) for a discussion on other types of syntactic focus marking across different varieties of Spanish.

constituents. This prosodic prominence is realized in a variety of ways, such as, but not limited to, a longer duration (de la Mota Gorriz, 1997; Face, 2002b; Kim & Avelino, 2003), a higher pitch peak (Barjam, 2004; Cabrera Abreu & García Lecumberri, 2003; de la Mota Gorriz, 1997; Domínguez, 2004; Face, 2001; García Lecumberri, 1995), and an earlier peak alignment (Barjam, 2004; de la Mota Gorriz, 1997; Face, 2001). In many varieties of Spanish, the previously mentioned late L+>H* peak produced in neutral, or broad, focus declaratives is retracted into the tonic syllable, a L+H* peak, in a contrastive focus context as seen in the sample pitch tracks of a male, monolingual speaker of Mexican Spanish in Figure 3.1.

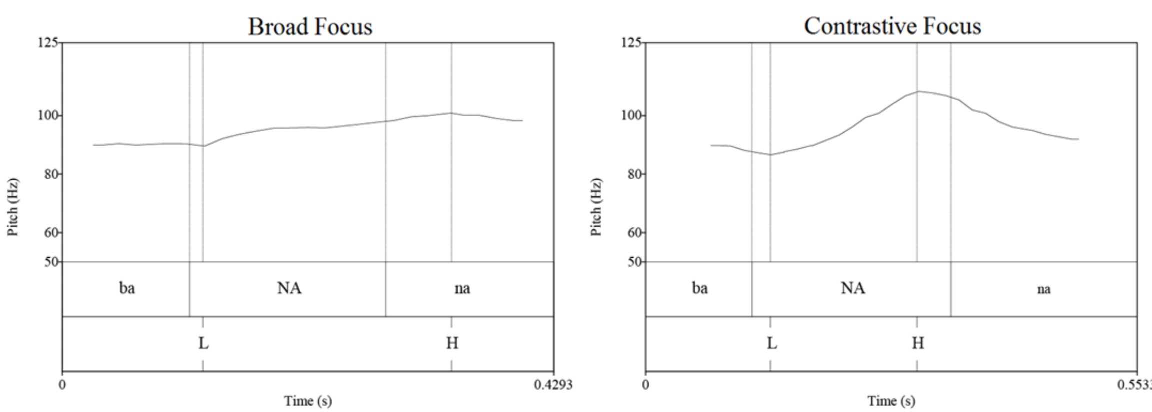


Figure 3.1: Sample pitch tracks of the word *banána* in broad focus and contrastive focus contexts as produced by a male monolingual speaker of Mexican Spanish.

#### *3.2.1.1. Prosodic focus marking in contact & bilingual Spanish*

As noted in Bullock (2009), different prosodic focus-marking strategies may be transferred from a language that relies on them to one that does not, or vice versa, in language contact and bilingual contexts. Recent studies of prosodic focus marking in different varieties of contact Spanish have demonstrated results that differ according to the language with which Spanish is in contact. In Buenos Aires Spanish, which presents an Italian superstratum, Barjam (2004) found that even though broad focus peaks were already aligned within the stressed syllable (as noted in Colantoni & Gurlekian, 2004), contrastive focus peaks were still aligned significantly earlier. Since variation was observed according to speaker, this result is taken as an indication that focus is marked by relative rather than absolute timing differences. Among the Spanish of Quechua-Spanish bilinguals, van Rijswijk & Muntendam (2012) found no peak alignment differences between broad and narrow focus contexts but did find earlier peaks in the contrastive focus context. Additionally, their study demonstrated that speakers actually produced a higher pitch peak in broad focus than in contrastive focus, which they hypothesize might be due to contact with Quechua.

Nevertheless, there are few studies to date that have examined the acoustic characteristics of prosodic focus marking in both Spanish and the language with which it is in contact. Of those that have, several are of particular interest here: Simonet (2008) and O'Rourke (2005, 2012b). Simonet (2008) analyzed several features of intonation of Spanish-Catalan bilinguals, including prosodic focus marking. He found no significant between-language differences in peak alignment in broad focus or in narrow focus contexts and suggested convergence as a possible result among both Spanish- and Catalan-dominant bilinguals. However, there were significant differences in terms of the alignment of the valley; in broad focus, the valleys were aligned later in Catalan while in narrow focus the valleys were found to occur earlier, with respect to the duration of stressed syllables, in Catalan than in Spanish. These results suggest that although there may be a convergence of one intonational feature, in this case peak alignment in both pragmatic contexts, other features may show no convergence or transfer, even among bilinguals with different degrees of language dominance.

O'Rourke (2005, 2012b) examined peak alignment and peak height in prosodic focus marking in both languages of Cuzco Quechua-Spanish bilinguals and compared them to Spanish monolinguals from Lima, Peru. Similar to Simonet (2008), she found evidence for the convergence of the alignment of the pitch peak between the two languages in both broad and contrastive focus contexts. However, her specific findings on Spanish demonstrated that there was a trend towards non-Lima-like intonation as she moved from Cuzco Spanish monolinguals, to Spanish-dominant bilinguals, to Quechua-dominant bilinguals and finally to native Quechua speakers, who produced few differences in peak alignment and height between pragmatic contexts. These findings were attributed to the fact that in Quechua contrastive focus is marked morphologically and the use of intonation "may be considered an additional strategy that may appear alongside the strategy found at the morphological level" (2012b:496). Consequently, Spanish monolinguals and those who were more Spanish-dominant tended to mark prosodic focus to a greater degree in both languages than Quechua-dominant bilinguals.

These studies demonstrate the importance of analyzing bilingual speech in both languages and including factors such as bilingual language dominance in these analyses. As Bullock & Toribio (2004) state, linguistic transfer among bilinguals can occur in either direction and, as a result, studies on contact and bilingual Spanish alone only provide half of the picture. Accordingly, this dissertation project analyzes contrastive focus marking in both languages of Spanish-K'ichee' bilinguals and in view of bilingual language dominance.

### 3.3. The present study

The present study examines the production of intonational contours associated with contrastive focus marking by Spanish-K'ichee' bilinguals. It analyses bilinguals from two distinct K'ichee' communities in the Guatemalan highlands, one that has been described as culturally and linguistically conservative, Nahualá, and one that has not, Cantel. While much is known about the syntactic structures used to mark contrastive focus in K'ichee', the role of prosody in contrastive focus marking remains to be investigated from an acoustic perspective. Furthermore, while acoustic studies of bilingual Spanish have increased, the variety spoken by Maya bilinguals in Guatemala has yet to be analyzed. Factors that have been overlooked in the majority of studies on K'ichee', Spanish, and bilingual focus marking include analyses of both natural and lab speech, analyses in both of the bilinguals' languages, and language dominance. Due to these limitations and overall lack of previous literature, it is necessary to undertake an in-depth acoustic analysis of prosodic contrastive focus marking in both languages spoken by these bilinguals in order to incorporate diverse linguistic and extralinguistic factors into our understanding of varying intonational contours with different pragmatic meanings in two distinct communities of bilinguals.

### 3.3.1. Research questions

The experiments in this dissertation are designed to test the following predictions of the realization of prosody in broad and contrastive focus contexts as produced by Spanish-K'ichee' bilinguals in both Nahualá and Cantel. The research questions and preliminary hypotheses are described below.

RQ1: *In the K'ichee' of Spanish-K'ichee' bilinguals from Nahualá and Cantel, are contrastive focus constituents prosodically emphasized? Are there effects of different syntactic structures of focus marking on prosodic prominence?*

As research revealed no prosodic focus marking in Yukateko (Gussenhoven 2006; Gussenhoven & Teeuw, 2008; Kügler et al., 2007), because it marks focus via changes in word order, and Yasavul (2013) found no differences between fronted focus and topic constituents, one might hypothesize that there is no prosodic focus in K'ichee' since it also marks focus via changes in word order. However, the Effort Code (Gussenhoven, 2004) states that all languages should be able to phonetically emphasize a focus constituent to some extent and it is expected that the K'ichee' speakers in this dissertation will do the same. Concerning the different syntactic structures used to mark contrastive focus, it is anticipated that the focus constituent of an in situ focus structure should be more prosodically marked than those marked by a change in word order since, according to Relevance Theory (Sperber & Wilson 1986/1995), a change in word order would already create a significant cognitive effect to draw the listener's attention to the focus constituent without any prosodic emphasis while a constituent marked within the same frame, i.e. in situ, would need other means of creating a sufficient cognitive effect in order to highlight the constituent for the listener.

RQ2: *In the Spanish of Spanish-K'ichee' bilinguals from Nahualá and Cantel, how are contrastive focus constituents prosodically marked and how does it compare to other varieties of contact and non-contact Spanish? Are there effects of different syntactic structures of focus marking on prosodic prominence?*

Since the literature on focus marking in Spanish demonstrates that prosody is employed to mark both in situ and clefted focus constituents, it is expected that the same will be found in this study. As shown in Baird (submitted), most Spanish-K'ichee' bilinguals produce late peaks similar to those found in the majority of varieties of non-contact Spanish and it is predicted that the speakers analyzed in this dissertation will also be able to use an early peak located within the tonic syllable as a phonetic strategy to mark contrastive focus. For those speakers that do display early peak alignment in broad focus, it is predicted that peak alignment will still be earlier in contrastive focus constituents than in broad focus constituents, as in Buenos Aires Spanish (Barjam, 2004). Aside from the well-documented role of peak alignment, it is anticipated that the bilinguals will use the other prosodic strategies outlined in Section 3.2.1 to mark contrastive focus constituents. Finally, following the same reasoning as in RQ1, it is hypothesized that in situ contrastive focus constituents will be realized with more prosodic prominence than those marked by clefting.

RQ3: *Are there dialectal differences in the contrastive focus marking in either language of these bilinguals in Nahualá and Cantel?*

For K'ichee', in terms of the linguistic structure of the dialects, main phonological differences are found between the vowel systems (Baird, 2010, 2014; England, 1992; López Ixcoy, 1994, 1997; Par Sapón & Can Pixabaj, 2000) and, consequently, the acoustic correlates of stress; Cantel K'ichee' can use duration to mark stress because it is not needed to mark phonemic vowel length while in Nahualá duration is used solely to mark phonemic vowel length (Baird, in press). Consequently, the Cantel K'ichee' speakers should also be able to use duration to mark contrastive focus while speakers of Nahualá K'ichee' should not be able to employ duration as a phonetic focus marking strategy. Since Spanish does not demonstrate any phonological restrictions on duration, all bilinguals in this study should be able to use duration to mark contrastive focus in

Spanish. In other words, it is not anticipated that Nahualá Spanish has adopted the phonological constraints of duration manifested in Nahualá K'ichee'

RQ4: *Are there effects of bilingual language dominance on the production of intonational contours associated with broad and contrastive focus constituents among these bilinguals in Nahualá and Cantel?*

Both Simonet (2008) and O'Rourke (2005, 2012b) demonstrated effects of language dominance on the intonational contours of broad and contrastive focus constituents. These effects included convergence of some, but not all intonational features and how language dominance can be correlated with degrees of prosodic focus marking. As mentioned above, the results in Baird (submitted) demonstrated convergence of peak alignment between Spanish and K'ichee' that was correlated with language dominance in broad focus contexts. Following the results from Baird (submitted) and O'Rourke (2005, 2012b), it is predicted that bilingual language dominance will affect prosodic focus marking among the bilinguals analyzed in this study; since in situ contrastive focus is expected to be more common in Spanish, it is predicted that Spanish-dominant bilinguals will mark focus to a greater degree than K'ichee'-dominant bilinguals in both languages.

### 3.4. Experimental design

In order to address the abovementioned research questions and hypotheses four production experiments were carried out in this study and are summarized in Table 3.1.

| Experiment | Type of speech | Language | Stress pattern of target words |
|---|---|---|---|
| Sociolinguistic Interview | Naturalistic | K'ichee' | N/A |
| Sociolinguistic Interview | Naturalistic | Spanish | N/A |
| Production Task | Lab | K'ichee' | Oxytone |
| Production Task | Lab | Spanish | Oxytone & Paroxytone |

Table 3.1: The production tasks of this dissertation.

The first two experiments consisted in sociolinguistic interviews in both languages in order to obtain naturalistic, spontaneous data. The other two experiments involved controlled production tasks that elicited lab speech for more fine-grained acoustic analyses. The order of the experiments was randomized for each participant and carried out by research assistants.

### 3.4.1. Research assistants

Recent sociophonetic research has shown that many variables can affect speech production and perception and that even the environment of the interviews and the interviewer need to be controlled (see, for example, Hay & Drager, 2010). As the presence of a non-native researcher can make native speakers in these communities uneasy during an experiment, it was decided to use local research assistants to conduct all experiments in this dissertation and the author, an L2 speaker of both Spanish and K'ichee', was never present during any interview. Due to cultural and dialectal considerations, four research assistants aided in the collection of data; one male and one female from each community participated so that each bilingual would be interviewed by a research assistant of the same dialect and sex.[25] All four research assistants were

[25] It would not have been culturally appropriate to have interviews with members of the opposite sex and it was decided that a single assistant from one dialect should not conduct the interviews in both Nahualá and Cantel in order to avoid dialectal discrepancies and that a speaker from a third dialect would introduce undesired variables.

literate in both Spanish and K'ichee' and their metalinguistic data is presented in Table 3.2. All were compensated for their work.

| Gender | Dialect | Age | Language dominance (score) |
|---|---|---|---|
| Female | Nahualá | 30 | K'ichee' (48.3) |
| Male | Nahualá | 29 | K'ichee' (32.8) |
| Female | Cantel | 31 | Spanish (17.2) |
| Male | Cantel | 33 | Spanish (23.6) |

Table 3.2: Metalinguistic data of research assistants; the language dominance scores come from the Bilingual Language Profile questionnaire (see Section 3.5.1).

### 3.4.2. Sociolinguistic interview

The sociolinguistics interviews consisted in a 5-20 minute conversation in which the native-speaker research assistant asked the participant to speak on a topic of his or her choice. During the conversation, the research assistant elicited contrastive focus at various stages by repeating something the participant had just said as a question and purposely erring on a portion of it, in a similar fashion to the production task.[26] This was done between 1 and 5 times during the interview.[27]

### 3.4.3. Production task methodology

As stated in Face (2003), while controlled production tasks do not provide as natural as data as spontaneous speech, they are essential to understanding intonation as they can control for many variables which spontaneous speech cannot.

[26] This was done in order to ensure that there were examples of contrastive focus during the interview.
[27] As stopping a speaker multiple times during a conversation to ask them what they just said gave the impression that the research assistant was not listening, the number of contrastive focus elicitations was kept low.

Previous research on broad and contrastive focus has used a simulated question-answer task. In this type of task, the participant is asked a question eliciting broad focus of an utterance, such as "What happened?", where the answer contains all new information, e.g., *His grandfather died yesterday*. The contrastive focus reading for the target word is then prompted by a question such as "*His grandmother died yesterday?*" which requires contrastive focus on the target word, in this example, grandfather, for the target answer, "*No, his **grandfather** died yesterday*." Each sentence with a contrastive-focus reading has its own prompting question that sets up the context for the answer.

In previous research, these elicitations have been prompted by reading tasks (for example, Face, 2001; O'Rourke, 2005, 2012b; Simonet, 2008; Smiljanić, 2004). However, in order to obtain more naturalistic data and to include speakers with varying levels of literacy, recent adaptations of this methodology have elicited focus via listening to audio files and responding to them (for example, Roggia, 2011). In this dissertation project, the data is elicited by a series of video clips. The use of video is important because it simulates a natural situation in which contrastive focus occurs, it controls the elicitation that is presented to the participants, and, as seen below, it never models contrastive focus for the participants, thus allowing them to produce contrastive focus however they choose.

The sequence of video clips for each question-answer set is as follows; (i) the first speaker appears on screen and gives the context to the participant by producing the utterance and the screen then fades to black for 2.5 seconds; (ii) a second speaker appears on screen and asks a question eliciting broad focus; (iii) the screen fades to black for 6 seconds as the participant produces the utterance previously modeled by the first speaker; (iv) the second speaker reappears on screen and asks a question eliciting contrastive focus; (v) the screen again fades to black and the participant responds to the contrastive focus question, correcting the error of the second speaker. This presentation order is summarized in (3.16).

| | | |
|---|---|---|
| (3.16) | Speaker 1: "Her grandfather died yesterday." | [presentation of information] |
| | Speaker 2: "What happened?" | [broad focus elicitation] |
| | Participant: "Her grandfather died yesterday." | [broad focus production] |
| | Speaker 2: "Her grandmother died yesterday?" | [contrastive focus elicitation] |
| | Participant: "No, her grandfather died yesterday." | [contrastive focus production] |

Four Spanish-K'ichee' bilinguals produced the elicitation material: a male and a female from each community.[28] These speakers were filmed producing the material with a Sony HDR-CX560 Handycam in quiet rooms. The videos were edited in *iMovie* software where the roles of Speaker 1 and Speaker 2 were randomized among the four native speakers to create 40 question-answer sets from the materials discussed in the following sections and other distractor tokens e.g., different Wh-word questions instead of contrastive focus elicitation questions. Each question-answer set was separated by 9 seconds and they were divided into groups of 10 question-answer sets; a 20 second break was given between each group. The elicitation material was randomized five different times and burned onto five different DVDs for each language, creating 25 possible combinations of elicitation material presentation for the participants.

#### *3.4.3.1. K'ichee' materials*

As K'ichee' demonstrates the aforementioned changes in word order to mark contrastive focus, it is not always possible to have identical utterances for broad and

[28] Three of the four speakers that provided the elicitation material were the research assistants mentioned in Section 3.4.1. As it was not feasible to have the same male speaker from Nahualá provide both the elicitation material and be a research assistant, the material was provided by a 23 year-old Nahualá male with a BLP language dominance score of K'ichee' 23.1.

contrastive focus productions. However, efforts were made to ensure that the target word in all carrier sentences is kept in relatively the same position in all focus contexts in order to control for phrase positional effects on the intonation of the target word in K'ichee' noted in Baird (in press); the target word is the third of four words in the utterance. In order to control for stress clash and tonal crowding (see, for example, Alvord, 2010; Henriksen, 2012; Prieto et al., 1995), the number of syllables between the word-final stressed syllable of the target word and the following tonic syllable was also controlled. Since changes in word order require the focused nominal to move to the position immediately before the verb, there are usually cases of stress clash between the nominal and the verb if the verb is conjugated in the 3rd person singular absolutive form with a null person marker.[29] This stress clash was avoided by having an adjective with an atonic-tonic syllable pattern, such as *iwir* 'yesterday', after the subject in a broad focus production, so the nominal is not located in phrase final position, and removing the adjective as part of the answer in the contrastive focus production. The lack of the adjective in the contrastive focus production causes the verb to be in phrase-final position where a status suffix is added, thus morphologically adjusting a verb from *xkam* 's/he died' to *xkamik* 's/he died (phrase-final)' and giving the verb the same atonic-tonic pattern as the adjective in the broad focus production. All tonic syllables of target words are therefore separated from the following tonic syllable by one atonic syllable (refer to (3.3) for the complete structure).

[29] Previous studies with similar production tasks tend to use 3rd person verbal forms in the presentation and elicitation of materials since it is semantically and pragmatically easier to have a participant hear that information and give it to a 3rd party that is not involved in the conversation (see for example, Face, 2001; O'Rourke, 2012b; Roggia, 2011; Simonet, 2008; Smiljanić, 2004).

In view of the above considerations, this dissertation only examines contrastive focus, Can Pixabaj & England's (2011) Focus I, of the subjects of intransitive verbs as focus of the agent of transitive verbs, as in (3.7), requires the agent to move from near the end of the phrase to its pre-verbal focus position and focus of objects of transitive verbs, as in (3.8), create a stress clash that cannot be avoided since the following verb cannot be phrase-final because the agent must follow. Furthermore, the sentences are kept relatively short and with simple syntactic structures for two reasons; (i) to reduce the cognitive load of the participants, fewer mistakes will be made in repeating shorter sentences; and (ii) to ensure that the sentences are felicitous in both dialects. For the target words, the vowel of the stressed syllable is always /a:/, in order to neutralize for the effects of intrinsic vowel pitch and duration.[30] Similarly, since nasals are the only consonants that do not devoice in word final position in K'ichee' (López Ixcoy, 1997), all target words end in either /m/ or /n/ and all tonic syllables of the target word have the structure /Ca:C/ where the onset is also a sonorant in order to avoid micropertubations or voicelessness in the $F_0$ track of the tonic syllable that is analyzed. Proceeding in this way, 80 sentences per participant were elicited (40 sentences x 2 pragmatic conditions). The full set of sentences, along with prompting questions, is given in Appendix C, and example sentences, with the target word in bold and the tonic syllable capitalized, are shown in (3.17).

[30] Since Cantel no longer has phonemic vowel length, this vowel is /a/. Furthermore, it was decided to not include vowel length as a variable as too few words in Nahualá could be found with short vowels that met the phonological restrictions for this experiment and were felicitous in Cantel. The low vowel /a/ was also chosen because it is the most common vowel in terms of frequency in K'ichee' and it is produced in the same acoustic area as Spanish /a/ by bilinguals (Baird, 2010).

(3.17) Xkam le **uMAAM** iwir. "Her/his grandfather died yesterday."
Are le **uMAAM** xkamik. "It was her/his grandfather that died."

***3.4.3.2. Spanish materials***

In order to carry out a cross-language comparison of the bilinguals in this study, the Spanish materials in the production task had the same structure as the K'ichee' materials described above. The materials were designed so that the target word had an oxytone stress pattern and a tonic syllable structure of /CaC/ with a nasal in coda position. The target word was the third of four words in the utterance and the ensuing word had an atonic-tonic syllable pattern. Since Spanish word order is reported to be less restrictive than K'ichee', the materials were set up so participants could easily answer the focus-eliciting question with in situ focus. For this purpose, only subjects of unergative verbs were used as target words since changes in word order are more likely to occur with unaccusative verbs in Spanish (Roggia, 2011). A total of 80 tokens were analyzed per speaker (40 phrases x 2 pragmatic conditions). The entire list of materials can be found in Appendix C, and an example of a broad and contrastive focus utterance, with the target word in bold and the stressed syllable in capital letters, is shown in (3.18).

(3.18) El señor **aleMÁN** llegó. "The German man arrived."

The majority of studies on Spanish intonation and prosodic focus marking have used target words with a paroxytone stress pattern. As O'Rourke (2012b) states, this is done because a paroxytone stress pattern allows for more phonetic space in which to analyze the intonational contour, i.e., there is a post-tonic syllable in which a contour may continue and a pitch peak may occur, unlike oxytones where the intonational contour tends to end at or near the end of the tonic syllable (Hualde, 2005). It is for this reason that this dissertation project analyzes both oxytone and paroxytone stress patterns in Spanish prosodic focus marking; an analysis of only oxytones would only permit a limited inspection of peak alignment in broad and contrastive focus contexts while an analysis of only paroxytones would not allow for a reliable cross-language comparison with K'ichee', which only has oxytones.

No statistical comparisons are made between Spanish paroxytone and oxytone target words since the stress patterns are different. Therefore, it is not necessary that the Spanish paroxytone target words have the same syllable structure as the Spanish and K'ichee' oxytone target words. The structure of the tonic syllable of the paroxytone target words is /Ca/ and all target words were comprised of sonorant consonants in order to avoid micropertubations or voicelessness in the $F_0$ track. The target word was the third of four words in the sentence and was followed by a word with an atonic-tonic stress pattern. Proceeding in this manner, a total of 80 tokens of Spanish paroxytones were elicited from each participant (40 repetitions x 2 pragmatic contexts). The material and prompting questions can be found in Appendix C, and an example sentence of the broad and contrastive focus utterance, with the target word in bold and the tonic syllable in capital letters, is shown in (3.19).

(3.19) La señora **aleMAna** cantó. "The German woman sang."

### 3.4.4. Procedure

As mentioned above, the order of the experiments was counterbalanced for each participant. For all experiments in this study, participants were recorded in quiet rooms in the respective communities via a Shure SM10A dynamic head-mounted microphone with a Marantz PMD661 solid state digital voice recorder digitized at 16 bits (44.1 kHz).

During the production experiments, the video clips were played for the participants via a Sony DVP-FX780 portable DVD player with built-in speakers. Each speaker participated in a 5-6 minute training session before doing the production task in each language. This training session consisted of question-answer sets that were not included in the actual task but were produced by the same speakers in the task. The participants were instructed to answer the questions in any way they felt comfortable, thus allowing for a variety of syntactic structures. The only instruction that they received was to answer in complete sentences in order to avoid target words in utterance-final position. Both paroxytone and oxytone target words were elicited during the Spanish production task.

### 3.4.5. Auditory and acoustic analyses

The sociolinguistic interviews yielded a total of 373 minutes of naturalistic speech in Nahualá that included 31 elicitations of contrastive focus in K'ichee' and 33 in Spanish while 289 minutes of naturalistic data in Cantel included 39 elicitations in K'ichee' and 42 in Spanish. A further breakdown of the data by speaker group is seen in Table 3.3.

| Naturalistic Data Elicited | | | | |
|---|---|---|---|---|
| | K'ichee' | | Spanish | |
| Speaker Group | Minutes | Tokens | Minutes | Tokens |
| Nahualá Females | 15.2 (3.9) | 17 | 15.1 (4.2) | 20 |
| Nahualá Males | 17.1 (4) | 14 | 14.5 (6.1) | 13 |
| Cantel Females | 9.6 (3.5) | 18 | 13.7 (5.3) | 24 |
| Cantel Males | 14.1 (2.7) | 21 | 10.7 (6.2) | 18 |

Table 3.3: Mean (SD) of minutes of naturalistic data elicited in the sociolinguistic interviews and total number of tokens of contrastive focus by speaker group.

Due to the small number of tokens obtained in the sociolinguistic interviews and the uncontrolled manner of the task, a complete and reliable analysis of focus marking in the naturalistic data was not possible. However, sample pitch tracks of these tokens are shown to demonstrate common intonational contours and for a comparison with the data obtained in the production tasks.

A total of 5,760 tokens were elicited in the production task; 2,880 from each dialect. Of these 112 were discarded in Nahualá (3.9%) and 158 were discarded in Cantel (5.5%) due to factors such as non-responses, incorrect responses and producing a target word in phrase-final position. The remaining 5,490 tokens were analyzed in *Praat* software for speech analysis (Boersma & Weenink, 1999-2013). A *Praat* script was used to parse each participant's recording into individual files for each target item and text grids were created by manually marking the syllable boundaries and location of H(igh) and L(ow) tones in each token. This segmentation was performed using a combination of both listening to the sound file and the visual inspection of the sound wave, pitch track, spectrogram, and intensity curve, and is described below.

With one exception, the voiced dental fricative onset /ð/ in the Spanish target word *Adán* 'Adam', all oxytone target syllables in both languages had a nasal in onset and coda position while all Spanish paroxytone target words had a nasal in onset position and the vocalic nucleus was followed by another nasal in the post-tonic syllable. Acoustically, while nasals still display formants, they differ from vowels by means of a lower amplitude in the waveform, lower intensity, abrupt discontinuities in the spectrogram and the presence of anti-formants due to the overall dampening of the sound in the nasal cavity; furthermore, they differ from an alveolar tap /ɾ/ in that they do contain formants (Johnson, 2003). All target syllables that had a nasal onset were segmented with the following guidelines: when syllables were preceded by a voiceless segment the onset on the syllable was marked at the beginning of the first voiced cycle in the waveform; when they were preceded by the voiced tap /ɾ/, the onset was marked at the beginning of the first voice cycle that included the presence of formants; and when they were preceded by a vowel they were marked at the beginning of the first voice cycle with a lower amplitude, a drop off in intensity and abrupt discontinuities in the spectrogram compared to the preceding vowel.[31] For the target word with /ð/ as an onset, the onset of the syllable was marked at the end of the voice cycle of the proceeding vowel before the significant drop off in both amplitude and intensity and the end of the formants. For oxytone target words, which all had a nasal in coda position, the end of the syllables were marked at the end of the last voice cycle when followed by a voiceless consonant, and, when followed by a vowel, by the end of the last voice cycle before both the amplitude and intensity rose and the spectrogram showed more consistent formants. For Spanish paroxytone target words, the end of the tonic syllable was marked at the drop off in amplitude and intensity, and at the end of clearer spectrogram before the following nasal.

Following previous analyses of intonational contours in Spanish and other languages (Face, 2001; Henriksen, 2012; Xu, 1999; Xu & Xu 2005), the valley, or (L)ow tone, was defined as the 'elbow' where a low level stretch turned into a clear rise and the peak, or (H)igh tone, was defined as the highest $F_0$ value of a peak from the rise-fall gesture. Finally, all of these acoustic segmentations are illustrated in Figure 3.2, a sample K'ichee' broad focus utterance produced by a female Nahualá speaker (NF4).

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[31] The only cases where the target syllable was preceded by /ɾ/ were in *hermáno* and *hermána* 'brother' and 'sister'. In both cases the onset was /m/, which displays more stable formants than /n/ and, as a result, provides a better visual clue as to when the nasal begins following the tap (Johnson, 2003).

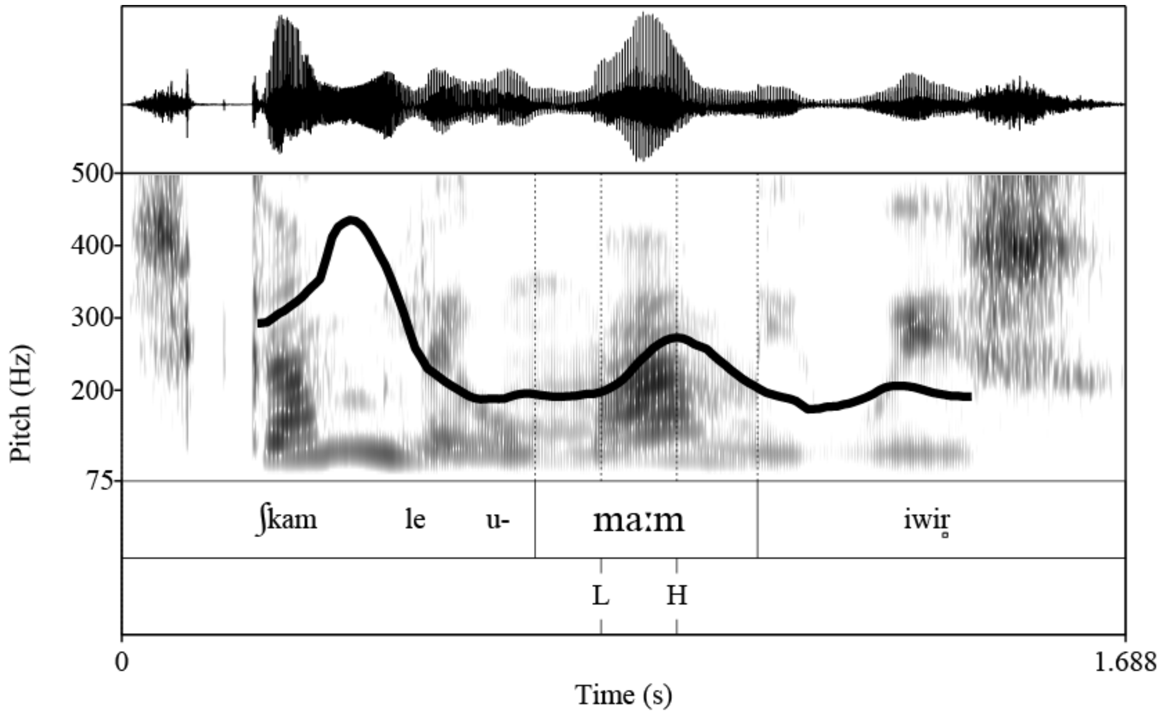


Figure 3.2: Example of the acoustic segmentations performed. The K'ichee' phrase is *xkam le umaam iwir* 'his/her grandfather died yesterday' and the tonic syllable of the target word is *maam*.

It would be inappropriate to pool data across different speakers in Hz since they may have very different pitch spans depending on their 'tessitura', their individual pitch range. Thus, all data measured in Hz was normalized before the statistical analyses were performed. As there is evidence that pitch operates in speech on a logarithmic scale in both production (Fujisaki, 2003) and perception (Nolan, 2003), the semitone (st) scale was used for normalization purposes for analyses involving Hz; semitone values were calculated in *Praat* with a reference value of 1 Hz (Prom-on et al. 2009; Stanford, 2009; Xu & Xu, 2005, Zhu, 1999).[32] Since the participants analyzed in this study present a large variation in age, and since this study represents one of the first phonetic analyses of

[32] Semitones were calculated in *Praat* via the following formula: semitones = 12*log2(mean $F_0$/1).

these speakers and dialects, individual analyses are also carried out for each speaker in order to not overgeneralize the findings of the different group analyses.

Following this segmentation and normalization, the data were analyzed using the *ProsodyPro* script in *Praat* (Xu, 2013). Measurements that were obtained in this way and reported in this dissertation are the following (Baird, submitted; Face, 2001; Henriksen, 2012; Lickley et al., 2005; Thomas, 2011; Xu, 1997; Xu & Xu, 2005):

- Duration (ms)- duration of the tonic syllable of the target word, for assessing lengthening by focus.
- Peak height (st)- highest $F_0$ of the intonational contour associated with the tonic syllable of the target word, for assessing increased pitch height by focus as well as pitch range by focus.
- Peak alignment (ms/ms)- relative peak alignment score: duration of syllable onset to the H tone/duration of entire tonic syllable, for assessing $F_0$ peak location relative to onset of stressed syllable of a target word as well as slope by focus.
- Valley height (st)- lowest $F_0$ in the stressed syllable of the target word before the $F_0$ peak, for assessing decreased valley height as well as pitch range by focus.
- Valley alignment (ms/ms)- relative valley alignment score: duration of syllable onset to the L tone/duration of entire tonic syllable, for assessing $F_0$ valley location relative to onset of stressed syllable of a target word as well as slope by focus.
- Rise (st-st)- difference in st between maximum $F_0$ and minimum $F_0$ in the stressed syllable of a target word, for assessing pitch range by focus.
- Slope (st/ms)- Rise/time interval between L tone and H tone, for assessing steepness of $F_0$ contour by focus.

### 3.5. Participants

A total of 24 Spanish-K'ichee' bilinguals participated in the different production experiments in this study and completed the Bilingual Language Profile (BLP) questionnaire: 6 females and 6 males from each dialect. Participants were recruited by the native-speaking research assistants; all were from their respective municipality centers and all were born and raised in their respective community. All subjects reported normal speech and hearing and were compensated for their participation. Ages of participants ranged between 19 and 75 years old (M: 40.3, SD: 14.9).

#### 3.5.1. The Bilingual Language Profile (BLP)

While there is currently not a widely accepted process for defining and measuring bilingual language dominance, the Bilingual Language Profile, or the BLP, (Birdsong et al., 2012) is used to interpret language dominance for the bilinguals analyzed in this dissertation.[33] The BLP is an instrument for assessing language dominance through self-reports that produces a dominance score on a continuum from 218 in one language to zero (a balanced bilingual) to 218 in the other language. It takes into account multiple dimensions: age of acquisition of the two languages, frequency and contexts of use, competence in different skills, and attitudes towards each language and the culture it represents.

All of these factors are organized into four modules which received equal importance in the global language dominance score: language history, language use, language proficiency, and language attitudes. The BLP was administered prior to beginning the experiments and the questionnaire was written in Spanish since the

[33] See Amengual (2013:72) for a list of different procedures that have been used to assess bilingual language dominance.

participants had varying levels of literacy in K'ichee' and dialectal differences would have required two separate K'ichee' versions of the BLP. Upon request by the participants, the research assistants would read the BLP to them and even explain the questions in K'ichee'. The version of the BLP used in this study is provided in Appendix A. The metalinguistic data for all 24 bilinguals, including individual BLP scores, are presented in Table 3.4. The overall BLP scores for all 24 bilinguals in all four modules are presented in Appendix B.

The BLP was chosen for this study because it has already been used among Spanish-K'ichee' bilinguals with promising results; bilinguals from Nahualá and Cantel were assessed for language dominance by the BLP and these results demonstrated a significant correlation between peak alignment in Spanish broad focus utterances and language dominance. As in Baird (submitted), the metalinguistic data in this dissertation demonstrate the tendency of Nahualá bilinguals to be K'ichee'-dominant and of Cantel bilinguals to be Spanish-dominant; the overall differences in BLP scores were significantly different between the two dialects according to an Independent Sample *t*-test, $t$ (22) = -5.914, $p < .001$ and are summarized in Figure 3.3. A one-way ANOVA between the BLP scores of the speaker grouped by gender and community, i.e., Nahualá females, Nahualá males, Cantel females and Cantel males, revealed a significant main effect, $F_{(3, 20)} = 11.529$, $p < .001$. However, a Post-Hoc (Bonferroni) demonstrated that the significant between-group differences were only between the groups from the different communities and not between Nahualá females and males, $p = 1.00$, n.s., or between Cantel females and males, $p = 1.00$ n.s.

| Speaker | Gender | Dialect | Age | BLP Score |
|---|---|---|---|---|
| NF1 | Female | Nahualá | 54 | K 73.3 |
| NF2 | Female | Nahualá | 44 | K 32.1 |
| NF3 | Female | Nahualá | 33 | K 45.9 |
| NF4 | Female | Nahualá | 28 | K 43.7 |
| NF5 | Female | Nahualá | 33 | K 31.4 |
| NF6 | Female | Nahualá | 22 | K 72.4 |
| NM1 | Male | Nahualá | 75 | K 123.5 |
| NM2 | Male | Nahualá | 23 | S 35.4 |
| NM3 | Male | Nahualá | 30 | K 19.2 |
| NM4 | Male | Nahualá | 37 | K 58.2 |
| NM5 | Male | Nahualá | 60 | K 77 |
| NM6 | Male | Nahualá | 40 | K 30.5 |
| CF1 | Female | Cantel | 33 | S 63.4 |
| CF2 | Female | Cantel | 44 | S 79.8 |
| CF3 | Female | Cantel | 34 | S 17.2 |
| CF4 | Female | Cantel | 19 | S 79.9 |
| CF5 | Female | Cantel | 58 | S 30.3 |
| CF6 | Female | Cantel | 26 | S 40.9 |
| CM1 | Male | Cantel | 53 | K 15.4 |
| CM2 | Male | Cantel | 45 | S 71.9 |
| CM3 | Male | Cantel | 31 | K 18.2 |
| CM4 | Male | Cantel | 63 | S 62.1 |
| CM5 | Male | Cantel | 55 | S 19.7 |
| CM6 | Male | Cantel | 26 | S 59.1 |

Table 3.4: Metalinguistic data of bilingual participants: BLP scores; K= K'ichee'-dominant, S= Spanish-dominant.

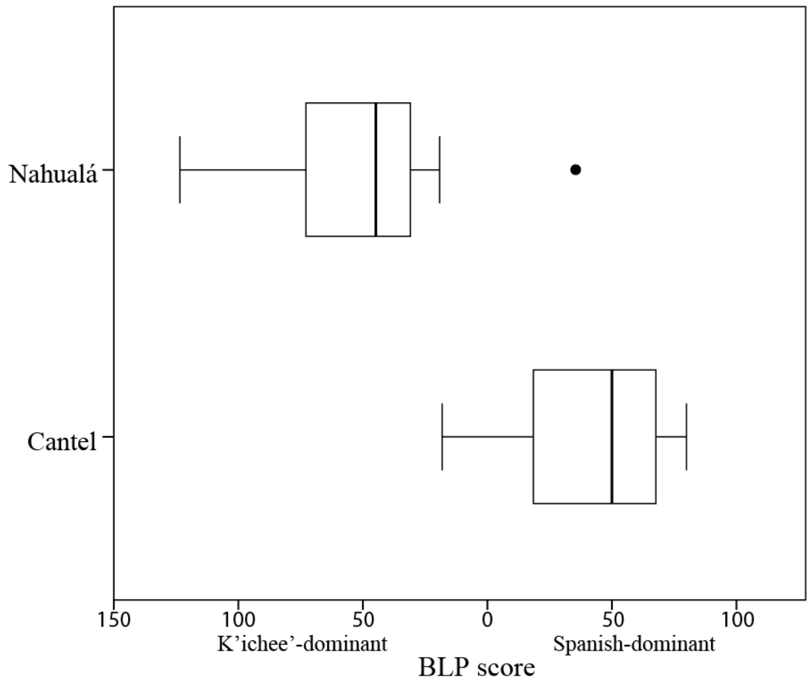


Figure 3.3: BLP dominance scores according to community.

In contrast to Baird (submitted), not all bilinguals from a community fall into the same category; two male bilinguals from Cantel were defined as K'ichee'-dominant and one male bilingual from Nahualá was defined as Spanish-dominant. The distributions of the responses to all items in the BLP divided by module are displayed in Figure 3.4. These individual density plots demonstrate two differences between the communities that appear to be the principle predictors of bilingual language dominance of the participants in this study: Language Use and Attitudes. Independent Sample *t*-tests demonstrate that no significant differences are found between Nahualá and Cantel for Language History, $t_{(22)} = 1.787$, $p = .088$, n.s., or Language Competence, $t_{(22)} = 1.136$, $p = .268$, n.s., while both Language Use, $t_{(22)} = 6.339$, $p < .001$, and Language Attitudes, $t_{(22)} = 4.187$, $p = .001$, are significantly different.

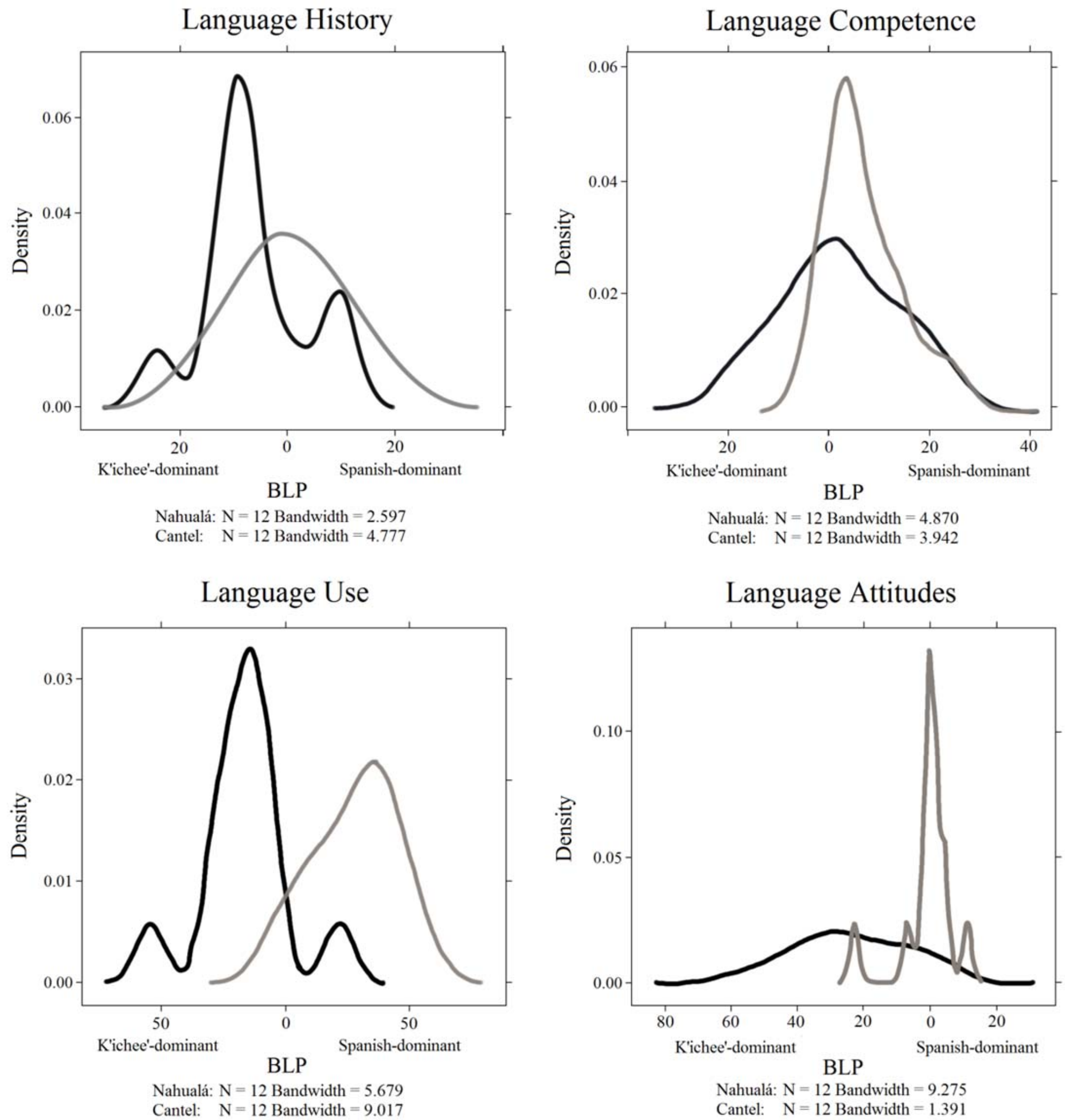


Figure 3.4: Density plots on the scores in each of the four modules of the BLP; Nahualá is represented by the black line and Cantel by the gray line.

A series of one-way ANOVAs of the speakers grouped by gender and community for each BLP module did not reveal a significant main effect for Language History, F $_{(3,}$

$_{20)}$ = 1.564, p = .229, n.s., or for Language Competence, $F_{(3,\ 20)} = .415$, p = .774, n.s. There was a significant main effect for Language Use, $F_{(3,\ 20)} = 12.689$, $p < .001$ and Language Attitudes, $F_{(3,\ 20)} = 6.086$, $p < .01$. A Bonferroni pairwise comparison of Language Use reflects the findings of the *t*-test of Language Use; the significant differences are between speaker groups from different communities, and there were no significant differences between Nahualá females and males, *p* = 1.00, n.s., or between Cantel females and males, *p* = 1.00, n.s.[34] A Bonferroni pairwise comparison of Language Attitude again reveals that there are also no differences between Nahualá females and males, *p* = 1.00, n.s., or between Cantel females and males, *p* = 1.00, n.s. However, while Nahualá females are significantly more K'ichee'-dominant in Language Attitudes than both Cantel females and males, at $p < .01$ and $p < .05$ respectively, there is no significant difference in Language Attitude between Nahualá males and Cantel males, *p* = .282, n.s., or between Nahualá males and Cantel females, *p* = .095, n.s.

Anthropological studies in Nahualá have found that fewer females tend to speak Spanish, are less educated, and, when they do go to school, they are given less opportunities to succeed than males and are more likely to drop out (Hanamaikai & Thompson, 2005; Semus, 2005) while a recent study in Cantel showed that both females and males have access to bilingual education, though the vast majority of both genders use Spanish more since it is more useful in nearby Quetzaltenango (Van Sistine & Levi, 2008). While the females from Nahualá in this study are bilingual and are not significantly different than the Nahualá males in any module of the BLP, they are significantly more K'ichee'-dominant than Cantel females and males in both Language

[34] Nahualá females and males were both significantly more K'ichee'-dominant in Language Use than both Cantel females and males at $p < .01$.

Use and Attitude, whereas Nahualá males are only significantly more K'ichee'-dominant than Cantel females and males in Language Use. Overall, the Nahualá females display the smallest variance in BLP scores of any of the four groups, ranging from K 31.4 to K 73.3, which may in part be due to the Nahualá gender differences of language use reported in the literature and reflected in the BLP findings in this study.[35]

Previous research among bilinguals and with the BLP has shown that language use seems to be a consistent factor in bilingual language dominance (Amengual, 2013). Among the speakers in this study, speaker NM2, the only Spanish-dominant bilingual from Nahualá, scored similarly to the other participants from Nahualá in every category but Language Use, where he was very Spanish-dominant. While speaker NM2 was born, raised, and continues to live in Nahualá, he has recently begun attending a university in Quetzaltenango were his required daily use of Spanish has increased. Similarly, the two males from Cantel that are K'ichee'-dominant, speakers CM1 and CM3, were the most K'ichee'-dominant in Language Use of all the Cantel bilinguals. It should be noted that the BLP scores for Language Use may be slightly skewed towards Spanish-dominant; one of the questions in this section of the BLP asks how often a participant counts in each language, and, as mentioned in Section 2.2.1, most K'ichee' speakers do not know, or at least don't use, K'ichee' numbers, they use Spanish numbers while counting, even while speaking K'ichee'. The results of this question of the BLP further illustrate this practice as every speaker, regardless of language dominance, stated that he or she used Spanish while counting at least 80% of the time, meaning that some speakers may be even more K'ichee'-dominant that these BLP results indicate.

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[35] The Standard Deviations of the overall BLP scores for the four groups are the following: Nahualá females, 18.8; Nahualá males, 54.2; Cantel females, 26.4; Cantel males, 40.3.

The differences in Linguistic Attitudes section of the BLP between the two communities reflect their attitudes toward the Spanish language and the ladino (non-Mayan) culture it represents; Romero (in press:27) states that most K'ichee' are proud of their culture and language and believe that "ladinos do not really have a solid identity". As noted in Figure 3.2, the BLP results of the Language Attitudes module in this study demonstrate that the difference is not one between K'ichee'-dominance and Spanish-dominance, like it is in Language Use, but rather one between K'ichee'-dominance and a balanced score of zero, particularly for the speakers in Cantel, where five of twelve speakers had a BLP Language Attitudes score of exactly zero.[36] These results demonstrate that none of the bilinguals analyzed in this dissertation appear to have negative attitudes towards K'ichee' language and culture, while at the same time, bilinguals from Cantel tend to have more positive attitudes towards Spanish language and culture than those from Nahualá.

### 3.6. SUMMARY

This chapter has provided a description of syntactic and prosodic focus marking in K'ichee' and Spanish, introduced research questions and hypotheses, and described the experimental design and the participants. The experiments outlined in this chapter analyze the prosodic characteristics of focus marking in both spontaneous and lab speech and their interaction with different syntactic structures. The goal of these experiments is to (i) analyze the prosodic characteristics of contrastive focus constituents in both languages; (ii) to explore the interaction between syntactic focus marking and prosodic focus marking; (iii) to examine the role of phonological differences between the dialects

[36] Of the 24 bilinguals, only 4 had Spanish-dominant Language Attitude scores; the most K'ichee'-dominant score was K 54.8 (NF6) and the most Spanish-dominant score was S 11.36 (CF2).

spoken in the communities and how they relate to focus marking; and (iv) to examine phonetic transfer, convergence, and variation in the intonational contours of the bilinguals by considering the role of language dominance in their productions.

# 4. Contrastive focus marking in K'ichee'

The present chapter analyzes the syntactic structure and the suprasegmental characteristics used in contrastive focus marking in K'ichee' by the Spanish-K'ichee' bilinguals from Nahualá and Cantel in both naturalistic and lab speech. The main goals of this chapter are to assess which syntactic structure or structures are used in K'ichee' to mark contrastive focus, to analyze if any prosodic prominence is given to a contrastive focus constituent when compared to a broad focus constituent in K'ichee', to explore possible gender and dialectal differences in focus marking, and, finally, to assess possible correlations of features of prosodic focus marking with bilingual language dominance, as interpreted by the Bilingual Language Profile (BLP).

The previous analyses of contrastive focus marking in K'ichee' have demonstrated that the primary strategy for marking a focus constituent involves a change in the basic VOS word order in which the focused nominal occurs in a preverbal position and is introduced by an emphatic particle, such as *are* (Can Pixabaj & England, 2011; López Ixcoy, 1997; Par Sapón & Can Pixabaj, 2000; among others). Other strategies of focus marking include two types of in situ focus for subjects of intransitive verbs and objects of transitive verbs: one that includes an emphatic particle and one that does not (Velleman, in press). While most studies have primarily documented these changes in word order, few have analyzed the prosodic features associated with focus constituents in K'ichee', and this research is limited to Yasavul's (2013) comparison of focused and topicalized Spanish proper names with paroxytone stress patterns within larger K'ichee' utterances. Thus, a more in-depth acoustic analysis of these prosodic features is needed (Can Pixabaj & England, 2011; Velleman, in press).

The experiments set forth in this chapter investigate differences in prosodic features between contrastive and broad focus constituents in K'ichee'. Twenty-four (24) native Spanish-K'ichee' bilinguals (see Section 3.5) participated in the two experiments presented in this chapter: the sociolinguistic interview and the question-answer production task. The research questions addressed in this chapter are the following:

(1) What type of syntactic structure do these Spanish-K'ichee' bilinguals from Nahualá and Cantel use when marking contrastive focus in K'ichee'? Do they use the preverbal nominal with the emphatic particle, an in situ focus structure, an in situ focus structure with an emphatic particle at the beginning, or a combination of these structures?

(2) Do these speakers give more prosodic prominence to a contrastive focus constituent than to a broad focus constituent in K'ichee'? How is this prominence realized across different syntactic structures of contrastive focus?

(3) Are there gender differences in the prosodic focus marking of these bilinguals? Do males and females mark focus in different ways and to different degrees?

(4) Are there dialectal differences in prosodic focus marking? Do the phonological differences between the two dialects, i.e. the lack of phonemic vowel length in Cantel, have any consequences on prosodic focus marking?

(5) Is there a correlation between language dominance and the acoustic realizations of prosodic focus marking of these bilinguals? Do Spanish-dominant bilinguals mark contrastive focus to a greater degree than K'ichee'-dominant bilinguals?

The remaining sections of this chapter are organized as follows: Section 4.1 describes the results of the sociolinguistic interviews in K'ichee', while Section 4.2

presents the results of the production task in K'ichee'; Section 4.3 analyzes possible correlations of different prosodic features of contrastive focus with bilingual language dominance and the overall results of this chapter are discussed in Section 4.4 and concluded in Section 4.5.

### 4.1. SOCIOLINGUISTIC INTERVIEWS

The importance of naturalistic data in the analyses of intonational systems has been highlighted by Face (2003) and discussed in Chapter 1. As mentioned in Section 3.4.3, the bilinguals in this study participated in a conversation with a native speaker of K'ichee' of the same gender and dialect, and, in order to insure examples of contrastive focus in the sociolinguistic interviews, the interviewer purposely elicited contrastive focus at various times throughout the interview. The number of contrastive focus elicitations ranged from 1 to 4 per participant, depending on the flow of the conversation, and yielded a total of 31 elicitations of contrastive focus nouns in Nahualá and 39 in Cantel.

Nonetheless, the data obtained from these interviews is entirely uncontrolled; the focus constituent appears in phrases of all sizes and in various positions throughout the phrase, mostly phrase final. Furthermore, the focus constituent was most commonly a word that did not end in a nasal consonant and subsequently devoiced, not allowing for an analysis of the intonational contour throughout the syllable. In these cases, the pitch peak, which commonly occurs near the end of the syllable during the coda in K'ichee' (Baird, in press), could not be located. Consequently, an in-depth acoustic analysis of the examples of contrastive focus obtained via the sociolinguistic interviews is not possible. However, the elicitations were analyzed for intonational patterns that were common in both broad focus and contrastive focus conditions and are discussed in the following subsections.

### 4.1.1 Intonational contours in Nahualá

Of the 31 examples of contrastive focus elicited in the sociolinguistic interviews in Nahualá K'ichee', only 17 were of nouns, either subjects or objects, and rest were of verbs. Of these 17 examples, 12 marked focus via a change in word order and the emphatic particle *are* and the other 5 were marked by the speaker only repeating the noun in isolation.[37]

Sample pitch tracks that are representative of the tokens produced by the Nahualá bilinguals in both broad and contrastive focus contexts are presented in Figure 4.1. In Figure 4.1a, the broad focus utterance (*le nueve meses rajawaxik kat'il*) *rumal jun la'jtuj* "(during the nine months it is important that you are seen/examined) by a midwife" with the contrastive focus *are la'jtuj* "(no), a midwife". In both utterances, the constituent *la'jtuj* is in utterance-final position, which causes the peak to occur earlier (Baird, in press), though the voiceless onset and coda in the tonic syllable /tuχ/ of the constituent do not allow for a complete assessment of the location of height of the valley or peak. The contrastive focus constituent reached a higher pitch, 247 Hz, than the broad focus constituent, 218 Hz. However, the constituent was slightly longer in broad focus, 557 ms, than in contrastive focus, 548 ms.

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[37] The 14 examples of verbs being focused were also marked by the speaker just repeating the verb in isolation, although in 5 cases the repetition of the verb was followed by a repetition of the entire utterance; however, the analysis of verbs that are marked for contrastive focus is outside of the scope of this project.

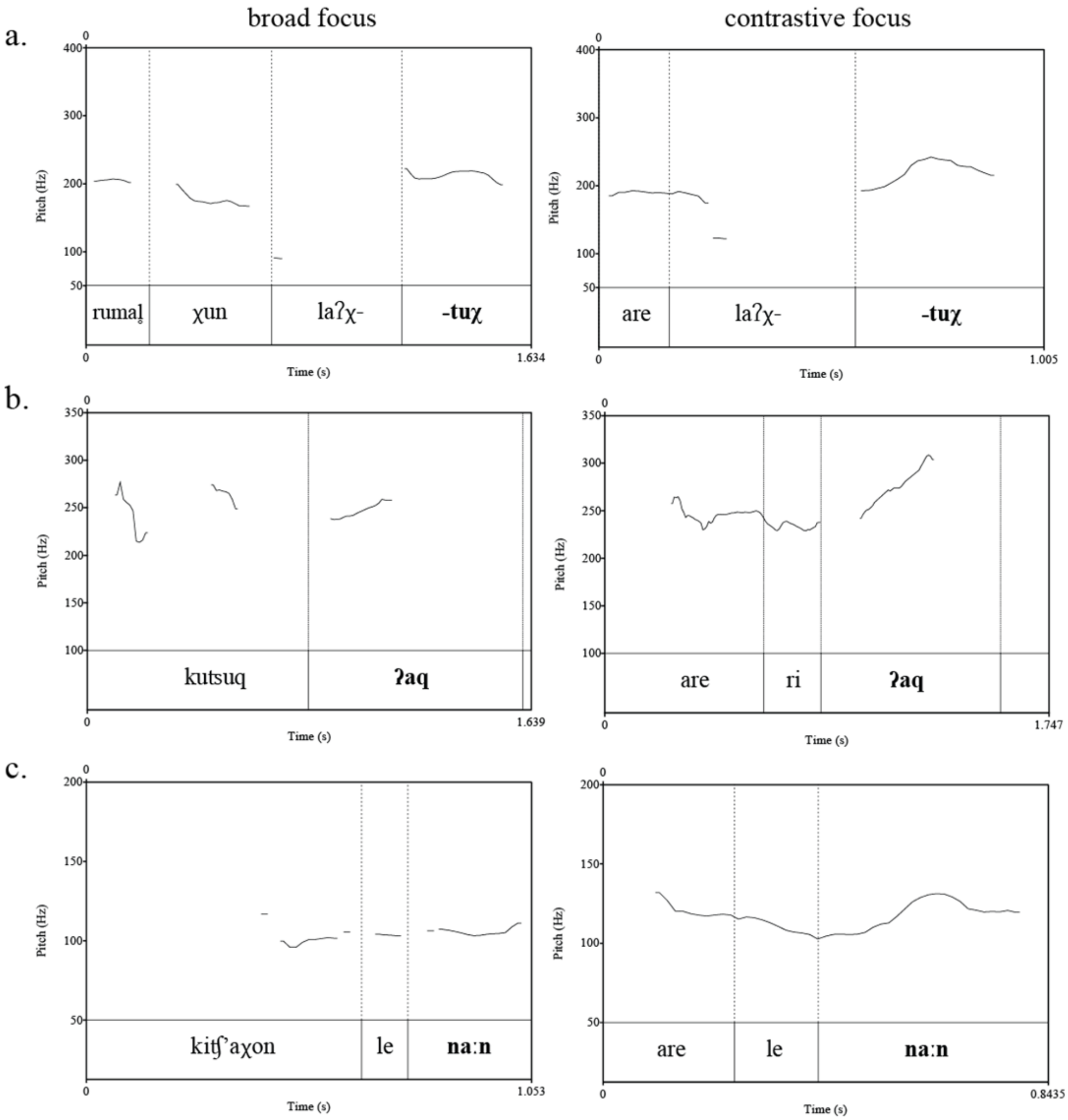


Figure 4.1: Sample pitch tracks from speakers NF1 (a), NF2 (b) and NM2 (c), on the left is a broad focus utterance and on the right is the corresponding contrastive focus utterance.

Figure 4.1b is a comparison of the broad focus utterance *kutzuq aq* "s/he feeds pigs" and the contrastive focus utterance *are ri aq* "(no), the pigs". The pitch contour rises in *aq* in both pragmatic conditions the contour peaks at a higher point in the contrastive focus condition: 316 Hz in contrastive focus as compared to 264 Hz in broad focus. The focus constituent *aq* was marginally longer in contrastive focus than in broad focus: 511 ms compared to 498 ms. Again, it is not possible to assess such features as the alignment of the valley or the peak in these examples, due to the voiceless onset and coda of *aq*.[38]

Finally, Figure 4.1c presents a comparison of the broad focus utterance (*keka'na*) *kich'ajon le naan* (*chuchi le b'inb'al ja'*) "the mothers (would go do) their laundry (on the banks of the river)" with the contrastive focus *are le naan* (*ka'nowik*) "(no), it was the mothers (that would do it)". Since the entire constituent is comprised of nasal consonants and vowels and located in phrase medial position in both utterances, it is possible to examine all of the acoustic features of prosodic marking in this example. The contrastive focus constituent *naan* was marginally longer the broad focus constituent, 435 ms compared to 422 ms, and there were similar valley heights between the constituents in the two utterances: 105 Hz in contrastive focus and 106 Hz in broad focus. However, the contrastive focus constituent had a higher pitch peak than in broad focus, 131 Hz compared to 112 Hz, an earlier peak alignment score, .589 compared to .903, an earlier valley alignment score, .239 compared to .807, a greater overall rise, 26 Hz compared to 6 Hz, and a steeper slope, .177 compared to .133.

[38] Phonologically, K'ichee' does not permit adjacent vowels and all words that begin with a vowel are claimed to begin with a glottal stop in order to avoid possible adjacency with a preceding word that may end in a vowel, such as *ri aq* in Figure 4.2a (López Ixcoy, 1997). Phonetically, intervocalic position is one of the few places where full glottal stops are canonically produced in K'ichee' and not reduced to creaky voice (Baird, 2011).

### 4.1.2 Intonational contours in Cantel

Of the 39 examples of contrastive focus elicited in the sociolinguistic interviews in Cantel K'ichee', 23 were of nouns, either subjects or objects, and rest were of verbs. Of these 23 tokens of contrastive focus of nouns, only 11 involved moving the constituent to a preverbal position with the emphatic particle *are*. The rest involved marking the constituent in an *in situ* structure or producing the constituent in isolation.[39]

Sample pitch tracks that are representative of broad and contrastive focus tokens elicited in the sociolinguistic interviews in Cantel are presented in Figure 4.2. Figure 4.2a is a comparison of the broad focus (*nan tat kkiya) ri rikil (chi re kek'astajik*) "(the parents give them) food (when they get up)" and the broad focus *are kirikil* "(no), it's their food". While the voiceless onset and coda in the tonic syllable /kil̥/ of the constituent *rikil* conceal the location and height of valley and the peak, the contrastive focus constituent was longer than the same constituent in broad focus, 531 ms compared to 398 ms, and it reached a higher pitch in the contour produced during the tonic syllable nucleus /i/, 371 Hz compared to 295 Hz.

In Figure 4.2b, the broad focus utterance *le utz taj mes* "bad (inorganic) trash" is compared to the contrastive focus utterance *are le mes* (*kub'anow k'ax che*) '(no), it's the trash (that is harming it). In these two examples there is no real difference in peak height, 303 Hz in broad focus and 308 Hz in contrastive focus. Furthermore, the broad focus constituent is longer, 341 ms, than the contrastive focus constituent, 295 ms; however, the contrastive focus constituent is located in phrase-medial position while the broad focus constituent is in phrase-final position, where it undergoes phrase-final lengthening in Cantel K'ichee' (Baird, in press). The valley in the broad focus condition

[39] As in Nahualá, a focused verb was marked via repeating the verb in isolation, followed by a repetition of the entire utterance in 12 of the 16 tokens.

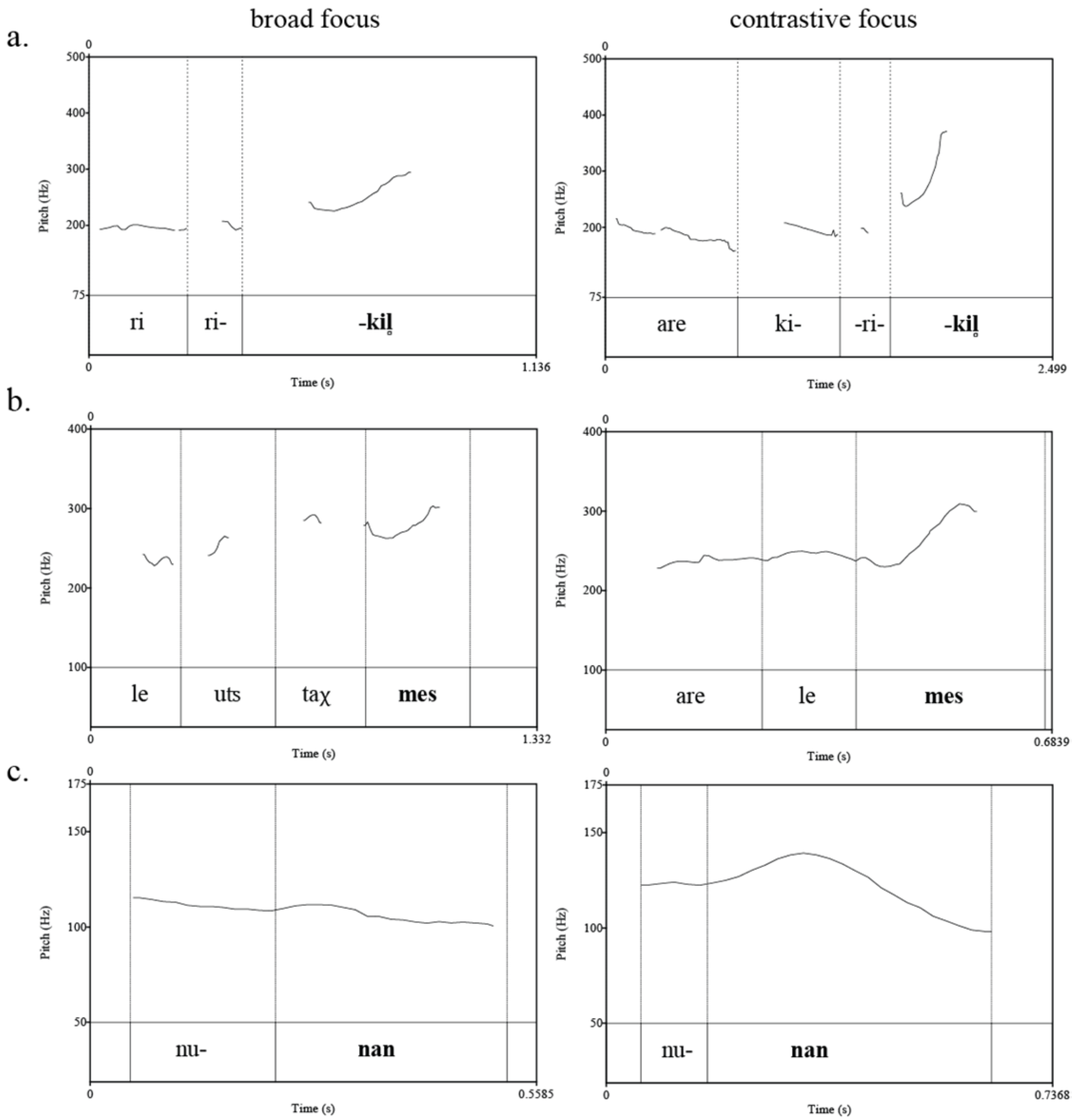


Figure 4.2: Sample pitch tracks from speakers CF2 (a), CF4 (b) and CM6 (c), on the left is a broad focus utterance and on the right is the corresponding contrastive focus utterance.

is higher than in contrastive focus: 262 Hz compared to 229 Hz, which consequently makes the rise bigger in contrastive focus than in broad focus: 79 Hz compared to 41 Hz.

Again, the voiceless coda on the constituent impedes the continuation of the pitch track and does not allow for an analysis of peak alignment or the exact height of the peak.

Finally, in Figure 4.2c, the broad focus utterance (*kinuto'*) *le nunan* "my mother (helps me)" is compared to the corresponding contrastive focus *nunan* "my mother" which was produced in isolation. Similar to Figure 4.1c, the constituent is *nan*, which consists of voiced segments and can be examined more than other constituents. The constituent is longer in contrastive focus than in broad focus, 614 ms compared to 468 ms, and it also reaches a higher peak, 140 Hz compared to 112 Hz. The valley is higher in contrastive focus, 121 Hz, than in broad focus, 103 Hz; however, since the contrastive focus constituent was produced in isolation, it appears at the beginning of the utterance and it is not subject to as much declination as the same constituent in broad focus, which appears in phrase-final position.[40] The valley alignment is similar in the two pragmatic contexts and the pitch peak appears earlier in broad focus, but again, research on K'ichee' (and several other languages) has shown phrase-positional effects on intonational contours in broad focus utterances (Baird, in press). Finally, the contrastive focus constituent has a greater rise than the broad focus constituent, 19 Hz compared to 9 Hz, and a steeper slope, and the rise is marginally steeper in contrastive focus; .168 compared to .15.

### 4.1.3 Discussion of naturalistic data

The sample pitch tracks shown from both dialects are representative of the tokens of contrastive focus elicited in the sociolinguistic interviews and demonstrate four things: (i) a tendency for the Nahualá speakers to mark contrastive focus via a change in word

[40] Declination is the gradual, time-dependent downsloping of an intonational contour throughout an utterance or breath group (Gussenhoven, 2004).

order and the emphatic particle *are* more than the Cantel speakers, (ii) an indication that contrastive focus constituents are prosodically marked in K'ichee', (iii) a tendency for Cantel speakers to mark contrastive focus with a longer duration than Nahualá speakers, and (iv) the effects of different uncontrolled variables in the dataset, such as the position of the constituent within the phrase and voiceless consonants within the constituent. As these tokens are uncontrolled, they do not allow for an in-depth analysis of all of the acoustic features of prosodic focus marking; only two tokens in the entire task consisted entirely of voiced segments, the constituent *naan/nan* "mother" demonstrated in Figures 4.1c and 4.2c, and could be fully examined.

### 4.2. PRODUCTION TASK

Since the production task generates a more controlled data set, a more in-depth acoustic analysis is possible. The methodology of the production task, the materials used, the procedure, and the methods of analysis are all outlined in Chapter 3 (see Section 3.4). The production task elicited a total of 1,920 tokens, of which 44 (2.3%) were discarded due to reasons such as non-responses, incorrect responses or placing the target word at the end of an utterance. The results are presented in the following subsections according to syntactic structure and the acoustic features of focus marking outlined in Section 3.4.5.

#### 4.2.1 Syntactic structure of contrastive focus in K'ichee'

The production task methodology did not control for the specific syntactic structure used in the contrastive focus context. Consequently, the speakers in this study produced a variety of the three possible syntactic structures mentioned above. A breakdown of the results of syntactic structure selection by speaker in the production task in Nahualá and Cantel can be seen in Tables 4.1 and 4.2, respectively. These results show

| Speaker | are + fronted subject | in situ | are + in situ |
|---|---|---|---|
| NF1 | 39 (97.5%) | 1 (2.5%) | - |
| NF2 | 40 (100%) | - | - |
| NF3 | 40 (100%) | - | - |
| NF4 | 40 (100%) | - | - |
| NF5 | 39 (97.5%) | 1 (2.5%) | - |
| NF6 | 40 (100%) | - | - |
| NM1 | 39 (97.5%) | - | 1 (2.5%) |
| NM2 | 40 (100%) | - | - |
| NM3 | 38 (100%) | - | - |
| NM4 | 40 (100%) | - | - |
| NM5 | 38 (100%) | - | - |
| NM6 | 40 (100%) | - | - |
| **Total** | **473 (99.4%)** | **2 (0.4%)** | **1 (0.2%)** |

Table 4.1: Number of occurrences of each syntactic structure of contrastive focus in the K'ichee' production task for Nahualá speakers.

| Speaker | are + fronted subject | in situ | are + in situ |
|---|---|---|---|
| CF1 | 14 (37.8%) | 23 (62.3%) | - |
| CF2 | 40 (100%) | - | - |
| CF3 | 3 (7.5%) | 37 (92.5%) | - |
| CF4 | 1 (2.5%) | 3 (7.5%) | 36 (90%) |
| CF5 | 16 (40%) | 23 (62.3%) | 1 (2.5%) |
| CF6 | 39 (97.5%) | 1 (2.5%) | - |
| CM1 | 34 (100%) | - | - |
| CM2 | 21 (58.3%) | 15 (41.7%) | - |
| CM3 | 4 (12.2%) | 28 (84.8%) | 1 (3%) |
| CM4 | 1 (2.5%) | 9 (22.5%) | 30 (75%) |
| CM5 | - | 40 (100%) | - |
| CM6 | 40 (100%) | - | - |
| **Total** | **213 (46.3%)** | **179 (38.9%)** | **68 (14.8%)** |

Table 4.2: Number of occurrences of each syntactic structure of contrastive focus in the production task for Cantel speakers.

that speakers from Nahualá used the *are + fronted subject* syntactic structure nearly 100% of the time to mark contrastive focus, while speakers from Cantel used varieties of in situ structures to mark focus at a significantly higher rate, $F_{(1, 22)} = 139.166$, $p < .001$.[41] Further analyses reveal no differences between genders within each dialect.[42]

As described in Section 3.4.3.1, the materials in the K'ichee' production task were designed so that the target word would be in the same location in the utterance in both broad focus and the *are + fronted subject* contrastive focus structure: the third of four words in the utterance. In cases where speakers produced an *in situ* contrastive focus structure, the target word was still the third of four words in the utterance since the utterance itself was identical to that of the broad focus context; however, it should be noted that in tokens of the *are + in situ* structure, the utterance was identical to the in situ and broad focus contexts with the exception of the emphatic particle *are* at the beginning and, consequently, the target word was the fourth of five words in these utterances. The acoustic analyses of the different prosodic features of these utterances are presented in the following sections.

### 4.2.2 Acoustic analyses of contrastive focus marking in K'ichee'

The acoustic data were analyzed via a series of Linear Mixed Models with Pragmatic Condition, Gender, and Dialect as factors (with Broad Focus, Male, and Nahualá as reference levels), Age as a continuous covariate, the measurement of the particular acoustic feature being analyzed as the dependent variable, and Speaker and

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[41] Via a one-way ANOVA with dialect as the independent variable and percent of tokens that were of the *are + fronted subject* structure for each speaker as the dependent variable.

[42] A similar one-way ANOVA with speaker group (Nahualá female, Nahualá male, Cantel female, Cantel male) as the independent variable had a main effect, $F_{(3, 20)} = 5.734$, $p < .01$. Post Hocs (Bonferroni) revealed that both Nahualá female and Nahualá male were significantly different from Cantel female and Cantel male at $p < .05$, there were no differences between groups from the same dialect at $p = 1.00$, n.s.

Token designated as random effects.[43,44] Since the speakers produced different syntactic structures of contrastive focus, the pragmatic condition factor subsequently consisted of four levels: broad focus, *are + fronted subject* contrastive focus, *in situ* contrastive focus and *are + in situ* contrastive focus. In these cases, the differences between the four levels were further explored via Bonferroni pairwise comparisons. As the results of the group Linear Mixed Models showed very little variation for Token, the individual speaker data were analyzed via a series of one-way ANOVAs with Pragmatic Condition as the Independent Variable and the particular acoustic measurement as the dependent variable. A Bonferroni pairwise comparison was only performed on an individual speaker if the speaker produced at least 5 tokens of each type of syntactic structure of contrastive focus.[45] While the group means and standard deviations are presented below, the individual speaker means and standard deviations are found in Appendix D.

Figures 4.3-4.6 demonstrate the average pitch contour of the tonic syllable of the target word across the different pragmatic contexts of all of the utterances for each speaker; for speakers from Cantel, the different syntactic structures of contrastive focus marking are also shown. These average pitch contours take into account all of the acoustic features of contrastive focus mentioned in Section 3.4.5, and, as seen in these

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43 Language Dominance was not included as a factor in order to avoid multicollinearality with Dialect, with which it was highly correlated (see Balling, 2008).

44 For Peak Height, Peak Alignment, Valley Height, Valley Alignment, and Rise the final Hessian matrix was not positive for Token although all convergence criteria were satisfied.

45 While statistical analyses are possible with less than 5 tokens, it was felt that they were not as reliable as analyses with more tokens of each syntactic structure. For example, several speakers produced only 1-4 tokens of a particular syntactic structure, which is only 2.5%-10% of the contrastive focus data elicited. These means would be compared to the means of the other 90%-97.5% of contrastive focus tokens if they were included in the analyses. 5 was chosen as the threshold for inclusion in the analyses in this dissertation since it excluded the data of those speakers that only produced 1-4 tokens of a particular syntactic structure of contrastive focus and the lowest number of tokens included from a syntactic structure in any analysis was 9, which was 22.5% of the contrastive focus data produced by speaker CM4 in K'ichee' (see Table 4.2).

figures, the speakers in this study demonstrate a greater excursion of their pitch contours in contrastive focus conditions. The following subsections are dedicated to the individual analyses of duration, peak height, peak alignment, valley height, valley alignment, rise, and slope in order to define exactly how these greater pitch excursions are realized.

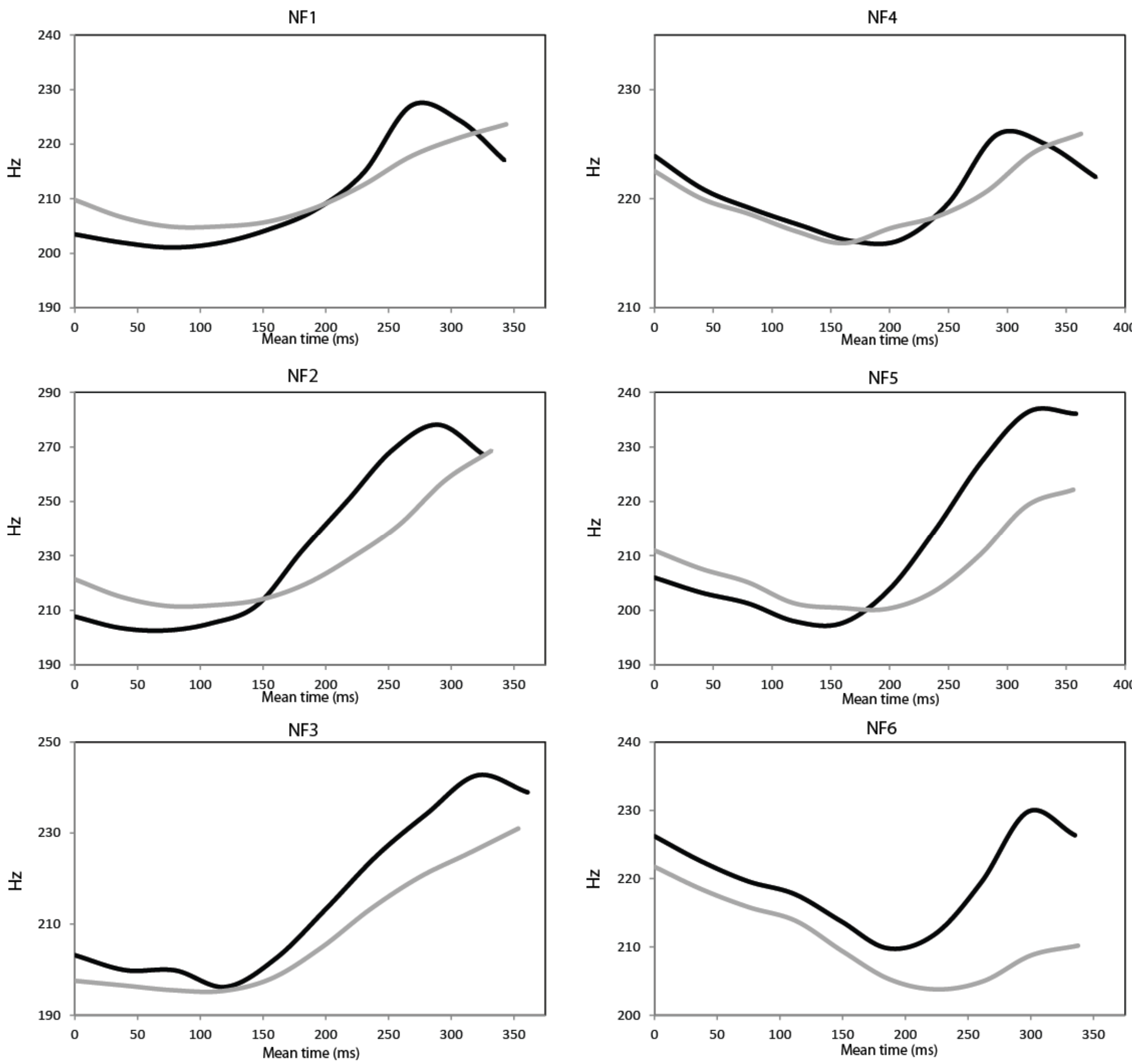


Figure 4.3: Nahualá female speakers: average pitch contours of the tonic syllable in broad focus (gray line) and *are + fronted subject* contrastive focus (black line) conditions.

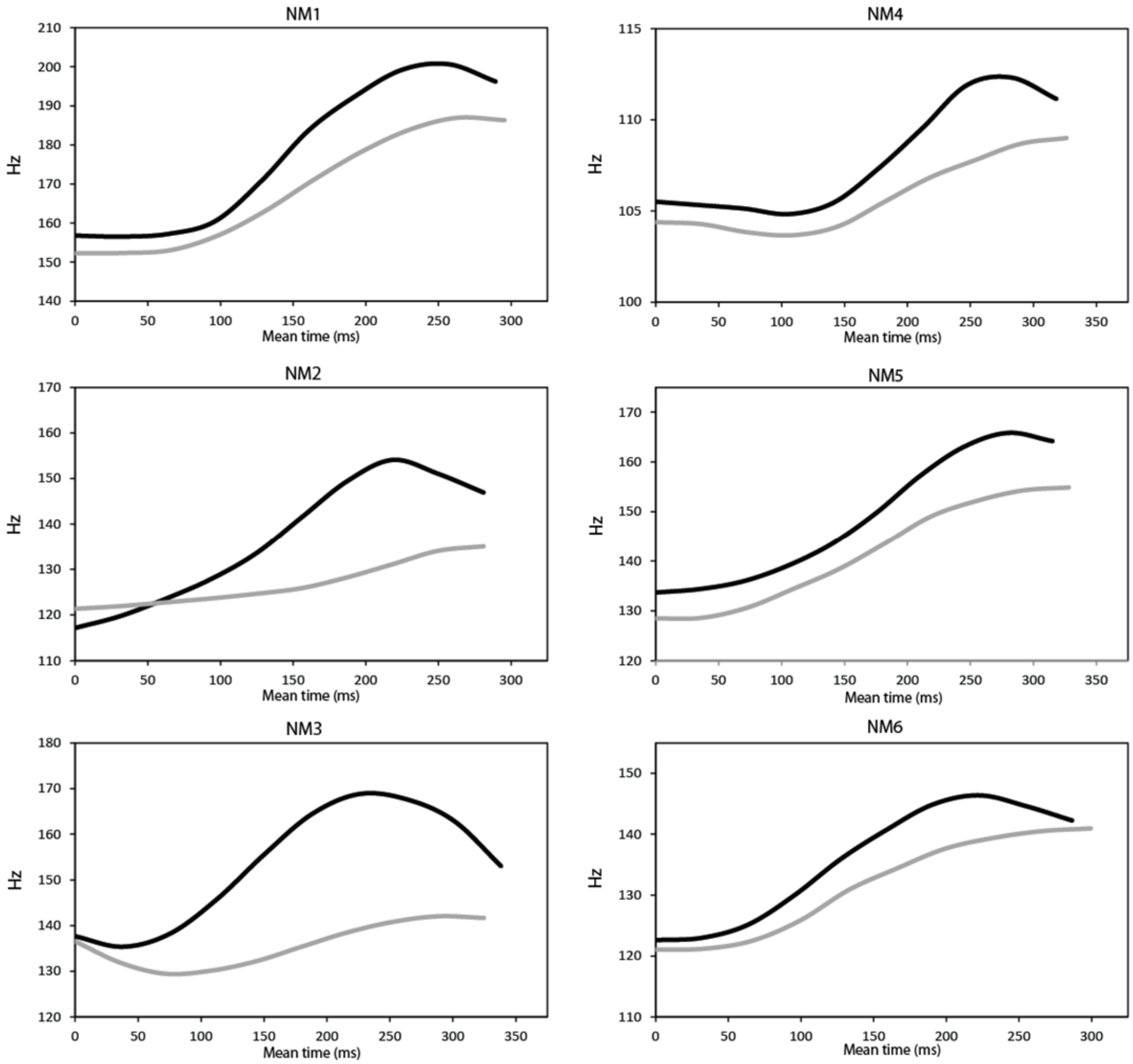


Figure 4.4: Nahualá male speakers: average pitch contours of the tonic syllable in broad focus (gray line) and *are + fronted subject* contrastive focus (black line) conditions.

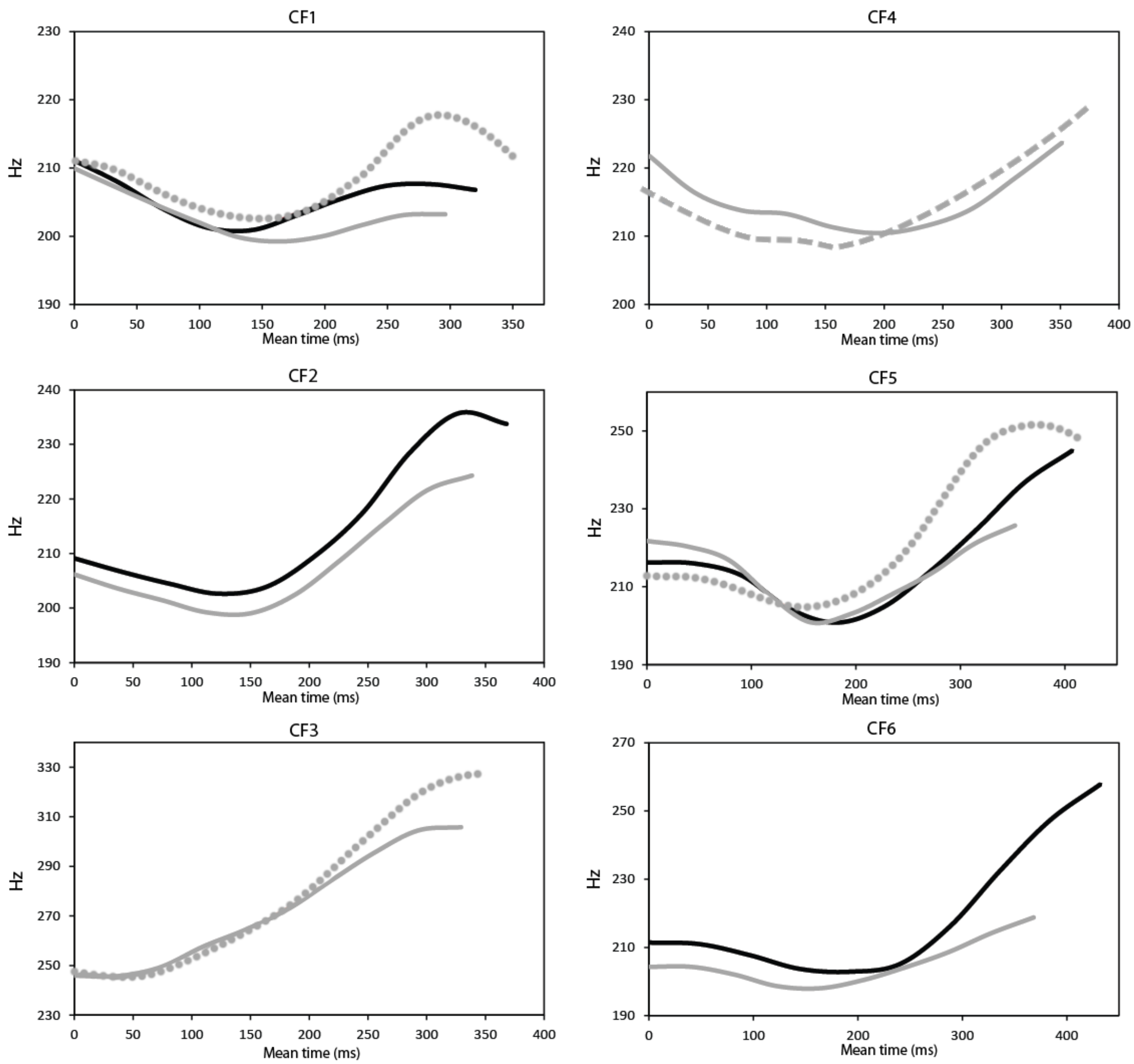


Figure 4.5: Cantel female speakers: average pitch contours of the tonic syllable in broad focus (solid gray line), *are + fronted subject* contrastive focus (solid black line), *in situ* contrastive focus (dotted gray line) and *are + in situ* contrastive focus (dashed gray line, only speaker CF4) conditions.

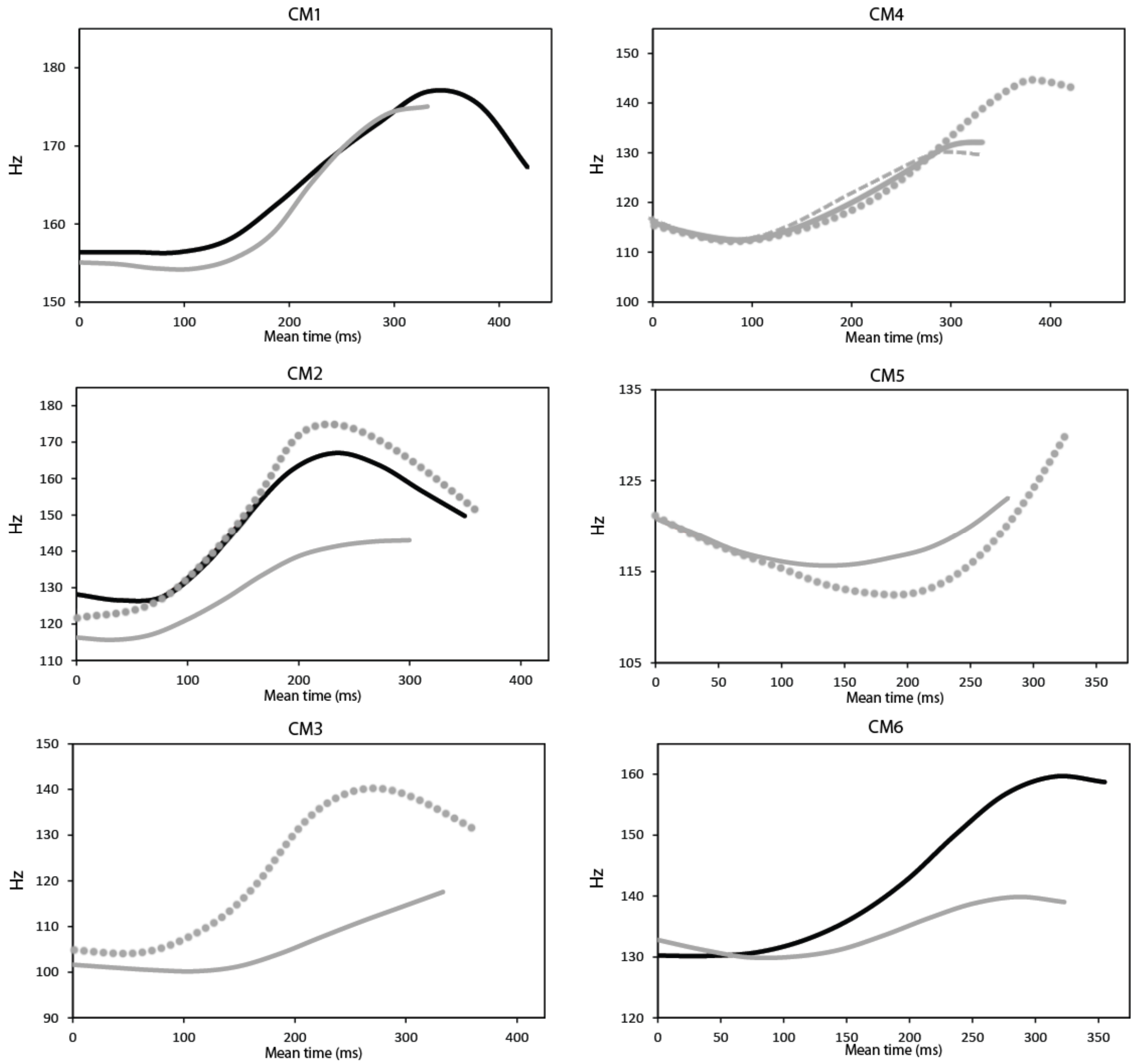


Figure 4.6: Cantel male speakers: average pitch contours of the tonic syllable in broad focus (solid gray line), *are + fronted subject* contrastive focus (solid black line), *in situ* contrastive focus (dotted gray line) and *are + in situ* contrastive focus (dashed gray line, only speaker CM4) conditions.

#### *4.2.2.1 Duration*

The group means, Linear Mixed Model results, and Bonferroni results of Duration are presented in Tables 4.3-4.5 and these results, grouped according to gender and dialect, are illustrated in Figure 4.7.

| Means (SD)- Duration (ms) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 354 (49) | 322 (60) | 328 (44) | 348 (66) |
| Broad Focus | 328 (45) | 343 (78) | 314 (79) | 328 (76) | 328 (76) |
| In Situ Contrastive Focus | 361 (68) | 388 (80) | 354 (110) | - | 361 (68) |
| Are + Fronted Subject Contrastive Focus | 344 (65) | 365 (79) | 336 (80) | 327 (76) | 355 (81) |
| Are + In Situ Contrastive Focus | 349 (52) | 369 (27) | 292 (31) | - | 349 (52) |

Table 4.3: Mean (SD) of Duration (ms) across all factors.

| Linear Mixed Model- Duration | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **316.75 (19.7)** | **$F_{(1, 41.078)}$ = 285.582, $p$ < .001** | **275.9** | **335.6** |
| **Pragmatic Condition** | **15.52 (8.5)** | **$F_{(3, 1856.53)}$ = 4.134, $p$ < .01** | **11.1** | **25.6** |
| **Gender** | **29.1 (11.3)** | **$F_{(1, 117.88)}$ = 4.78, $p$ < .05** | **5.6** | **52.7** |
| **Dialect** | **25.4 (10.8)** | **$F_{(1, 20.483)}$ = 5.854, $p$ < .01** | **22.8** | **31.9** |
| Age | -.07 (.39) | $F_{(1, 54.598)}$ = .439, $p$ = .511, n.s. | -.88 | .73 |
| Pragmatic Condition * Gender | -.07 (4.9) | $F_{(3, 1855.27)}$ = .345, $p$ = .793, n.s. | -9.8 | 9.7 |
| **Pragmatic Condition * Dialect** | **47.4 (5.1)** | **$F_{(1, 1856.84)}$ = 86.973, $p$ < .001** | **37.5** | **57.4** |
| Pragmatic Condition * Age | .46 (1.2) | $F_{(3, 1855.68)}$ = 1.206, $p$ = .254, n.s. | -1.9 | 2.7 |
| Random Effects | | | | |
| Residual | 2152 (70.99) | - | - | - |
| Speaker | 640.5 (212.1) | - | - | - |
| Token | 1.28 (6.01) | - | - | - |
| Model Information Criteria (BIC) = 19803.078 | | | | |

Table 4.4: Results of Linear Mixed Model of Duration: significant results are in bold.

| Bonferroni Pairwise Comparisons- Duration | |
|---|---|
| Comparison | Significance |
| ***in situ* > broad focus** | ***p* < .001** |
| ***in situ* > *are* + *fronted subject*** | ***p* < .05** |
| ***in situ* > *in situ* + *are*** | ***p* < .001** |
| ***are* + *fronted subject* > broad focus** | ***p* < .001** |
| *are* + *fronted subject* ≈ *are* + *in situ* | *p* = .191 |
| *are* + *in situ* ≈ broad focus | *p* = 1.00 |

Table 4.5: Results of Bonferroni Pairwise Comparisons of Pragmatic Condition of Duration: significant results are in bold.

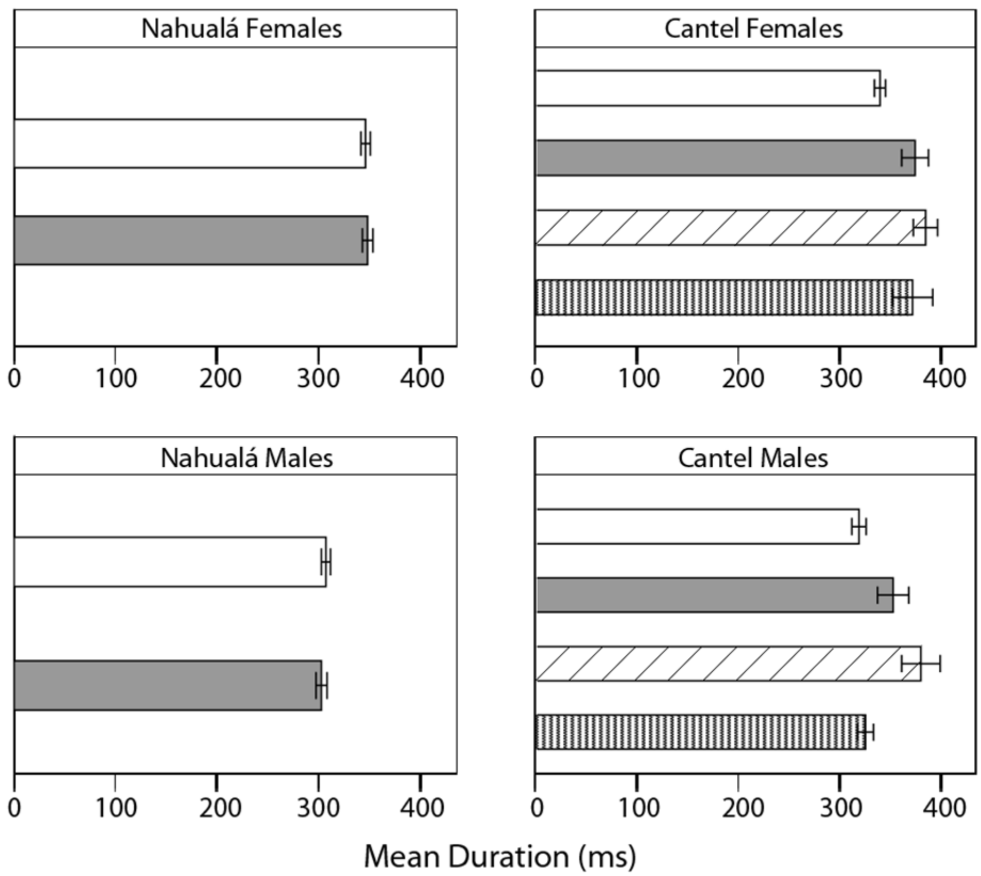


Figure 4.7: Bar graphs of mean duration of tonic syllable (ms) in K'ichee' in all pragmatic conditions: broad focus (white), *are + fronted subject* contrastive focus (gray), *in situ* contrastive focus (diagonal lines) and *are + in situ* contrastive focus (vertical lines). 95% confidence interval bars included.

The results of the Linear Mixed Model reveal that there is a main effect of Gender, Dialect, and Pragmatic Condition on the Duration of the tonic syllable. Specifically, females produced a longer tonic syllable than males across all four pragmatic conditions, Cantel speakers produced a longer tonic syllable than Nahualá speakers, and the Bonferroni pairwise comparisons demonstrate that *in situ* contrastive focus was significantly longer than the other pragmatic conditions while the syntactically marked *are* + fronted subject contrastive focus condition was longer than broad focus. The significant interaction between Pragmatic Condition and Dialect reveals that, while speakers from Cantel are using a significantly longer duration to mark contrastive focus, Nahualá speakers are not.

The individual speaker analyses presented in Tables 4.6 and 4.7 confirm these findings; all speakers from Cantel significantly lengthen the tonic syllable in contrastive focus while none of the speakers from Nahualá significantly lengthen the tonic syllable in the same condition. Furthermore, the speakers from Cantel that produced more than one syntactic structure to mark contrastive focus always marked the *in situ* focus with a significantly longer duration than broad focus and CM4 also marked it with a longer duration than *are* + *in situ* contrastive focus.

| Individual Speaker ANOVAs- Duration | | | | | |
|---|---|---|---|---|---|
| NF1 | NF2 | NF3 | NF4 | NF5 | NF6 |
| $F_{(1, 78)}$ = .023, $p$ = .879, n.s. | $F_{(1,78)}$ = 1.109, $p$ = .316, n.s. | $F_{(1, 78)}$ = .963, $p$ = .329, n.s. | $F_{(1, 73)}$ = 2.015, $p$ = .16, n.s. | $F_{(1, 74)}$ = .070, $p$ = .792, n.s. | $F_{(1, 73)}$ = .109, $p$ = .743, n.s. |
| NM1 | NM2 | NM3 | NM4 | NM5 | NM6 |
| $F_{(1, 78)}$ = 1.135, $p$ = .29, n.s. | $F_{(1, 78)}$ = .001, $p$ = .984, n.s. | $F_{(1, 77)}$ = 2.771, $p$ = .1, n.s. | $F_{(1, 78)}$ = 1.022, $p$ = .315, n.s. | $F_{(1, 78)}$ = 2.328, $p$ = .131, n.s. | $F_{(1, 76)}$ = 2.419, $p$ = .119, n.s. |
| **CF1*** | **CF2** | **CF3** | **CF4** | **CF5*** | **CF6** |
| **$F_{(2, 72)}$ = 6.313, $p < .01$** | **$F_{(1, 77)}$ = 12.72, $p < .001$** | **$F_{(1, 76)}$ = 5.67, $p < .01$** | **$F_{(1, 76)}$ = 3.562, $p < .05$** | **$F_{(2, 78)}$ = 16.846, $p < .001$** | **$F_{(1,78)}$ = 25.9, $p < .001$** |
| **CM1** | **CM2*** | **CM3** | **CM4*** | **CM5** | **CM6** |
| **$F_{(1, 67)}$ = 19.045, $p < .001$** | **$F_{(2, 68)}$ = 6.73, $p < .01$** | **$F_{(1, 67)}$ = 7.75, $p < .01$** | **$F_{(2, 78)}$ = 20.1, $p < .001$** | **$F_{(1, 78)}$ = 16.794, $p < .001$** | **$F_{(1, 78)}$ = 4.897, $p < .05$** |

Table 4.6: Results from the ANOVAs of duration for all 24 speakers: significant results are in bold. An asterisk signifies that the participant produced more than one syntactic structure for contrastive focus and is further analyzed in the Bonferroni pairwise comparisons in Table 4.7.

| Bonferroni Pairwise Comparisons- Duration | | |
|---|---|---|
| Speaker | Comparison | Significance |
| CF1 | *are + fronted subject* ≈ broad focus | $p$ = .08 |
| | ***in situ*** **> broad focus** | **$p < .01$** |
| | *in situ ≈ are + fronted subject* | $p$ = .528 |
| CF5 | ***are + fronted subject*** **> broad focus** | **$p < .001$** |
| | ***in situ*** **> broad focus** | **$p < .001$** |
| | *in situ ≈ are + fronted subject* | $p$ = 1.00 |
| CM2 | ***are + fronted subject*** **> broad focus** | **$p < .05$** |
| | ***in situ*** **> broad focus** | **$p < .01$** |
| | *in situ ≈ are + fronted subject* | $p$ = .996 |
| CM4 | *are + in situ* ≈ broad focus | $p$ = 1.00 |
| | ***in situ*** **> broad focus** | **$p < .001$** |
| | ***in situ*** **>** ***are + in situ*** | **$p < .001$** |

Table 4.7: Bonferroni pairwise comparisons of duration for the speakers that produced more than one type of syntactic structure to mark contrastive focus. Significant results are in bold.

#### *4.2.2.2 Peak Height*

The group means, Linear Mixed Model results, and Bonferroni results of Peak Height are presented in Tables 4.8-4.10 and these results, grouped according to gender and dialect, are illustrated in Figure 4.8.

| Means (SD)- Peak Height (st) | | | | | | |
|---|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 95.6 (3.8) | 87.0 (4.2) | 91.4 (5.2) | 91.3 (5.6) |
| Broad Focus | 90.6 (5.2) | 95.5 (6.1) | 85.9 (7.4) | 91.2 (5.2) | 90.8 (5.4) |
| In Situ Contrastive Focus | 92.0 (7.1) | 97.6 (7.3) | 86.8 (6.2) | - | 92.0 (7.1) |
| Are + Fronted Subject Contrastive Focus | 91.1 (5.6) | 96.2 (6.2) | 86.2 (8.3) | 91.7 (6.2) | 91.4 (6.8) |
| Are + In Situ Contrastive Focus | 90.2 (5.1) | 94.5 (9.1) | 85.2 (6.4) | - | 90.2 (5.1) |

Table 4.8: Mean (SD) of Peak Height (st) across all factors.

| Linear Mixed Model- Peak Height | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **85.5 (1.4)** | **$F_{(1, 32.645)} = 32.645$, $p < .001$** | **82.6** | **88.4** |
| **Pragmatic Condition** | **1.91 (.5)** | **$F_{(3, 1861.08)} = 9.555$, $p < .001$** | **.96** | **2.9** |
| **Gender** | **8.9 (.8)** | **$F_{(1, 74.599)} = 69.395$, $p < .001$** | **7.2** | **10.6** |
| Dialect | -.38 (.8) | $F_{(1, 20.174)} = .038$, $p = .847$, n.s. | -1.9 | 1.2 |
| Age | .03 (.03) | $F_{(1, 40.363)} = .323$, $p = .573$, n.s. | -.03 | .09 |
| **Pragmatic Condition * Gender** | **1.0 (3.1)** | **$F_{(3, 1859.3)} = 5.341$, $p < .01$** | **.66** | **2.7** |
| **Pragmatic Condition * Dialect** | **1.1 (.3)** | **$F_{(1, 1860.08)} = 13.123$, $p < .001$** | **.48** | **1.6** |
| **Pragmatic Condition * Age** | **-.04 (.02)** | **$F_{(3, 1860.13)} = 3.633$, $p < .05$** | **-.05** | **-.01** |
| Random Effects | | | | |
| Residual | 6.984 (.229) | - | - | - |
| Speaker | 3.255 (1.06) | - | - | - |
| Token | .000 (.000) | - | - | - |
| Model Information Criteria (BIC) = 9111.586 | | | | |

Table 4.9: Results of Linear Mixed Model of Peak Height: significant results are in bold.

| Bonferroni Pairwise Comparisons- Peak Height | |
|---|---|
| Comparison | Significance |
| ***in situ* > broad focus** | ***p* < .001** |
| *in situ ≈ are + fronted subject* | *p* = .771 |
| ***in situ* > *in situ + are*** | ***p* < .01** |
| *are + fronted subject* ≈ broad focus | *p* = .228 |
| ***are + fronted subject* > *are + in situ*** | ***p* < .01** |
| *are + in situ* ≈ broad focus | *p* = 1.00 |

Table 4.10: Results of Bonferroni Pairwise Comparisons of Pragmatic Condition of Peak Height: significant results are in bold.

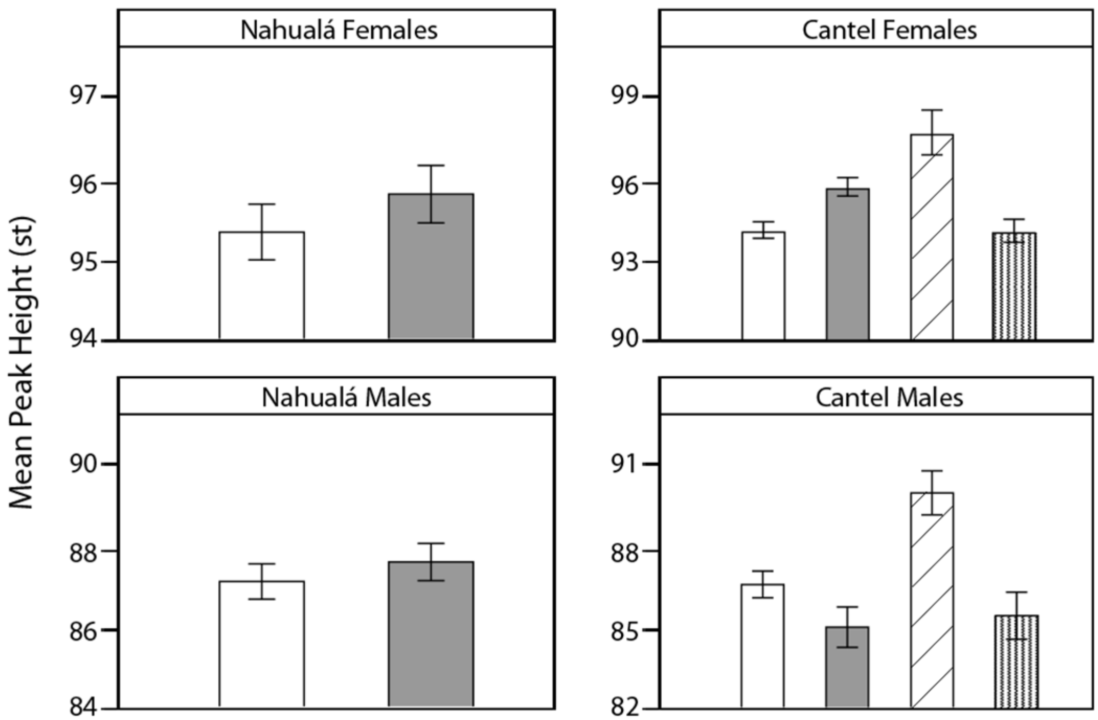


Figure 4.8: Bar graphs of mean peak height of tonic syllable (st) for all speaker groups in K'ichee' in all pragmatic conditions: broad focus (white), *are + fronted subject* contrastive focus (gray), *in situ* contrastive focus (diagonal lines) and *are + in situ* contrastive focus (vertical lines). 95% confidence interval bars included.

These analyses reveal that there is a main effect of both Gender and Pragmatic Condition on the height of the pitch peak. As expected, the females produced higher pitch peaks across all four pragmatic conditions than the males, which is likely due to anatomical differences. For Pragmatic Condition, the pairwise comparisons demonstrate that the *in situ* contrastive focus condition had significantly higher peaks than all other conditions, with the exception of *are + fronted subject*. All three interactions, Pragmatic Condition*Gender, Pragmatic Condition*Dialect, and Pragmatic Condition*Age, were significant: the first significant interaction reveals that females tended to mark both an *in situ* and an *are + fronted subject* contrastive focus constituent more, when compared to the height of the broad focus constituent in semitones, than the males; the second significant interaction demonstrates that Cantel bilinguals tended to mark contrastive focus constituents more than Nahualá bilinguals; the third significant interaction demonstrates that younger speakers also marked focus more than older speakers. However, it should be noted that the majority of the speakers over 40 years old were male (7 of 11), so this significant interaction may be a reflection of the Pragmatic Condition*Gender interaction.

The results of the individual speaker ANOVAs and necessary Bonferroni pairwise comparisons are presented in Tables 4.11 and 4.12. The individual speaker analyses reveal that, while all Cantel female speakers in this study mark contrastive focus with a significantly higher pitch peak, the Nahualá females, Nahualá males, and Cantel males demonstrate more variation as not every speaker marked contrastive focus in K'ichee' with a significantly higher pitch peak, in fact, only 8 of 18 do. The Bonferroni pairwise comparisons show that the speakers that used more than one syntactic structure to mark contrastive focus and demonstrated an overall main effect of pragmatic condition consistently marked the *in situ* contrastive focus condition with higher peaks than the broad focus condition; speakers CF1 and CM2 even produced significantly higher peaks in *in situ* contrastive focus more than the syntactically marked focus conditions.

| Individual Speaker ANOVAs- Peak Height | | | | | |
|---|---|---|---|---|---|
| **NF1** | NF2 | NF3 | NF4 | NF5 | **NF6** |
| **$F_{(1, 78)}$ = 4.938, $p < .05$** | $F_{(1,78)}$ = .355, $p = .553$, n.s. | $F_{(1, 78)}$ = .959, $p = .33$, n.s. | $F_{(1, 73)}$ = 1.67, $p = .2$, n.s. | $F_{(1, 74)}$ = .914, $p = .342$, n.s. | **$F_{(1, 73)}$ = 10.844, $p < .001$** |
| NM1 | **NM2** | **NM3** | NM4 | NM5 | **NM6** |
| $F_{(1, 78)}$ = 3.136, $p = .08$, n.s. | **$F_{(1, 78)}$ = 7.184, $p < .01$** | **$F_{(1, 77)}$ = 59.222, $p < .001$** | $F_{(1, 78)}$ = .171, $p = 68$, n.s. | $F_{(1, 78)}$ = 1.401, $p = .24$, n.s. | **$F_{(1, 76)}$ = 18.761, $p < .001$** |
| **CF1*** | **CF2** | **CF3** | **CF4** | **CF5*** | **CF6** |
| **$F_{(2, 72)}$ = 53.087, $p < .001$** | **$F_{(1, 77)}$ = 10.78, $p < .01$** | **$F_{(1, 76)}$ = 6.507, $p < .01$** | **$F_{(1, 76)}$ = 6.807, $p < .01$** | **$F_{(2, 78)}$ = 21.799, $p < .001$** | **$F_{(1,78)}$ = 41.095, $p < .001$** |
| CM1 | **CM2*** | CM3* | CM4* | **CM5** | **CM6** |
| $F_{(1, 67)}$ = 04, $p = .842$, n.s. | **$F_{(2, 68)}$ = 9.663, $p < .001$** | $F_{(1, 67)}$ = 1.39, $p = .139$, n.s. | $F_{(2, 78)}$ = .183, $p = .833$, n.s. | **$F_{(1, 78)}$ = 19.55, $p < .001$** | **$F_{(1, 78)}$ = 39.261, $p < .001$** |

Table 4.11: Results from the ANOVAs of peak height for all 24 speakers; significant results are in bold and indicate that the speaker had significantly higher peaks in the contrastive focus condition than in the broad focus condition. An asterisk signifies that the participant produced more than one syntactic structure for contrastive focus and where there is a significant main effect the data is further analyzed in the Bonferroni pairwise comparisons in Table 4.12.

| | Bonferroni Pairwise Comparisons- Peak Height | |
|---|---|---|
| Speaker | Comparison | Significance |
| CF1 | *are + fronted subject* ≈ broad focus | $p = .904$ |
| | ***in situ* > broad focus** | **$p < .001$** |
| | ***in situ* > *are + fronted subject*** | **$p < .001$** |
| CF5 | ***are + fronted subject* > broad focus** | **$p < .01$** |
| | ***in situ* > broad focus** | **$p < .001$** |
| | *in situ ≈ are + fronted subject* | $p = 1.00$ |
| CM2 | *are + fronted subject* ≈ broad focus | $p = .871$ |
| | ***in situ* > broad focus** | **$p < .001$** |
| | ***in situ* > *are + fronted subject*** | **$p < .01$** |
| CM4 | -no significant main effect- | |

Table 4.12: Bonferroni pairwise comparisons of peak height for the speakers that produced more than one type of syntactic structure to mark contrastive focus. Significant results are in bold.

#### *4.2.2.3 Peak Alignment*

The group means, Linear Mixed Model results, and Bonferroni results of Peak Alignment are presented in Tables 4.13-4.15 and these results, grouped according to gender and dialect, are illustrated in Figure 4.9.

| Means (SD)- Peak Alignment | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | .83 (.14) | .79 (.15) | .80 (.13) | .81 (.15) |
| Broad Focus | .86 (.11) | .86 (.11) | .86 (.12) | .85 (.12) | .87 (.12) |
| In Situ Contrastive Focus | .75 (.12) | .76 (.12) | .71 (.12) | - | .75 (.12) |
| Are + Fronted Subject Contrastive Focus | .77 (.13) | .82 (.12) | .72 (.12) | .75 (.12) | .78 (.12) |
| Are + In Situ Contrastive Focus | .79 (.15) | .82 (.16) | .76 (.16) | - | .79 (.15) |

Table 4.13: Mean (SD) of Peak Alignment across all factors.

| Linear Mixed Model- Peak Alignment | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **.828 (.04)** | **$F_{(1, 51.967)}$ = 353.086, $p$ < .001** | **.75** | **.91** |
| **Pragmatic Condition** | **-.344 .04)** | **$F_{(3, 1856.195)}$ = 28.625, $p$ < .001** | **-.43** | **-.26** |
| Gender | .005 (.02) | $F_{(1, 179.83)}$ = 2.205, $p$ = .139, n.s. | -.04 | .05 |
| Dialect | .03 (.02) | $F_{(1, 20.592)}$ = 2.301, $p$ = .144, n.s. | -.01 | .07 |
| Age | .001 (.001) | $F_{(1, 73.892)}$ = .1.61, $p$ = .208, n.s. | -.001 | .002 |
| **Pragmatic Condition * Gender** | **.096 (.01)** | **$F_{(3, 1856.137)}$ = 24.69, $p$ < .001** | **.07** | **.12** |
| Pragmatic Condition * Dialect | .002 (.01) | $F_{(1, 1866.765)}$ = .043 , $p$ = .836, n.s. | -.02 | .03 |
| **Pragmatic Condition * Age** | **.005 (.001)** | **$F_{(3, 1856.134)}$ = 9.957, $p$ < .001** | **.003** | **.006** |
| Random Effects | | | | |
| Residual | .0112 (.0003) | - | - | - |
| Speaker | .0023 (.0007) | - | - | - |
| Token | .0000 (.0000) | - | - | - |
| Model Information Criteria (BIC) = -2924.24 | | | | |

Table 4.14: Results of Linear Mixed Model of Peak Alignment: significant results are in bold.

| Bonferroni Pairwise Comparisons- Peak Alignment | |
|---|---|
| Comparison | Significance |
| ***in situ* < broad focus** | ***p* < .001** |
| *in situ ≈ are + fronted subject* | *p* = .243 |
| ***in situ* < *in situ + are*** | ***p* < .05** |
| ***are + fronted subject* < broad focus** | ***p* < .001** |
| *are + fronted subject ≈ are + in situ* | *p* = 1.00 |
| ***are + in situ* < broad focus** | ***p* < .01** |

Table 4.15: Results of Bonferroni Pairwise Comparisons of Pragmatic Condition of Peak Alignment: significant results are in bold.

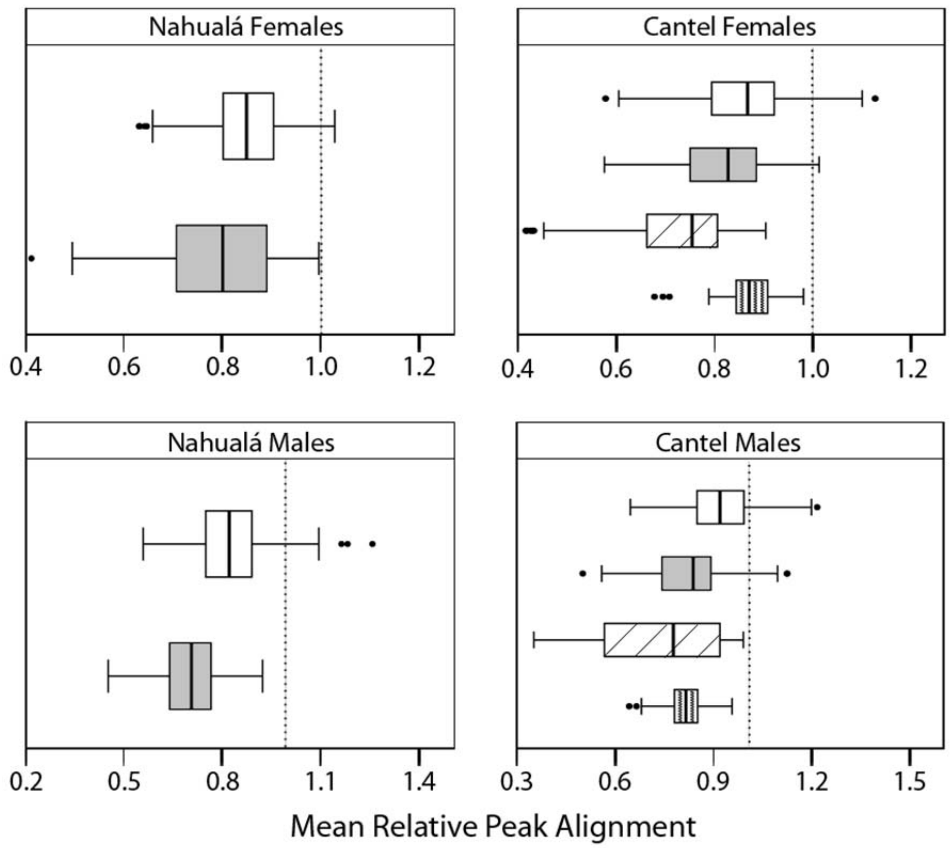


Figure 4.9: Boxplots of mean peak alignment for all speaker groups in K'ichee' in all pragmatic conditions: broad focus (white), *are + fronted subject* contrastive focus (gray), *in situ* contrastive focus (diagonal lines) and *are + in situ* contrastive focus (vertical lines). A lower number indicates an earlier peak and the dotted line indicates a relative alignment score of 1.0, i.e., the end of the tonic syllable.

These Linear Mixed Model results reveal that there was a significant main effect of Pragmatic Condition and the pairwise comparisons demonstrate that all three contrastive focus conditions had significantly earlier peaks than the broad focus condition, *in situ* contrastive focus even had earlier peaks than *are + in situ* contrastive focus. The significant interaction between Pragmatic Condition and Gender demonstrate that, while there are no differences in peak alignment in broad focus, males mark all three contrastive focus conditions with an earlier peak than females. Again, the significant interaction between Pragmatic Condition and Age may be a reflection of the ages of the participants in this study, as older speakers marked contrastive focus with earlier peaks than younger speakers.

| Individual Speaker ANOVAs- Peak Alignment | | | | | |
|---|---|---|---|---|---|
| **NF1** | **NF2** | **NF3** | **NF4** | **NF5** | **NF6** |
| **$F_{(1, 78)}$ = 16.043, $p < .001$** | **$F_{(1,78)}$ = 13.7, $p < .001$** | **$F_{(1, 78)}$ = 6.943, $p < .01$** | **$F_{(1, 73)}$ = 33.74, $p < .001$** | **$F_{(1, 74)}$ = 31.383, $p < .001$** | **$F_{(1, 73)}$ = 24.677 $p < .001$** |
| **NM1** | **NM2** | **NM3** | **NM4** | **NM5** | **NM6** |
| **$F_{(1, 78)}$ = 9.779, $p < .01$** | **$F_{(1, 78)}$ = 21.262, $p < .001$** | **$F_{(1, 77)}$ = 62.749, $p < .001$** | **$F_{(1, 78)}$ = 39.937, $p < .001$** | **$F_{(1, 78)}$ = 24.497, $p < .001$** | **$F_{(1, 76)}$ = 43.326, $p < .001$** |
| **CF1*** | **CF2** | **CF3** | **CF4** | **CF5*** | **CF6** |
| **$F_{(2, 72)}$ = 30.794, $p < .001$** | **$F_{(1, 77)}$ = 21.336, $p < .001$** | **$F_{(1, 76)}$ = 8.211, $p < .01$** | **$F_{(1, 76)}$ = 5.772, $p < .01$** | **$F_{(2, 78)}$ = 8.592, $p < .001$** | **$F_{(1,78)}$ = 40.329, $p < .001$** |
| **CM1** | **CM2*** | **CM3** | **CM4*** | CM5 | **CM6** |
| **$F_{(1, 67)}$ = 50.045, $p < .001$** | **$F_{(2, 68)}$ = 55.572, $p < .001$** | **$F_{(1, 67)}$ = 15.516, $p < .001$** | **$F_{(2, 78)}$ = 11.165, $p < .001$** | $F_{(1, 78)}$ = 1.37, $p = .685$, n.s. | **$F_{(1, 78)}$ = 32.322, $p < .001$** |

Table 4.16: Results from the ANOVAs of peak alignment for all 24 speakers. Bold indicates that the speaker demonstrated a main effect where the contrastive focus condition had significantly earlier peaks than the broad focus condition. An asterisk signifies that the participant produced more than one syntactic structure for contrastive focus and is further analyzed in the Bonferroni pairwise comparisons in Table 4.17.

The individual speaker analyses presented in Table 4.16 confirm the findings of the overall analyses. There was a significant main effect of pragmatic condition on the alignment of the pitch peak for 23 of 24 speakers; the peaks in the contrastive focus conditions were earlier than in the broad focus condition. Likewise, the results of the Bonferroni pairwise comparisons presented in Table 4.17 reveal that, among the speakers that produced more than one syntactic structure, the peaks were significantly earlier in the contrastive focus conditions than in the broad focus condition regardless of the syntactic structure used to mark contrastive focus. Speakers CF1, CF5, and CM4 even produced earlier peaks in the *in situ* condition than in the syntactically marked conditions. These results suggest that an earlier pitch peak is a common acoustic feature of contrastive focus marking among these speakers of K'ichee'.

| Bonferroni Pairwise Comparisons-Peak Alignment | | |
|---|---|---|
| Speaker | Comparison | Significance |
| CF1 | ***are* + *fronted subject* < broad focus** | ***p* < .01** |
| | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < *are* + *fronted subject*** | ***p* < .001** |
| CF5 | ***are* + *fronted subject* < broad focus** | ***p* < .01** |
| | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < *are* + *fronted subject*** | ***p* < .01** |
| CM2 | ***are* + *fronted subject* < broad focus** | ***p* < .001** |
| | ***in situ* < broad focus** | ***p* < .001** |
| | *in situ* ≈ *are* + *fronted subject* | *p* = .183 |
| CM4 | ***are* + *in situ* < broad focus** | ***p* < .01** |
| | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < *are* + *in situ*** | ***p* < .001** |

Table 4.17: Bonferroni pairwise comparisons of peak alignment for the speakers that produced more than one type of syntactic structure to mark contrastive focus. Significant results are in bold.

### *4.2.2.4 Valley Height*

The group means, Linear Mixed Model results, and Bonferroni results of Valley Height are presented in Tables 4.18-4.20 and these results, grouped according to gender and dialect, are illustrated in Figure 4.10.

| Means (SD)- Valley Height (st) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 91.8 (1.8) | 82.9 (2.7) | 87.3 (5.6) | 87.5 (4.6) |
| Broad Focus | 87.6 (5.6) | 92.1 (4.4) | 82.9 (4.4) | 87.7 (4.3) | 87.3 (4.2) |
| In Situ Contrastive Focus | 86.0 (4.9) | 90.6 (6.1) | 81.6 (5.7) | - | 86.0 (4.9) |
| Are + Fronted Subject Contrastive Focus | 87.4 (4.5) | 91.7 (4.4) | 81.7 (2.8) | 87.4 (4.2) | 87.4 (4.4) |
| Are + In Situ Contrastive Focus | 86.9 (7.2) | 91.1 (8.1) | 82.9 (4.4) | - | 86.9 (7.2) |

Table 4.18: Mean (SD) of Valley Height (st) across all factors.

| Linear Mixed Model- Valley Height | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **82.5 (1.1)** | **$F_{(1, 29.234)} = 7329.197, p < .001$** | **80.2** | **84.8** |
| **Pragmatic Condition** | **1.2 (.4)** | **$F_{(3, 1859.215)} = 5.43, p < .05$** | **4.4** | **7.7** |
| **Gender** | **9.2 (.6)** | **$F_{(1, 58.348)} = 126.937, p < .001$** | **7.8** | **10.5** |
| Dialect | -.4 (.6) | $F_{(1, 20.047)} = .092, p = .765$, n.s. | -1.7 | .80 |
| Age | .02 (.02) | $F_{(1, 34.736)} = .237, p = .63$, n.s. | -.03 | .06 |
| Pragmatic Condition * Gender | -.3 (2.1) | $F_{(3, 1857.58)} = 1.341, p = .263$, n.s. | -.89 | .12 |
| Pragmatic Condition * Dialect | .5 (.2) | $F_{(1, 185.55)} = 1.343 , p = .259$, n.s. | -.07 | .86 |
| Pragmatic Condition * Age | -.02 (.01) | $F_{(3, 1858.34)} = 1.905, p = .121$, n.s. | -.08 | .11 |
| Random Effects | | | | |
| Residual | 3.357 (.110) | - | - | - |
| Speaker | 2.073 (.674) | - | - | - |
| Token | .000 (.000) | - | - | - |
| Model Information Criteria (BIC) = 7749.119 | | | | |

Table 4.19: Results of Linear Mixed Model of Valley Height: significant results are in bold.

| Bonferroni Pairwise Comparisons- Valley Height | |
|---|---|
| Comparison | Significance |
| ***in situ* < broad focus** | ***p* < .05** |
| ***in situ* < *are + fronted subject*** | ***p* < .05** |
| *in situ* ≈ *in situ + are* | *p* = .286 |
| *are + fronted subject* ≈ broad focus | *p* = .861 |
| *are + fronted subject* ≈ *are + in situ* | *p* = .388 |
| ***are + in situ* < broad focus** | ***p* < .05** |

Table 4.20: Results of Bonferroni Pairwise Comparisons of Pragmatic Condition of Valley Height: significant results are in bold.

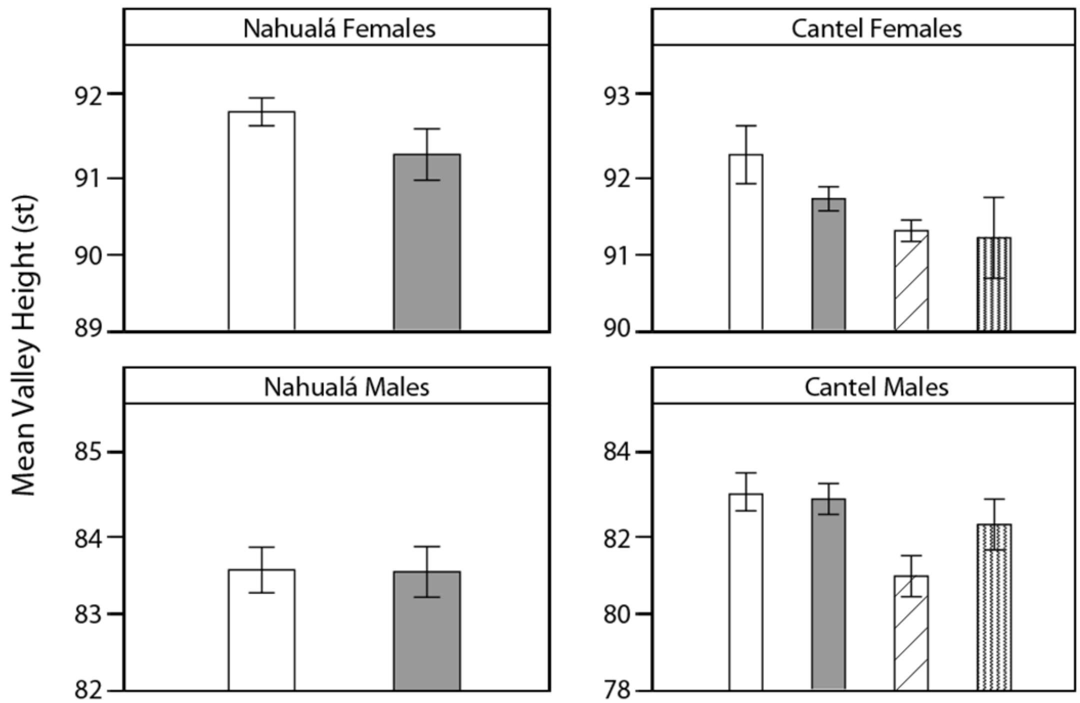


Figure 4.10: Bar graphs of mean valley height of tonic syllable (st) for all speaker groups in K'ichee' in all pragmatic conditions: broad focus (white), *are + fronted subject* contrastive focus (gray), *in situ* contrastive focus (diagonal lines) and *are + in situ* contrastive focus (vertical lines). 95% confidence interval bars included.

Overall, the results of Valley Height only demonstrate a significant main effect of Gender and Pragmatic Condition. As with Peak Height, females produced higher valleys than males across all four pragmatic conditions. The pairwise comparisons of Pragmatic Condition show that both *in situ* and *are + in situ* contrastive focus conditions were marked with a lower valley than broad focus and that *in situ* contrastive focus was also marked with a lower valley than *are + fronted subject* contrastive focus.

| Individual Speaker ANOVAs- Valley Height | | | | | |
|---|---|---|---|---|---|
| NF1 | **NF2** | NF3 | **NF4** | **NF5** | NF6 |
| $F_{(1, 78)}$ = 2.678, $p$ = .106, n.s. | **$F_{(1,78)}$ = 9.07, $p < .01$** | $F_{(1, 78)}$ = .857, $p$ = .357, n.s. | **$F_{(1, 73)}$ = 4.332, $p < .05$** | **$F_{(1, 74)}$ = 6.223, $p < .01$** | $F_{(1, 73)}$ = 1.249 $p$ = .267 |
| NM1 | NM2 | NM3 | NM4 | NM5 | NM6 |
| $F_{(1, 78)}$ = 2.997, $p$ = .069, n.s. | $F_{(1, 78)}$ = .255, $p$ = .615, n.s. | $F_{(1, 77)}$ = 2.179, $p$ = .144, n.s. | $F_{(1, 78)}$ = .079, $p$ = .779, n.s. | $F_{(1, 78)}$ = .806, $p$ = .372, n.s. | $F_{(1, 76)}$ = .707, $p$ = .09, n.s. |
| **CF1*** | CF2 | **CF3** | **CF4** | **CF5*** | **CF6** |
| **$F_{(2, 72)}$ = 26.551, $p < .001$** | $F_{(1, 77)}$ = 2.5, $p$ = .118, n.s. | **$F_{(1, 76)}$ = 3.712, $p < .05$** | **$F_{(1, 76)}$ = 11.159, $p < .001$** | **$F_{(2, 78)}$ = 13.698, $p < .001$** | **$F_{(1,78)}$ = 3.619, $p < .05$** |
| CM1 | **CM2*** | **CM3** | CM4* | CM5 | CM6 |
| $F_{(1, 67)}$ = 2.493, $p$ = .119, n.s. | **$F_{(2, 68)}$ = 9.95, $p < .001$** | **$F_{(1, 67)}$ = 9.621, $p < .001$** | $F_{(2, 78)}$ = 1.656, $p$ = .198, n.s. | $F_{(1, 78)}$ = .786, $p$ = .378, n.s. | $F_{(1, 78)}$ = .807, $p$ = .372, n.s. |

Table 4.21: Results from the ANOVAs of valley height for all 24 speakers. Results in bold indicate that the speaker produced a significantly lower valley height in contrastive focus than in broad focus. An asterisk signifies that the participant produced more than one syntactic structure for contrastive focus and, where there is a main effect, the speaker is further analyzed in the Bonferroni pairwise comparisons in Table 4.22.

The individual speaker ANOVAs and corresponding Bonferroni pairwise comparisons of Valley Height are presented in Tables 4.21 and 4.22. The results are similar to the findings for Peak Height; a lower valley height is used to mark contrastive focus by some speakers, by not by all. Finally, those speakers that produced more than one syntactic structure for the contrastive focus conditions consistently produced lower peaks in the *in situ* contrastive focus condition than in the other conditions; speakers CF1, CF5, and CM2 also produced lower valleys in the syntactically marked *are + fronted subject* contrastive focus condition than in broad focus.

| Bonferroni Pairwise Comparisons-Valley Height | | |
|---|---|---|
| Speaker | Comparison | Significance |
| CF1 | *are + fronted subject* ≈ broad focus | $p = .373$ |
| | ***in situ* < broad focus** | $\mathbf{p < .001}$ |
| | ***in situ < are + fronted subject*** | $\mathbf{p < .001}$ |
| CF5 | ***are + fronted subject* < broad focus** | $\mathbf{p < .01}$ |
| | ***in situ* < broad focus** | $\mathbf{p < .001}$ |
| | ***in situ < are + fronted subject*** | $\mathbf{p < .001}$ |
| CM2 | *are + fronted subject* ≈ broad focus | $p = .777$ |
| | ***in situ* < broad focus** | $\mathbf{p < .01}$ |
| | ***in situ < are + fronted subject*** | $\mathbf{p < .001}$ |
| CM4 | -no significant main effect- | |

Table 4.22: Bonferroni pairwise comparisons of valley height for the speakers that produced more than one type of syntactic structure to mark contrastive focus. Significant results are in bold.

#### *4.2.2.5 Valley Alignment*

Tables 4.23-4.25 contain the group means and the results of the Linear Mixed Model and Bonferroni pairwise comparisons for Valley Alignment.

| Means (SD)- Valley Alignment | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | .49 (.15) | .26 (.15) | .31 (.13) | .35 (.15) |
| Broad Focus | .37 (.13) | .44 (.15) | .30 (.17) | .35 (.14) | .38 (.14) |
| In Situ Contrastive Focus | .32 (.14) | .37 (.16) | .23 (.14) | - | .32 (.14) |
| Are + Fronted Subject Contrastive Focus | .32 (.16) | .44 (.14) | .24 (.14) | .26 (.14) | .35 (.14) |
| Are + In Situ Contrastive Focus | .33 (.15) | .39 (.14) | .25 (.16) | - | .33 (.15) |

Table 4.23: Mean (SD) of Valley Alignment across all factors.

| Linear Mixed Model- Valley Alignment | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **.22 (.11)** | **$F_{(1, 21.03)}$ = 7.763, *p* < .05** | **.01** | **.45** |
| **Pragmatic Condition** | **-.04 (.01)** | **$F_{(3, 1848.978)}$ = 47.957, *p* < .001** | **-.05** | **-.02** |
| **Gender** | **.19 (.06)** | **$F_{(1, 23.576)}$ = 5.355, *p* < .05** | **.06** | **.33** |
| Dialect | .01 (.06) | $F_{(1, 20.019)}$ = 1.26, *p* = .275, n.s. | -.12 | .13 |
| Age | .001 (.002) | $F_{(1, 21.571)}$ = .582, *p* = .454, n.s. | -.01 | .01 |
| **Pragmatic Condition * Gender** | **-.04 (.01)** | **$F_{(3, 1848.693)}$ = 10.116, *p* < .001** | **-.05** | **-.02** |
| **Pragmatic Condition * Dialect** | **.12 (.01)** | **$F_{(1, 1848.483)}$ = 300.701, *p* < .001** | **.11** | **.14** |
| **Pragmatic Condition * Age** | **.006 (.001)** | **$F_{(3, 1848.827)}$ = 52.505, *p* < .001** | **-.001** | **.011** |
| Random Effects | | | | |
| Residual | .0042 (.0001) | - | - | - |
| Speaker | .0222 (.0071) | - | - | - |
| Token | .0000 (.0000) | - | - | - |
| Model Information Criteria (BIC) = -4685.889 | | | | |

Table 4.24: Results of Linear Mixed Model of Valley Alignment: significant results are in bold.

| Bonferroni Pairwise Comparisons- Valley Alignment | |
|---|---|
| Comparison | Significance |
| ***in situ* < broad focus** | ***p* < .001** |
| *in situ ≈ are + fronted subject* | *p* = 1.00 |
| *in situ ≈ in situ + are* | *p* = 1.00 |
| ***are + fronted subject* < broad focus** | ***p* < .001** |
| *are + fronted subject ≈ are + in situ* | *p* = 1.00 |
| ***are + in situ* < broad focus** | ***p* < .01** |

Table 4.25: Results of Bonferroni Pairwise Comparisons of Pragmatic Condition of Valley Alignment: significant results are in bold.

The results of valley alignment reveal a significant main effect of Gender and Pragmatic Condition: males produced earlier valleys across all four pragmatic conditions than females and the results of the pairwise comparison of Pragmatic Condition reveal that, while there are no significant differences between any of the contrastive focus conditions, all had significantly earlier valleys than broad focus. All three interactions, Pragmatic Condition*Gender, Pragmatic Condition*Dialect, and Pragmatic Condition*Age, were significant and demonstrated a tendency for males, Nahualá speakers, and older speakers to mark contrastive focus with an earlier valley. These results, separated by gender and dialect, are illustrated in Figure 4.11, where the Nahualá males demonstrate the earliest valley alignment in contrastive focus, near the onset of the tonic syllable, of all the speakers.

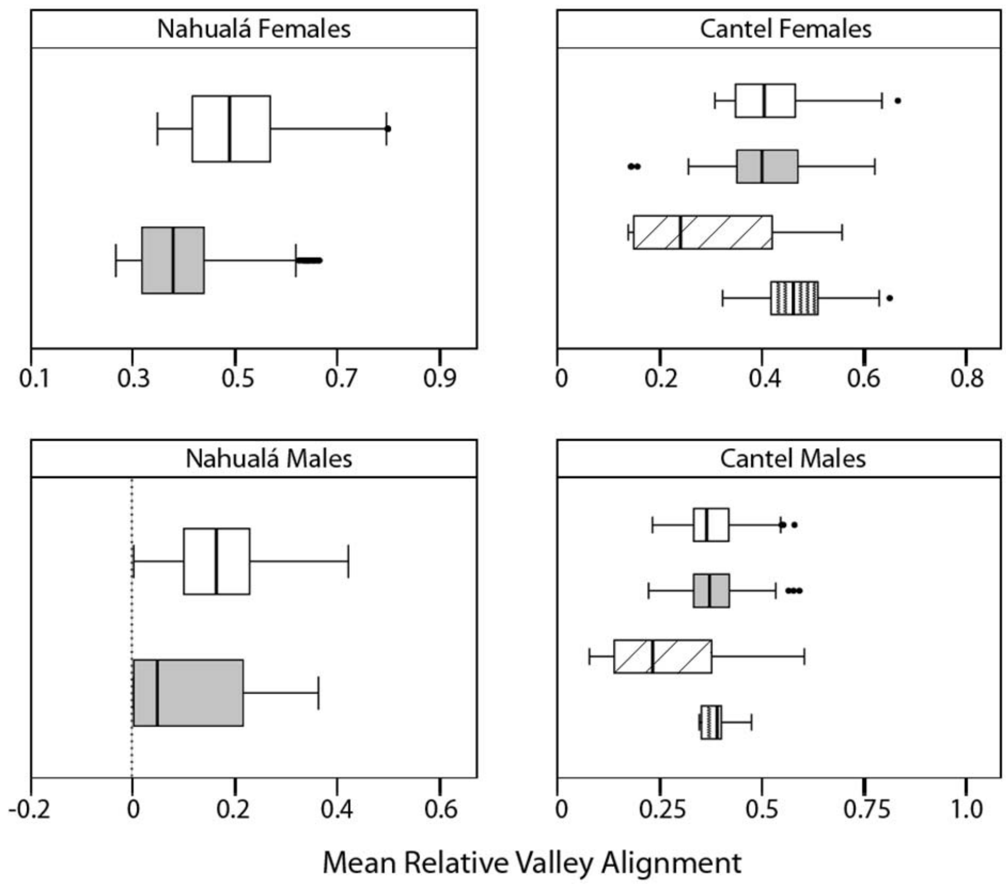


Figure 4.11: Boxplots of mean valley alignment for all speaker groups in K'ichee' in all pragmatic conditions: broad focus (white), *are + fronted subject* contrastive focus (gray), *in situ* contrastive focus (diagonal lines) and *are + in situ* contrastive focus (vertical lines). A lower number indicates an earlier valley and the dotted line, where necessary, indicates a relative alignment score of 0, i.e., the beginning of the tonic syllable.

Similar to the findings on peak alignment reported in Section 4.2.2.3, the individual speaker analyses presented in Table 4.26 confirm that there is a significant main effect of pragmatic condition on valley alignment for 22 of the 24 speakers; valleys were aligned earlier in a contrastive focus condition. The Bonferroni pairwise comparisons in Table 4.27 further demonstrate that most speakers analyzed in this study mark *in situ* contrastive focus with an earlier valley than in broad focus. Furthermore, every speaker analyzed via a Bonferroni, with the exception CM4, had earlier valleys in their syntactically marked contrastive focus conditions than in broad focus and speaker CF1 produced an earlier valley in *in situ* contrastive focus than in *are + fronted subject* contrastive focus.

| Individual Speaker ANOVAs- Valley Alignment | | | | | |
|---|---|---|---|---|---|
| **NF1** | **NF2** | **NF3** | **NF4** | **NF5** | NF6 |
| **$F_{(1, 78)} = 116.051$, $p < .001$** | **$F_{(1,78)} = 421.399$, $p < .001$** | **$F_{(1, 78)} = 237.152$, $p < .001$** | **$F_{(1, 73)} = 183.174$, $p < .001$** | **$F_{(1, 74)} = 168.876$, $p < .001$** | $F_{(1, 73)} = .365$, $p = .548$, n.s. |
| **NM1** | **NM2** | **NM3** | **NM4** | **NM5** | **NM6** |
| **$F_{(1, 78)} = 23.88$, $p < .001$** | **$F_{(1, 78)} = 71.35$, $p < .001$** | **$F_{(1, 77)} = 561.96$, $p < .001$** | **$F_{(1, 78)} = 63.337$, $p < .001$** | **$F_{(1, 78)} = 389.22$, $p < .001$** | **$F_{(1, 76)} = 221.247$, $p < .001$** |
| **CF1*** | **CF2** | **CF3** | **CF4** | **CF5*** | **CF6** |
| **$F_{(2, 72)} = 28.552$, $p < .001$** | **$F_{(1, 77)} = 4.5$, $p < .05$** | **$F_{(1, 76)} = 617.002$, $p < .001$** | **$F_{(1, 76)} = 5.865$, $p < .01$** | **$F_{(2, 78)} = 58.559$, $p < .001$** | **$F_{(1,78)} = 37.805$, $p < .001$** |
| **CM1** | **CM2*** | **CM3** | CM4* | **CM5** | **CM6** |
| **$F_{(1, 67)} = 33.173$, $p < .001$** | **$F_{(2, 68)} = 17.81$, $p < .001$** | **$F_{(1, 67)} = 159.317$, $p < .001$** | $F_{(2, 78)} = .342$, $p = .711$, n.s. | **$F_{(1, 78)} = 62.585$, $p < .001$** | **$F_{(1, 78)} = 4.91$, $p < .05$** |

Table 4.26: Results from the ANOVAs of valley alignment for all 24 speakers. Results in bold indicate a main effect where the contrastive focus condition had significantly earlier valleys than the broad focus condition. An asterisk signifies that the participant produced more than one syntactic structure for contrastive focus and, where there is a significant main effect, is further analyzed in the Bonferroni pairwise comparisons in Table 4.27.

| Bonferroni Pairwise Comparisons-Valley Alignment | | |
|---|---|---|
| Speaker | Comparison | Significance |
| CF1 | ***are* + *fronted subject* < broad focus** | ***p* < .001** |
| | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < *are* + *fronted subject*** | ***p* < .001** |
| CF5 | ***are* + *fronted subject* < broad focus** | ***p* < .001** |
| | ***in situ* < broad focus** | ***p* < .001** |
| | *in situ* ≈ *are* + *fronted subject* | *p* = .319 |
| CM2 | ***are* + *fronted subject* < broad focus** | ***p* < .001** |
| | ***in situ* < broad focus** | ***p* < .001** |
| | *in situ* ≈ *are* + *fronted subject* | *p* = 1.0 |
| CM4 | -no significant main effect- | |

Table 4.27: Bonferroni pairwise comparisons of valley alignment for the speakers that produced more than one type of syntactic structure to mark contrastive focus. Significant results are in bold.

#### *4.2.2.6 Rise*

As noted in the methodology in Section 3.4.5, the acoustic measurement for Rise comes from the difference between the acoustic measurements of Peak Height and Valley Height. Accordingly, it should be noted that these measurements are not independent of each other and a Pearson correlation analysis (two-tailed) demonstrates a significant correlation between Peak Height and Rise, r = .354, n = 1881, $p < .001$, and between Valley Height and Rise, r = -.08, n = 1881, $p < .01$: higher peaks and lower valleys are correlated with a greater overall rise. These correlations are illustrated in Figures 4.12 and 4.13.

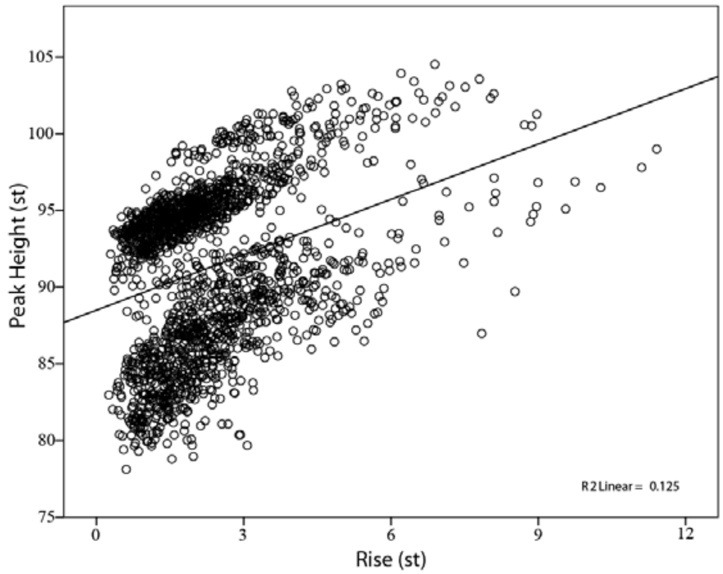


Figure 4.12: Overall Rise (st) as a function of Peak Height (st).

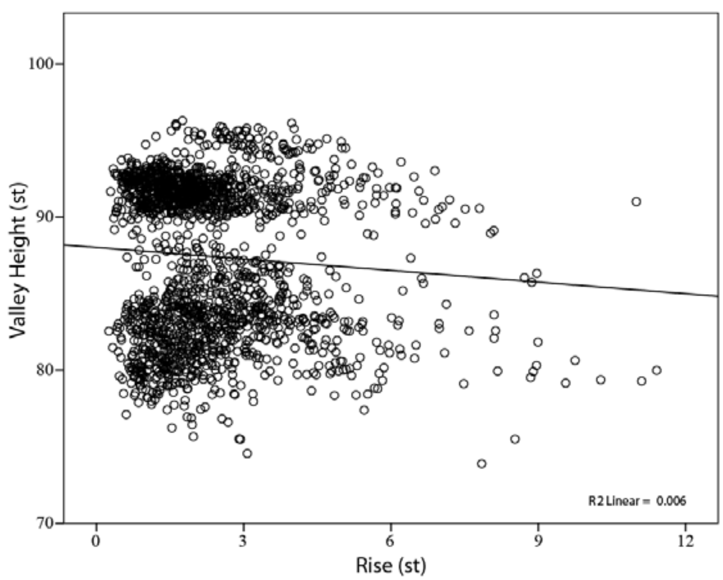


Figure 4.13: Overall Rise (st) as a function of Valley Height (st).

The group means, Linear Mixed Model results, and Bonferroni results of Rise are presented in Tables 4.28-4.30 and these results, grouped according to gender and dialect, are illustrated in the Boxplots in Figure 4.14.

| Means (SD)- Rise (st) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 3.9 (2.9) | 4.1 (2.3) | 3.9 (2.9) | 4.0 (2.3) |
| Broad Focus | 3.5 (2.5) | 3.5 (3.6) | 3.6 (3.7) | 3.6 (3.6) | 3.5 (3.6) |
| In Situ Contrastive Focus | 4.5 (2.8) | 4.7 (5.2) | 4.8 (3.8) | - | 4.5 (2.8) |
| Are + Fronted Subject Contrastive Focus | 4.4 (2.8) | 4.4 (3.6) | 4.4 (5.3) | 4.3 (3.6) | 4.3 (4.0) |
| Are + In Situ Contrastive Focus | 3.7 (2.6) | 3.7 (3.8) | 3.7 (5.8) | - | 3.7 (2.6) |

Table 4.28: Mean (SD) of Rise (st) across all factors.

| Linear Mixed Model- Rise | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **2.9 (.9)** | **$F_{(1, 46.181)} = 15.922, p < .001$** | **1.1** | **4.9** |
| **Pragmatic Condition** | **1.4 (.4)** | **$F_{(3, 1860.086)} = 7.479, p < .001$** | **.6** | **2.3** |
| Gender | -.2 (.5) | $F_{(1, 145.922)} = .004, p = .947$, n.s. | -1.3 | .9 |
| Dialect | -.1 (.5) | $F_{(1, 20.642)} = .321, p = .577$, n.s. | -1.1 | 1 |
| Age | .02 (.02) | $F_{(1, 63.499)} = .086, p = .771$, n.s. | -.02 | .05 |
| Pragmatic Condition * Gender | .2 (2.7) | $F_{(3, 1859.118)} = .55, p = .648$, n.s. | -.7 | .3 |
| **Pragmatic Condition * Dialect** | **.7 (.3)** | **$F_{(1, 1865.775)} = 6.56 , p < .05$** | **.2** | **1.2** |
| Pragmatic Condition * Age | -.02 (.02) | $F_{(3, 1859.55)} = 1.449, p = .227$, n.s. | -.06 | .01 |
| Random Effects | | | | |
| Residual | 5.619 (.185) | - | - | - |
| Speaker | 1.381 (.461) | - | - | - |
| Token | .000 (.000) | - | - | - |
| Model Information Criteria (BIC) = 8693.678 | | | | |

Table 4.29: Results of Linear Mixed Model of Rise: significant results are in bold.

| Bonferroni Pairwise Comparisons- Rise | |
|---|---|
| Comparison | Significance |
| ***in situ* > broad focus** | ***p* < .001** |
| *in situ* ≈ *are + fronted subject* | *p* = 1.00 |
| *in situ* ≈ *in situ + are* | *p* = .368 |
| ***are + fronted subject* > broad focus** | ***p* < .05** |
| *are + fronted subject* ≈ *are + in situ* | *p* = .309 |
| *are + in situ* ≈ broad focus | *p* = 1.00 |

Table 4.30: Results of Bonferroni Pairwise Comparisons of Pragmatic Condition of Rise: significant results are in bold.

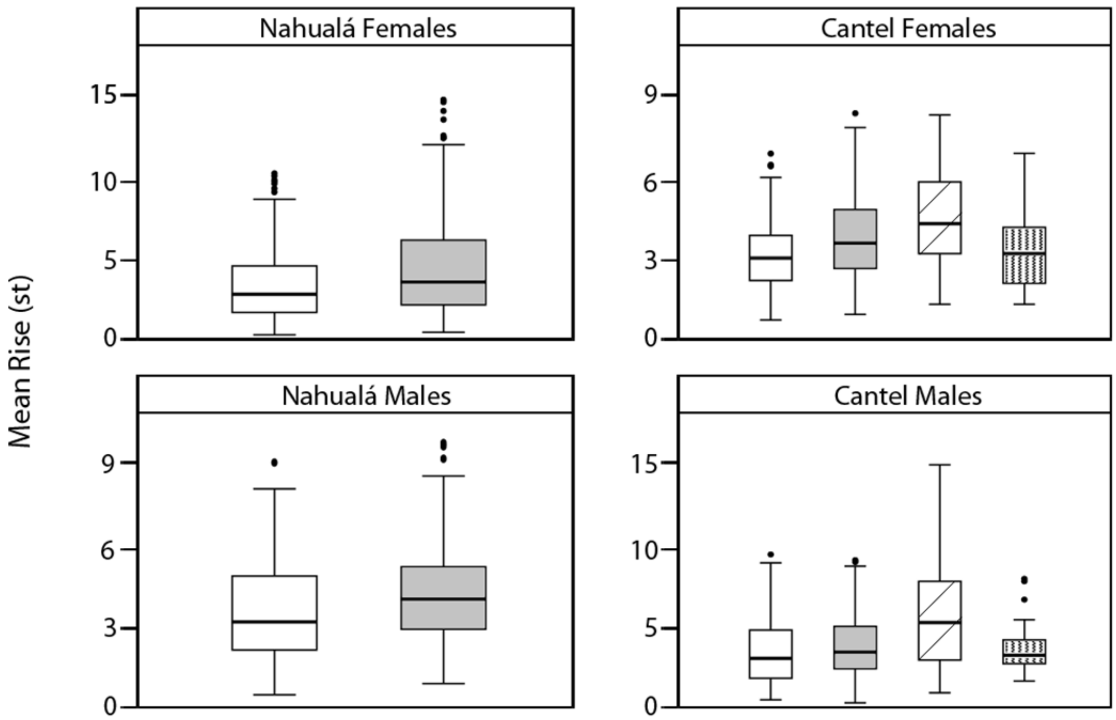


Figure 4.14: Boxplots of mean pitch rise (st) for all speaker groups in K'ichee' in all pragmatic conditions: broad focus (white), *are + fronted subject* contrastive focus (gray), *in situ* contrastive focus (diagonal lines) and *are + in situ* contrastive focus (vertical lines).

The results of Rise reveal that there is only a main effect of Pragmatic Condition; pairwise comparisons show that both *in situ* and *are + fronted subject* contrastive focus conditions are marked with a significantly greater rise than broad focus and *are + in situ* contrastive focus. The significant interaction between Pragmatic Condition and Dialect reveals that Cantel bilinguals marked contrastive focus with a greater overall rise than Nahualá bilinguals.

| Individual Speaker ANOVAs- Rise | | | | | |
|---|---|---|---|---|---|
| **NF1** | NF2 | NF3 | NF4 | **NF5** | **NF6** |
| $\mathbf{F_{(1, 78)}}$ **= 5.227,** $\boldsymbol{p < .05}$ | $F_{(1,78)}$ = .086, $p$ = .77, n.s. | $F_{(1, 78)}$ = 1.725, $p$ = .193, n.s. | $F_{(1, 73)}$ = .061, $p$ = .805, n.s. | $\mathbf{F_{(1, 74)}}$ **= 7.189,** $\boldsymbol{p < .01}$ | $\mathbf{F_{(1, 73)}}$ **= 6.901** $\boldsymbol{p < .01}$ |
| NM1 | **NM2** | **NM3** | NM4 | NM5 | **NM6** |
| $F_{(1, 78)}$ = .005, $p$ = .946, n.s. | $\mathbf{F_{(1, 78)}}$ **= 9.03,** $\boldsymbol{p < .01}$ | $\mathbf{F_{(1, 77)}}$ **= 66.524,** $\boldsymbol{p < .001}$ | $F_{(1, 78)}$ = 2.495, $p$ = .118, n.s. | $F_{(1, 78)}$ = 1.939, $p$ = .168, n.s. | $\mathbf{F_{(1, 76)}}$ **= 10.501,** $\boldsymbol{p < .01}$ |
| **CF1*** | CF2 | **CF3** | CF4 | **CF5*** | **CF6** |
| $\mathbf{F_{(2, 72)}}$ **= 32.958,** $\boldsymbol{p < .001}$ | $F_{(1, 77)}$ = 3.183, $p$ = .078, n.s. | $\mathbf{F_{(1, 76)}}$ **= 7.909,** $\boldsymbol{p < .001}$ | $F_{(1, 76)}$ = .089, $p$ = .915, n.s. | $\mathbf{F_{(2, 78)}}$ **= 19.742,** $\boldsymbol{p < .001}$ | $\mathbf{F_{(1,78)}}$ **= 46.361,** $\boldsymbol{p < .001}$ |
| CM1 | **CM2*** | CM3 | CM4* | **CM5** | **CM6** |
| $F_{(1, 67)}$ = 2.422, $p$ = .124, n.s. | $\mathbf{F_{(2, 68)}}$ **= 10.115,** $\boldsymbol{p < .001}$ | $F_{(1, 67)}$ = .058, $p$ = .944, n.s. | $F_{(2, 78)}$ = .192, $p$ = .826, n.s. | $\mathbf{F_{(1, 78)}}$ **= 6.848,** $\boldsymbol{p < .05}$ | $\mathbf{F_{(1, 78)}}$ **= 34.323,** $\boldsymbol{p < .001}$ |

Table 4.31: Results from the ANOVA of rise for all 24 speakers. Results in bold indicate a main effect where the contrastive focus condition had a significantly greater rise than the broad focus condition. An asterisk signifies that the participant produced more than one syntactic structure for contrastive focus and, where there is a significant main effect, is further analyzed in the Bonferroni pairwise comparisons in Table 4.32.

The individual speaker results of the ANOVAs presented in Table 4.31 demonstrate a similar pattern to the results of peak height and valley height, the measurements from which rise is obtained; a greater rise in pitch is used to mark contrastive focus by some, but not all speakers in this study. The Bonferroni pairwise comparisons in Table 4.32 show that, for speakers that produced more than one type of syntactic structure to mark contrastive focus and had a main effect of pragmatic condition, the *in situ* contrastive focus condition always had the greatest rise and, for speakers CF1 and CF5, the rise was greater than in the *are + fronted subject* contrastive focus condition. Moreover, speaker CF5 produced three significant levels of pitch rise for each condition, with *in situ* contrastive focus having the greatest rise and *are + fronted subject* contrastive focus having a greater rise than broad focus.

| Bonferroni Pairwise Comparisons-Rise | | |
|---|---|---|
| Speaker | Comparison | Significance |
| CF1 | *are + fronted subject* ≈ broad focus | $p = 1.0$ |
| | ***in situ* > broad focus** | $\mathbf{p < .001}$ |
| | ***in situ* > *are + fronted subject*** | $\mathbf{p < .001}$ |
| CF5 | ***are + fronted subject* > broad focus** | $\mathbf{p < .01}$ |
| | ***in situ* > broad focus** | $\mathbf{p < .001}$ |
| | ***in situ* > *are + fronted subject*** | $\mathbf{p < .001}$ |
| CM2 | *are + fronted subject* ≈ broad focus | $p = .377$ |
| | ***in situ* > broad focus** | $\mathbf{p < .001}$ |
| | *in situ* ≈ *are + fronted subject* | $p = .079$ |
| CM4 | -no significant main effect- | |

Table 4.32: Bonferroni pairwise comparisons of rise for the speakers that produced more than one type of syntactic structure to mark contrastive focus. Significant results are in bold.

#### *4.2.2.7 Slope*

Similar to Rise, the acoustic measurement for Slope is calculated via the measurements for Rise and Duration, and is, consequently, not independent from these measurements. A Pearson correlation analysis (two-tailed) demonstrates this as there was a significant correlation between Rise and Slope, r = .155, n = 1881, $p < .001$, and between Duration and Slope, r = -.045, n = 1881, *p* = .05.  As illustrated in Figures 4.15 and 4.16, a greater overall rise was correlated with a steeper slope while a longer duration was correlated with a less steep slope.

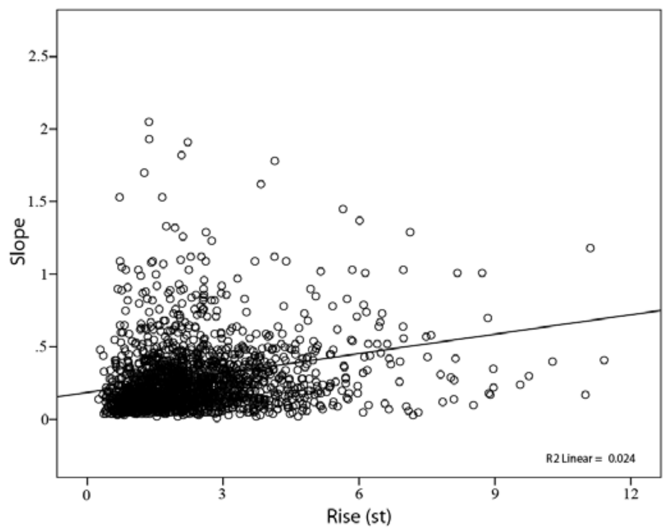


Figure 4.15:  Slope as a function of Rise (st).

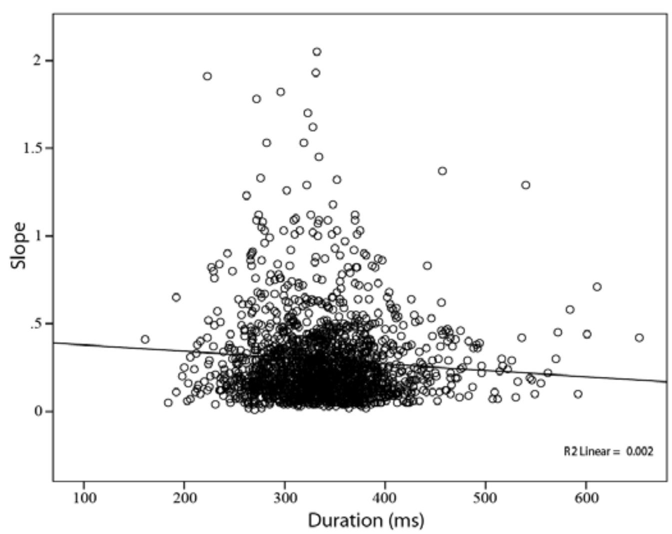


Figure 4.16:  Slope as a function of Duration (ms).

The results of the analysis of Slope are presented in Tables 4.33-4.35 and are illustrated in the Boxplots in Figure 4.17, separated by dialect and gender. These results indicate that there is only a main effect of Pragmatic Condition and the pairwise comparisons show that both *in situ* and *are + fronted subject* contrastive focus conditions had significantly steeper slopes than broad focus.

| Means (SD)- Slope | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | .34 (.33) | .25 (.56) | .33 (.58) | .29 (.29) |
| Broad Focus | .20 (.15) | .23 (.24) | .17 (.24) | .16 (.24) | .24 (.24) |
| In Situ Contrastive Focus | .39 (.47) | .49 (.34) | .38 (.27) | - | .39 (.47) |
| Are + Fronted Subject Contrastive Focus | .39 (.66) | .48 (.27) | .33 (.44) | .35 (.34) | .40 (.45) |
| Are + In Situ Contrastive Focus | .31 (.47) | .33 (.44) | .32 (.37) | - | .31 (.47) |

Table 4.33: Mean (SD) of Slope across all factors.

| Linear Mixed Model- Slope | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **.199 (.097)** | **$F_{(1, 132.12)} = 4.074, p < .05$** | **.161** | **.238** |
| **Pragmatic Condition** | **.162 (.079)** | **$F_{(3, 1712.04)} = 3.718, p < .01$** | **.008** | **.315** |
| Gender | .061 (.056) | $F_{(1, 614.93)} = .338, p = .561$, n.s. | -.054 | .176 |
| Dialect | .08 (.053) | $F_{(1, 21.12)} = 3.745, p$ .066, n.s. | -.029 | .189 |
| Age | .002 (.002) | $F_{(1, 220.86)} = .22, p = .639$, n.s. | -.002 | .006 |
| Pragmatic Condition * Gender | .098 (.085) | $F_{(3, 1735.82)} = 1.595, p = .189$, n.s. | -.068 | .264 |
| Pragmatic Condition * Dialect | .035 (.047) | $F_{(1, 1828.44)} = .571, p = .45$, n.s. | -.056 | .127 |
| Pragmatic Condition * Age | .002 (.003) | $F_{(3, 1724.41)} = .273, p = .845$, n.s. | -.004 | .009 |
| Random Effects | | | | |
| Residual | .186 (.006) | - | | - |
| Speaker | .012 (.005) | - | | - |
| Token | .003 (.001) | - | | - |
| Model Information Criteria (BIC) = 2305.475 | | | | |

Table 4.34: Results of Linear Mixed Model of Slope: significant results are in bold.

| Bonferroni Pairwise Comparisons- Slope | |
|---|---|
| Comparison | Significance |
| ***in situ* > broad focus** | ***p* < .001** |
| *in situ* ≈ *are + fronted subject* | *p* = 1.00 |
| *in situ* ≈ *in situ + are* | *p* = .183 |
| ***are + fronted subject* > broad focus** | ***p* < .001** |
| *are + fronted subject* ≈ *are + in situ* | *p* = 1.00 |
| *are + in situ* ≈ broad focus | *p* = .206 |

Table 4.35: Results of Bonferroni Pairwise Comparisons of Pragmatic Condition of Slope: significant results are in bold.

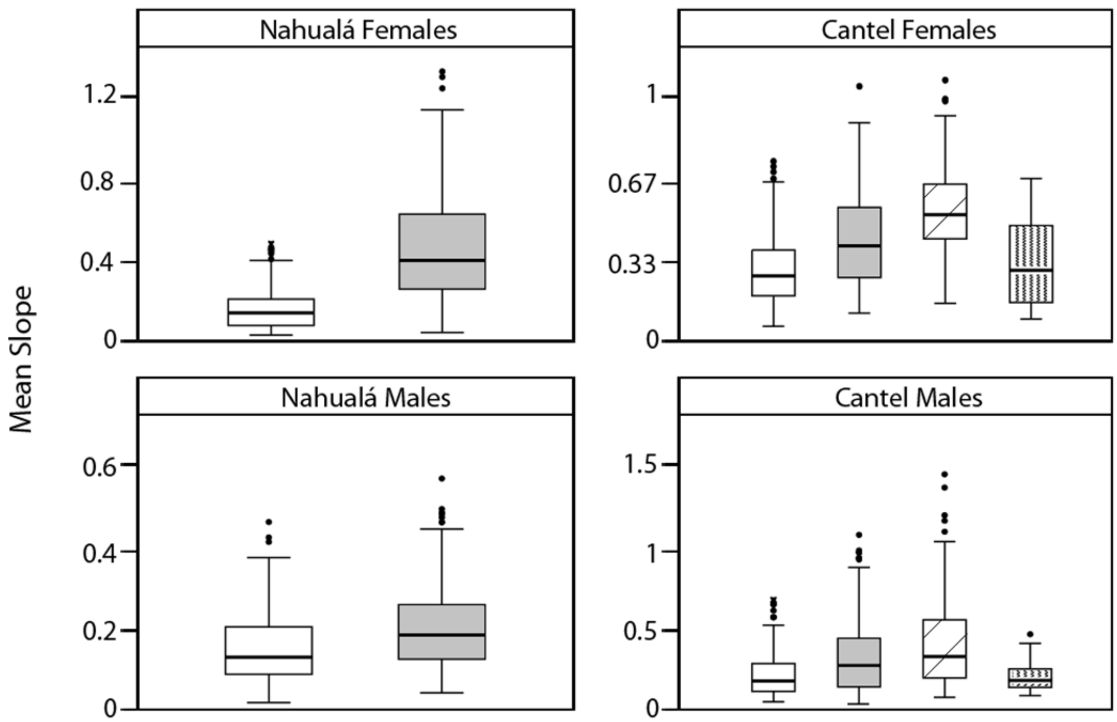


Figure 4.17: Boxplots of mean slope of intonational contour for all speaker groups in K'ichee' in all pragmatic conditions: broad focus (white), *are + fronted subject* contrastive focus (gray), *in situ* contrastive focus (diagonal lines) and *are + in situ* contrastive focus (vertical lines). A higher number indicates a steeper slope.

| Individual Speaker ANOVAs- Slope | | | | | |
|---|---|---|---|---|---|
| **NF1** | **NF2** | **NF3** | **NF4** | **NF5** | **NF6** |
| **$F_{(1, 78)}$ = 16.043, $p < .001$** | **$F_{(1,78)}$ = 19.207, $p < .001$** | **$F_{(1, 78)}$ = 12.114, $p < .001$** | **$F_{(1, 73)}$ = 19.489, $p < .001$** | **$F_{(1, 74)}$ = 52.826, $p = < .001$** | **$F_{(1, 73)}$ = 54.029, $p < .001$** |
| **NM1** | **NM2** | **NM3** | NM4 | **NM5** | NM6 |
| **$F_{(1, 78)}$ = 9.546, $p < .01$** | **$F_{(1, 78)}$ = 91.94, $p < .001$** | **$F_{(1, 77)}$ = 47.452, $p < .001$** | $F_{(1, 78)}$ = .901, $p = .345$, n.s. | **$F_{(1, 78)}$ = 4.561, $p < .05$** | $F_{(1, 76)}$ = .017, $p = .896$, n.s. |
| **CF1*** | **CF2** | **CF3** | CF4 | **CF5*** | **CF6** |
| **$F_{(2, 72)}$ = 4.133, $p < .05$** | **$F_{(1, 77)}$ = 6.391, $p < .01$** | **$F_{(1, 76)}$ = 20.835, $p < .001$** | $F_{(1, 76)}$ = 1.417, $p = .249$, n.s. | **$F_{(2, 78)}$ = 4.654 $p < .05$** | **$F_{(1,78)}$ = 58.994, $p < .001$** |
| **CM1** | **CM2*** | CM3 | **CM4*** | CM5 | **CM6** |
| **$F_{(1, 67)}$ = 4.366, $p < .05$** | **$F_{(2, 68)}$ = 33.337, $p < .001$** | $F_{(1, 67)}$ = 1.147, $p = .324$, n.s. | **$F_{(2, 78)}$ = 4.212, $p < .05$** | $F_{(1, 78)}$ = .125, $p = .724$, n.s. | **$F_{(1, 78)}$ = 62.189, $p < .001$** |

Table 4.36: Results from the ANOVAs of slope for all 24 speakers; significant results are in bold and indicate that the speaker had a steeper slope in a particular contrastive focus condition than in broad focus. An asterisk signifies that the participant produced more than one syntactic structure for contrastive focus and, where there is a significant main effect, they further analyzed in the Bonferroni pairwise comparisons in Table 4.37.

Tables 4.36 and 4.37 summarize the results of the individual speaker ANOVAs and corresponding Bonferroni pairwise comparisons, which indicate that 19 of 24 speakers use a significantly steeper slope to mark contrastive focus. For the speakers that produced more than one syntactic structure in the contrastive focus condition and displayed an overall main effect of pragmatic condition, *in situ* contrastive focus consistently had a steeper slope than broad focus. The slope of the particular syntactically marked contrastive focus varied according to speaker; for speakers CF1 and

CM4 it was only significantly steeper in the *in situ* contrastive focus condition, for speaker CF5 both contrastive focus conditions had a significantly steeper slope than the broad focus condition and speaker CM2 produced three significant levels of slope with *in situ* contrastive focus being the steepest and *are + fronted subject* contrastive focus being steeper than broad focus.

| Bonferroni Pairwise Comparisons- Slope | | |
|---|---|---|
| Speaker | Comparison | Significance |
| CF1 | *are + fronted subject* ≈ broad focus | $p$ = .083 |
| | ***in situ* > broad focus** | **$p$ < .05** |
| | *in situ* ≈ *are + fronted subject* | $p$ = 1.0 |
| CF5 | *are + fronted subject* ≈ broad focus | $p$ = .702 |
| | ***in situ* > broad focus** | **$p$ < .001** |
| | ***in situ* > *are + fronted subject*** | **$p$ < .001** |
| CM2 | ***are + fronted subject* > broad focus** | **$p$ < .001** |
| | ***in situ* > broad focus** | **$p$ < .001** |
| | ***in situ* > *are + fronted subject*** | **$p$ < .05** |
| CM4 | *are + in situ* ≈ broad focus | $p$ = 1.00 |
| | ***in situ* > broad focus** | **$p$ < .05** |
| | *in situ* ≈ *are + in situ* | $p$ = .095 |

Table 4.37: Bonferroni pairwise comparisons of slope for the speakers that produced more than one type of syntactic structure to mark contrastive focus. Significant results are in bold.

## 4.3 CORRELATIONS WITH BILINGUAL LANGUAGE DOMINANCE

As previous studies have shown, different bilinguals can mark focus using the same strategies, but may do so to different degrees (O'Rourke, 2012b). This section provides a further analysis of each strategy of contrastive focus marking previously analyzed in this chapter, with the exception of duration, and takes into consideration the role of bilingual language dominance, as interpreted by the Bilingual Language Profile (Birdsong et al., 2012). Duration is not analyzed according to the BLP because the results from Section 4.2.2.1 suggest that there are dialectal differences in how duration is used to mark contrastive focus in K'ichee'.

With the exception of syntactic structure, the degree of focus score for each of the acoustic strategies of contrastive focus marking was assessed in the following way: for each speaker, the mean score of an acoustic feature in the broad focus condition was subtracted from the mean score of that same acoustic feature in a contrastive focus condition. However, since there were three different syntactic structures of contrastive focus used by the participants in this study, different degree of focus scores were calculated using the mean from the broad focus responses subtracted from the mean of each respective syntactic structure response of contrastive focus. Following the same threshold set forth for individual speaker Bonferroni pairwise comparisons in Section 4.2.2, a speaker needed to produce at least 5 tokens of a particular syntactic structure in order to be included in the correlation analysis of the degree of focus that was based on that specific structure. Proceeding in this way, only the *are + fronted subject* contrastive focus condition had enough tokens for a correlation analysis; 19 of 24 speakers in this study produced more than 5 tokens of it. Since only 7 speakers produced at least 5 tokens of the *in situ* contrastive focus condition and only 2 speakers produced at least 5 tokens of the *are + in situ* contrastive focus condition, they are not included in this correlation analysis.[46]

### 4.3.1 Syntactic structure of contrastive focus

The results from Section 4.1.2 demonstrate the differences in the syntactic structure of contrastive focus marking between Nahualá and Cantel. While these results

[46] A Pearson correlation analysis (two-tailed) was run on the 7 speakers who produced enough tokens of *in situ* contrastive focus for all of the acoustic features but it never revealed any significant results, which may in part be due to the low number of data points in the analysis.

displayed between-speaker variance among the Cantel speakers, they did not among Nahualá speakers as the *are* + *fronted subject* syntactic structure was used 99.4% of the time in the production task. The data reported in Section 3.5 demonstrated that the Cantel bilinguals in this study were significantly more Spanish-dominant than the Nahualá bilinguals, or that among the population studied in this study, dialect and language dominance are not independent of each other. A Pearson correlation analysis (two-tailed) revealed a significant relationship between the syntactic structure of contrastive focus used the BLP language dominance score when all 24 speakers were grouped together: $r = -.468$, $n = 24$, $p < .05$ (see Figure 4.18). However, when separated by dialect, there is no correlation between BLP and percent of tokens that used the *are* + *fronted subject* syntactic structure in Nahualá, $r = .442$, $n = 12$, $p = .15$, n.s., or in Cantel, $r = .097$, $n = 12$, $p = .765$, n.s, though it should be noted that a correlation analysis of the speakers from only one dialect greatly lowers the number of the tokens included in the analysis. Overall, Spanish-dominant bilinguals, i.e., most speakers from Cantel, demonstrated a greater tendency to use varieties of *in situ* contrastive focus in the production task than did K'ichee'-dominant bilinguals, i.e., most speakers from Nahualá.

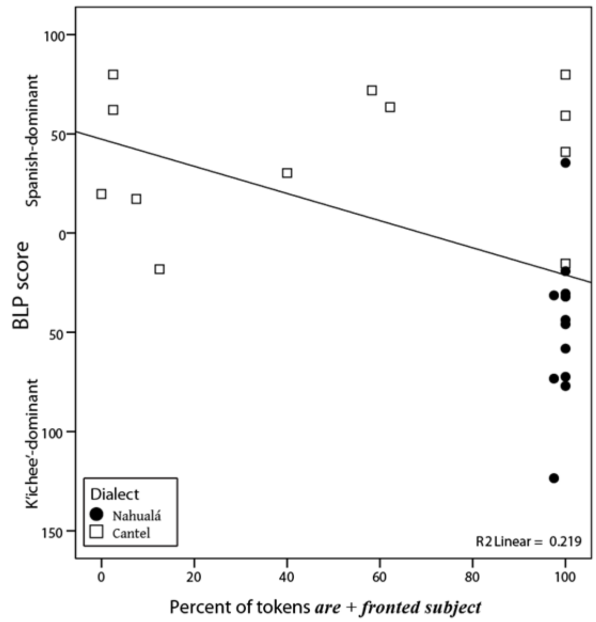


Figure 4.18: Percent of *are + fronted subject* tokens in contrastive focus condition as a function of the speakers' BLP score.

### 4.3.2 Acoustic features of contrastive focus

| Pearson correlation analyses with BLP score (two-tailed) | |
|---|---|
| **Peak Height** | **r = .723, *p* < .001** |
| Peak Alignment | r = -.281, *p* = .242, n.s. |
| Valley Height | r = .317, *p* = .186, n.s. |
| Valley Alignment | r = .142, *p* = .562, n.s. |
| **Rise** | **r = .663, *p* < .01** |
| Slope | r = -.026, *p* = .915, n.s. |

Table 4.38: Pearson correlation analyses between the BLP score and the corresponding acoustic measurement of prosodic focus marking. In all analyses, n = 19 and significant results are in bold.

As seen in Table 4.38, a series of Pearson correlation analyses (two-tailed) of all the acoustic features of contrastive focus marking, with the exception of duration, only reveal significant positive correlations of the BLP score and the degree of focus score for peak height and rise; the results of these two correlations are further illustrated in Figures 4.19 and 4.20. These results indicate that only the degree of focus of peak height and rise, which, as seen in Section 4.2.2.6, are correlated with each other, are correlated with bilingual language dominance among these bilinguals. In both cases, Spanish-dominant bilinguals were more likely to mark contrastive focus to a greater degree than K'ichee'-dominant bilinguals, regardless of dialect.

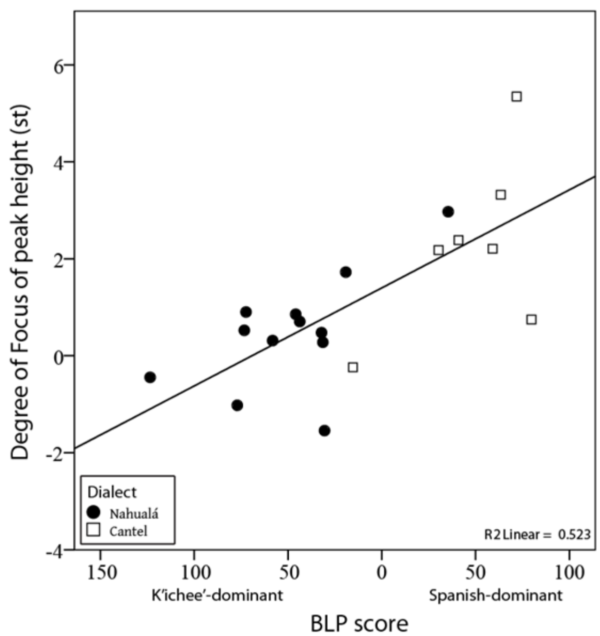


Figure 4.19: Mean peak height in *are + fronted subject* contrastive focus (st) minus mean peak height in broad focus (st) as a function of the speakers' BLP score.

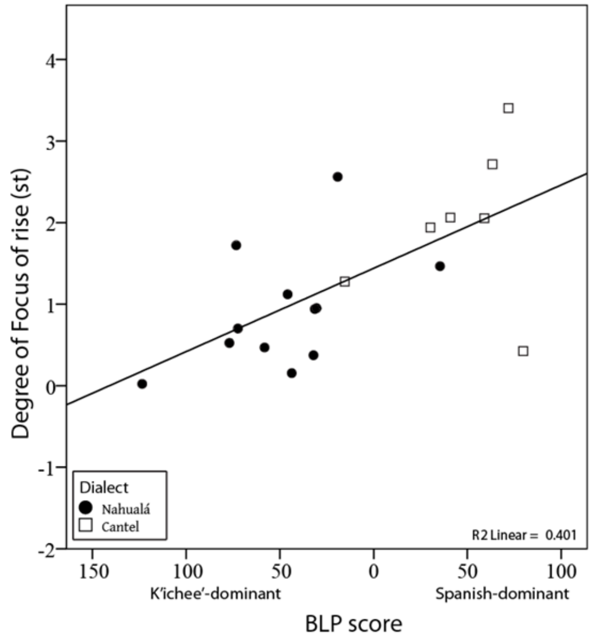


Figure 4.20: Mean rise in *are + fronted subject* contrastive focus (st) minus mean rise in broad focus condition (st) as a function of the speakers' BLP score.

### 4.4. DISCUSSION

The goal of this chapter was to analyze the prosodic features of contrastive focus marking in K'ichee' according to factors such as age, gender, dialect, and bilingual language dominance. Though these speakers demonstrate several variations according to these factors, they predominantly displayed similar patterns of prosodic contrastive focus marking. The research questions posed at the beginning of this chapter and the results of the analyses are summarized below.

The first question addressed was what type of syntactic structure these bilinguals use to mark contrastive focus in K'ichee'. The results of the choice of syntactic structure in both the sociolinguistic and the production task confirm the findings of Velleman (in press) that both *in situ* and *are + in situ* focus structures are possible in K'ichee', even though, overall, the speakers in this study preferred the syntactic structure found in grammatical descriptions of K'ichee': *are + fronted subject* (Can Pixabaj & England, 2011; López Ixcoy, 1997; Par Sapón & Can Pixabaj, 2000). It should be acknowledged that these findings could be a result of the production task itself in that there may be some underlying grammatical rule in Nahualá K'ichee' that prohibits, or at least reduces, the use of *in situ* contrastive focus in the context provided by the task. However, if there is such a restriction in Nahualá K'ichee', it does not appear to be as prevalent in Cantel K'ichee', as the same task produced the two *in situ* structures at a significantly greater rate than in Nahualá. Furthermore, there was greater within-speaker variation among the Cantel bilinguals; speakers CF1, CF5 and CM2, for example, produced both the *are + fronted subject* and the *in situ* forms at almost equal rates throughout the task.

These results demonstrate a possible change, or at least a variation that wasn't previously noted, in the syntactic structure used to mark contrastive focus in K'ichee'; the two in situ structures were used frequently by the Cantel speakers, though they were rarely used by Nahualá speakers. Even though there was a significant correlation between the syntactic structure used and the level of bilingual language dominance, the data presented in this study do not allow for the claim that these changes as simply due to contact with Spanish and further work on different syntactic structures is needed. For example, Velleman (in press) proposes that *in situ* focus is not possible for subjects of transitive verbs, and, while the question-answer task solely analyzed the focus of the subjects of intransitive verbs, the data from the sociolinguistic interviews indicated that these bilinguals still mark the focus of transitive verbs via these aforementioned changes in word order.[47] However, as Bullock & Toribio (2004) state, contexts of language

[47] See, for example, the phrase presented in Figure 4.2c, in which the subject of a transitive verb is focused via this change in word order by a speaker from Cantel.

contact and bilingualism may accelerate a change that was already proceeding in a language, and syntactic work among bilingual speakers has demonstrated so-called ‘bilingual optimization strategies’, in which bilinguals may avoid complex syntactic structures in a particular language in both bilingual and monolingual modes in favor of a parallel structure that exists in both of their languages (Muysken, 2005, 2013; Toribio, 2004). Consequently, a possible explanation of the variation and simplification of some of the forms of syntactic structures used to mark contrastive focus in Cantel may be language-specific changes in K’ichee’ that follow Velleman’s proposal of optional focus constituent movement for the subject of an intransitive verb that are being accelerated by bilingual optimization strategies among the Cantel bilinguals that, according to the BLP, use Spanish at a significantly higher rate than the Nahualá bilinguals.

The second research question was whether or not any prosodic prominence is given to a contrastive focus constituent in K’ichee’ and how this prominence varies across the different syntactic structures of contrastive focus. Overall, the results from the sociolinguistic interviews and the production task presented in this chapter provide evidence that a contrastive focus constituent is prosodically marked in K’ichee’ when compared to the same constituent in a broad focus context: there was always a significant main effect of Pragmatic Condition in the acoustic analyses of the production task data.

Although the group results demonstrate these main effects of pragmatic condition on the corresponding acoustic features of contrastive focus marking, further analysis reveals variation among individual speakers; analyses of peak height, valley height, and rise demonstrate greater individual speaker variation, as around half of the speakers in this study did not mark a contrastive focus constituent with a higher peak, a lower valley, or a greater rise. As the analyses demonstrate, there is a significant correlation between the height of the peak and the overall rise and between the height of the valley and the overall rise; consequently, the results of the analyses of these three acoustic measures are similar. Overall, these results indicate that peak height, valley height, and rise are speaker-specific in terms on how they are used to mark contrastive focus in K'ichee'. On the other hand, the individual speaker analyses of duration, peak alignment, valley alignment, and slope confirm the findings of the group analyses, with a few exceptions. While the use of duration differed according to dialect, the most consistent forms of marking contrastive focus prosodically across the speakers analyzed in this study were an earlier pitch peak, an earlier valley, i.e., an earlier start to the pitch rise, and a steeper slope, a measurement that is determined by both rise and the distance between the alignment of the valley and peak. These results are consistent with previous proposals within the Autosegmental-Metrical framework, where changes in the location of the intonational event, i.e. the location of the high and low tones, help convey pragmatic meanings (Estebas & Prieto, 2008; Face, 2001, 2002a; Frota, 2000; Pierrehumbert, 1980, Pierrehumbert & Steele, 1989; Silverman & Pierrehumbert, 1990) and, overall, the individual speaker results demonstrate that the location of the high and low tones may be more important in marking focus in K'ichee' than how high and low the tones actually are.

Among the speakers that produced more than one syntactic structure to mark contrastive focus, there was an overall tendency to give the most prosodic emphasis to the constituent in the *in situ* structure. It should be noted that in the group comparison of the different types of contrastive focus marking, only two speakers produced more than one token of *are + in situ* contrastive focus: speakers CF4 and CM4. Accordingly, the individual speaker analyses were performed to corroborate the findings of the group analyses. In every Bonferroni pairwise comparison of an acoustic feature of prosodic focus marking reported in this chapter, with the exception of when there was no overall main effect for a few individual speakers, the *in situ* contrastive focus condition was significantly more marked than the broad focus condition and, in multiple cases, the *in situ* contrastive focus condition was even significantly more marked than the syntactically marked contrastive focus condition produced by the same speaker. In some cases, individual speakers produced a 'focus prominence hierarchy': three significantly different degrees of focus across three conditions, such as with peak and valley alignment with speaker CF1 and with peak alignment, valley height, and rise in speaker CF5. In these cases, the *in situ* contrastive focus constituent was always significantly more marked than both the syntactically marked contrastive focus and the broad focus constituents and the syntactically marked contrastive focus constituent was also significantly more marked than the broad focus constituent. These results follow the proposals of Relevance Theory (Sperber & Wilson, 1986/1995); more prosodic emphasis would be needed in an in situ structure because the word order is the exact same as the broad focus structure and the speaker would therefore only be able to rely on this prosodic emphasis to highlight the focused constituent for the listener, while a focused constituent marked syntactically, by a change in word order, would already draw the attention of the listener and any prosodic emphasis given to the constituent would work alongside this change in word order.

The third research question explored in this chapter was whether there were any gender differences in the focus marking of these bilinguals. The results of the analyses revealed a main effect of Gender in duration, peak height, peak alignment, valley height, and valley alignment. The females in this study produced longer tonic syllables across all four pragmatic conditions than the males. Previous research on Dutch by Quené (2008) has demonstrated gender differences in syllable duration, in his study females also produced longer syllables than males. However, he notes that variations in syllable duration are a result of phrase length and speaking rate: while phrase length was controlled in this task, speaking rate was not and could therefore be a factor in the between-gender differences in duration.

While it is not surprising that females had significantly higher peaks and valleys than males across all pragmatic conditions, it is noteworthy that males tended to have earlier aligned peaks and valleys than females in most pragmatic conditions. As seen in the interactions between Pragmatic Condition and Gender, and as noted below in the discussion on dialectal differences, it is primarily the Nahualá male speakers that produce earlier peaks and valleys than the other speakers, particularly in contrastive focus conditions. Research on broad focus peak alignment in contact situations has demonstrated cases of one gender have earlier peaks than the other (Michnowicz & Barnes, 2013) and cases where there is no between-gender differences in broad focus peak alignment (Barnes & Michnowicz, 2013).[48] In the former, the authors propose that differences in gender roles in the communities, males tend to travel more for purposes of work and consequently have more contact with different language varieties, have led to these differences in peak alignment. Though the BLP scores do not indicate any differences between males and females from either dialect, the gender roles have been reported to be similar, particularly in Nahualá where more between-gender variation is seen (Hanamaikai & Thompson, 2005; Semus, 2005).

[48] In Michnowicz & Barnes (2013), female Yucatecan Spanish speakers tended to have earlier peaks than males.

As stated in Section 1.3.2, perceived prominence is not simply a correlate of peak height; it is an estimate of how wide the pitch excursion is based on what the listener's impressions of the normal pitch-register of the speaker are and research has demonstrated that speakers with higher pitch-registers need to create a larger pitch-span than speakers with lower pitch-registers in order to successfully draw the listener's attention to a constituent (Gussenhoven & Rietveld, 1998; among others). Generally speaking, females have higher pitch registers than males and the same is true among the bilinguals in this study. The significant interaction in the group analysis between Pragmatic Condition and Gender for Peak Height demonstrates that while both males and females significantly mark a contrastive focus constituent with a higher pitch peak than a broad focus constituent, the females, as a group, mark the contrastive focus constituent even more than the males, thus creating a greater pitch excursion than the males.[49]

Additionally, Age appeared to be correlated with Gender, 7 of the 11 participants over the age of 40 were male, as it never demonstrated a significant main effect and only demonstrated a significant interaction with Pragmatic Condition when there was also a significant interaction between Pragmatic Condition and Gender: the results in these significant interactions were always parallel.

The fourth research question addressed in this chapter is whether there were any dialectal differences in focus marking. The differences in duration between Nahualá and Cantel from both the sociolinguistic interviews and the production task support the earlier findings on K'ichee' stress presented in Baird (in press). In Nahualá, duration is

[49] While the females had a higher overall pitch than the males, the normalization of the data from Hz to st allows for this cross-gender analysis: thus, the females in this study tended to mark contrastive focus with a higher peak than males when comparing the differences in peak height (st) between contrastive focus conditions and the broad focus conditions of each gender.

employed to phonemically distinguish between long and short vowels in tonic syllables and not for other purposes, such as marking stress, whereas in Cantel, which no longer has phonemic vowel length, duration has been repurposed to mark stress alongside intonation. The results from both the group and the individual speaker analyses in this study provide further evidence of the restrictions of the use of duration to mark anything other than phonemic vowel length in Nahualá and for duration to be used in other capacities in Cantel, such as marking contrastive focus. Accordingly, the phonological differences between the vowel systems of Nahualá and Cantel appear to have an effect on prosodic contrastive focus marking in these two dialects.

Apart from phonological differences between the two dialects, it is again noted that Nahualá males produced significantly earlier valleys than the rest of the speakers. Likewise, the significant interactions between Pragmatic Condition and Dialect for both peak height and rise reveal that Cantel speakers have a tendency to mark contrastive focus constituents more than Nahualá bilinguals, which is also correlated with language dominance, as discussed below.

Finally, the correlation between contrastive focus marking and bilingual language dominance was explored via the data from the production task. As mentioned above, a correlation analysis demonstrated that the Spanish-dominant bilinguals in this study were more likely to use either of the *in situ* structures in the context provided by the production task. The results of the analyses of the degree of focus scores and the BLP language dominance score only revealed significant correlations with those acoustic measurements that also revealed a significant interaction between Dialect and Pragmatic Condition: Peak Height and Rise. Spanish-dominant bilinguals were more likely to mark contrastive focus with a greater peak height, and consequently, and greater overall pitch rise than

K'ichee'-dominant bilinguals, regardless of dialect.[50] These results are best understood when considering the previous findings of prosodic contrastive focus marking in K'ichee', which demonstrated that an earlier alignment of the high and low tones, i.e., the peaks and the valleys, was consistently used to prosodically mark a contrastive focus constituent while the actual height of the tones varied among speakers. Therefore, these results suggest that while the location of the tones may be a consistent acoustic strategy of contrastive focus marking, the actual height of at least the high tones may be correlated with the individual speaker's dialect, and, consequently, with the level of bilingual language dominance.

### 4.5. CONCLUSIONS

The tasks outlined in this chapter have investigated contrastive focus marking in K'ichee' and how it varies according to dialect and bilingual language dominance. The overarching questions of this study were what type of syntactic structure do these speakers use to mark contrastive focus, do they give any significant prosodic prominence to a contrastive focus constituent, are there any dialectal differences in contrastive focus marking and is there any correlation between focus marking and bilingual language dominance? In accordance with Velleman's (in press) findings, *in situ* contrastive focus is possible in K'ichee' and occurred at a significantly higher rate among Cantel speakers. However, contrary to findings on Yukateko (Gussenhoven, 2006; Gussenhoven & Teeuw, 2008; Kügler et al., 2007) and Yasavul's (2013) findings on focused versus topicalized constituents in K'ichee', the results from the production task in this chapter indicate that contrastive focus constituents are prosodically marked in K'ichee' when

[50] Again, the results showed a significant correlation between these two measures, a higher peak height was correlated with a greater overall rise.

compared to broad focus constituents and that this prosodic focus marking is most consistently realized through earlier peaks and valleys and steeper slopes. The dialectal differences reported in this chapter corroborate the proposal reported in Baird (in press), that Nahualá K'ichee' does not employ duration to mark stress of focus because of its phonemic inventory while Cantel K'ichee' does. Finally, the results reported in this chapter demonstrate a positive correlation between the BLP bilingual language dominance score and syntactic structure of contrastive focus, peak height, and pitch rise; Spanish-dominant bilinguals tended use the *in situ* contrastive focus structure more in the production task and to mark focus to a greater degree than K'ichee'-dominant bilinguals in peak height and overall rise.

## 5. Contrastive focus marking in Guatemalan bilingual Spanish

The previous chapter described K'ichee' in terms of the syntactic structures and the suprasegmental features used to mark a contrastive focus constituent in both naturalistic and lab speech. The aim of the current chapter is to analyze the suprasegmental features used to mark contrastive focus in the Spanish spoken by these Spanish-K'ichee' bilinguals from Nahualá and Cantel. Since both *in situ* and clefted syntactic structures are well documented in the literature, an analysis of the choice of syntactic structure to mark contrastive focus in Spanish is not performed in this chapter. However, since the location of the tonic syllable can vary in Spanish, both oxytone and paroxytone stress patterns are analyzed in this chapter; oxytones are analyzed for a comparison with the K'ichee' data and paroxytones are analyzed for a comparison with studies on other varieties of Spanish, which tend to examine paroxytones because they provide more "phonetic space", i.e., a post-tonic syllable within the target word where part of the intonational contour associated with the tonic syllable may occur (Hualde, 2005; O'Rourke, 2012b). The principle goals of this chapter are to analyze the prosodic features of contrastive focus marking in the Spanish of these Spanish-K'ichee' bilinguals under study and compare them to other varieties of Spanish, to investigate possible differences between the two dialects at issue, Nahualá and Cantel, and to consider the role of bilingual language dominance, as interpreted by the BLP, in prosodic focus marking. Since previous literature on different varieties of Spanish has demonstrated that intonation is used to mark focus, it is expected that it will also be used to mark contrastive focus among the bilingual speakers analyzed in this chapter.

The literature on the role of prosody in focus marking in Spanish has described the prosodic prominence given to a focus constituent as, but not limited to, the following:

a longer duration (de la Mota Gorriz, 1997; Face, 2002b; Kim & Avelino, 2003), a higher pitch peak (Barjam, 2004; Cabrera Abreu & García Lecumberri, 2003; de la Mota Gorriz, 1997; Domínguez, 2004; Face, 2001; García Lecumberri, 1995), and an earlier peak alignment (Barjam, 2004; de la Mota Gorriz, 1997; Face, 2001). Studies on contact Spanish have shown that these features are subject to transfer and convergence with the other language, and may not be realized in the same way in all varieties (Barjam, 2004; O'Rourke, 2005, 2012b; Simonet, 2008; van Rijswijk & Muntendam, 2012). Reiterating McMahon (2004), such studies of contact and bilingual intonation are important for understanding how intonational systems, and languages in general, change.

The two experiments in this chapter analyze the role of prosody in distinguishing between contrastive and broad focus constituents in the Spanish spoken by these Spanish-K'ichee' bilinguals; while the sociolinguistic interview did not control the stress pattern of the target word, the production task elicited both oxytone and paroxytone patterns. The same 24 bilinguals that participated in the experiments described in Chapter 4 participated in the sociolinguistic interview and the production task reported in this chapter (see Section 3.5). The research questions addressed in this chapter are the following:

(1) Do the Spanish-K'ichee' bilinguals in this study give more prosodic prominence to a contrastive focus constituent than to a broad focus constituent in Spanish? Does this prosodic prominence differ according to different stress patterns or syntactic structures of contrastive focus? Does this prominence in paroxytone target words differ from the prosodic focus marking described in other varieties of Spanish?

(2) Are there gender differences in how contrastive focus is prosodically marked? Do males mark focus differently than females?

(3) Are there dialectal differences between the Nahualá and Cantel bilingual groups in terms of prosodic focus marking? Do the phonological restrictions on the use of duration in Nahualá K'ichee' have any influence on contrastive focus marking in Nahualá Spanish?

(4) Is there a correlation between bilingual language dominance and the prosodic prominence given to a contrastive focus constituent in the Spanish of these bilinguals? Do Spanish-dominant bilinguals mark any prosodic feature of contrastive focus to a greater degree than K'ichee'-dominant bilinguals as they did in K'ichee'?

The rest of this chapter is organized in the following way: the data from the sociolinguistic interviews is described in Section 5.1. The results of the production task for both stress patterns are described in Section 5.2, and correlations between prosodic focus marking and bilingual language dominance are presented in Section 5.3. The overall results of this chapter are discussed in Section 5.4 and concluded in Section 5.5.

### 5.1 SOCIOLINGUISTIC INTERVIEWS

For each participant, the Spanish sociolinguistic interview was conducted by the same research assistant that conducted the sociolinguistic interview in K'ichee'. Due to reasons similar to those reported in Chapter 4, the data in the Spanish sociolinguistic interviews is uncontrolled and is therefore not analyzed acoustically. The number of contrastive focus elicitations ranged from 1 to 5 per participant, depending on the flow of the conversation, and yielded a total of 33 elicitations of contrastive focus in Nahualá and

42 in Cantel. The examples elicited from the interviews are described below and the intonational patterns associated with broad and contrastive focus are discussed.

### 5.1.1 Intonational contours in Nahualá

Sample pitch tracks of broad and contrastive focus are seen in Figure 5.1. Figure 5.1a is a comparison of *con mis hermanitos* 'with my younger siblings' in broad and contrastive focus; *hermanitos* is the focus constituent. The tonic syllable of *hermanitos*, /ni/, is longer in contrastive focus, 203 ms, than in broad focus, 169 ms. The contour begins to rise at the beginning of the tonic syllable in both focus contexts from similar valley heights: 193 Hz in contrastive focus and 187 Hz in broad focus. The peak in the contrastive focus utterance occurs earlier, within the tonic syllable, and reaches a height of 230 Hz; however, the true height and location of the pitch peak cannot be determined in the broad focus utterance because the /t/ following the tonic syllable interrupts the intonational contour, but, it is very likely that the peak occurs during the realization of the /t/.

Figure 5.1b is a comparison of the broad focus (*los niños*) *de cuarto* (*grado*) '(the kids) from fourth (grade)' and the contrastive focus *de cuarto* 'from fourth', which was produced in isolation. The tonic syllable /kwaɾ/ is marginally longer in contrastive focus, 273 ms, than broad focus, 264 ms. The height and location of the valley cannot be determined because of the onset /k/. The pitch occurs within the tonic syllable in contrastive focus and reaches a height of 234 Hz, though in this case the word does occur in phrase-final position which affects the location of the peak (Hualde, 2005; Prieto et al., 1995). Again, the onset /t/ in the post-tonic syllable does not allow for a complete analysis of the peak height and location in broad focus, but it does not occur before the /t/ and it is not likely that it reaches a height greater than 234 Hz.

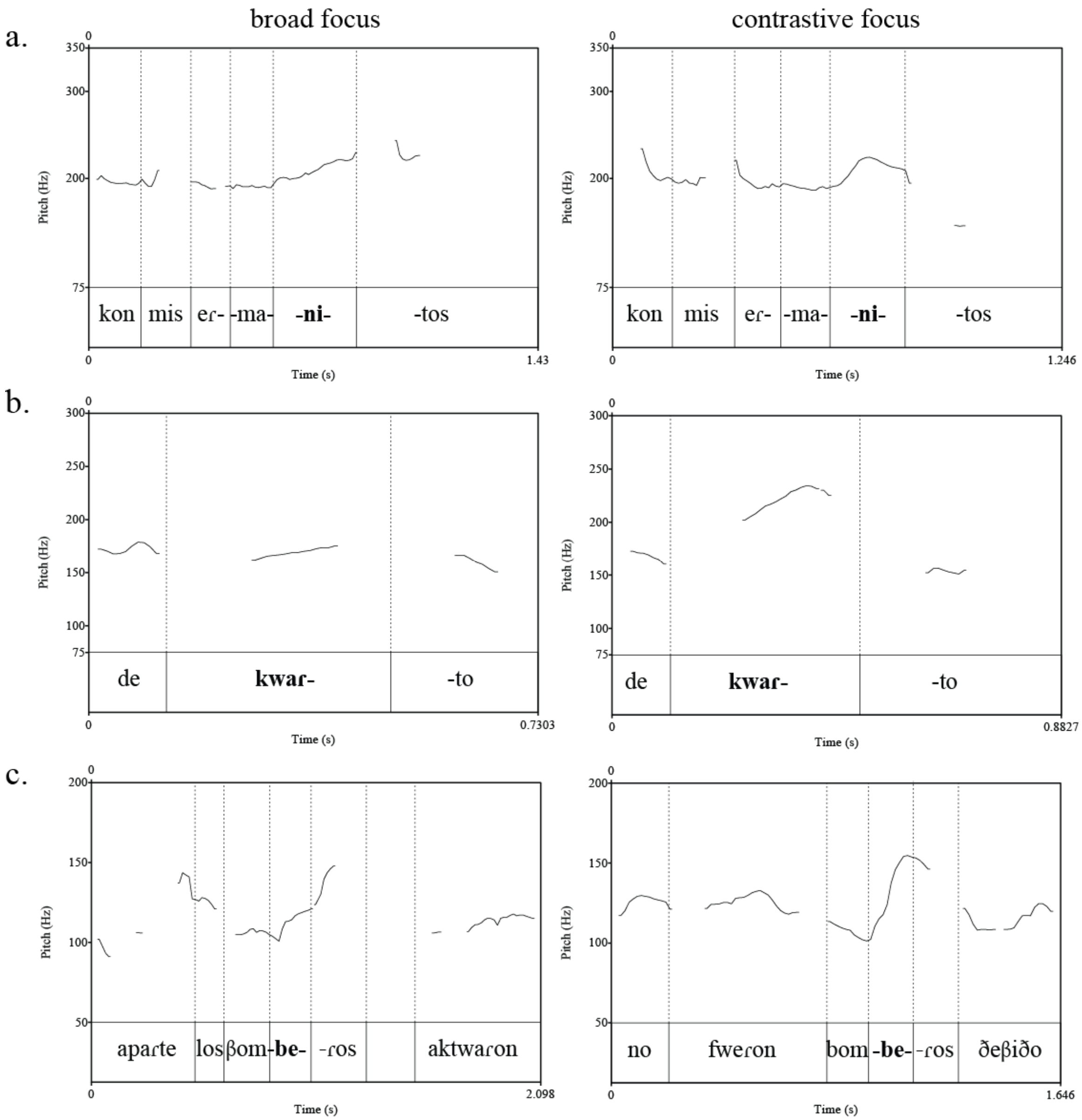


Figure 5.1: Sample pitch tracks from speakers NF2 (a), NF3 (b) and NM3 (c), on the left is a broad focus utterance and on the right is the corresponding contrastive focus utterance.

Finally, Figure 5.1c compares the broad focus utterance *aparte, los bomberos actuaron (rápidamente)* 'besides, the firefighters acted (quickly)' with the clefted contrastive focus utterance *no, fueron bomberos debido (a que la policía dijo que no podía hacer nada)* 'no, it was firefighters because (the police said they couldn't do anything).' The difference in duration between the tonic syllable /be/ of the constituent *bomberos* in the two contexts is minimal: 139 ms in contrastive focus and 142 ms in broad focus. The valleys begin at similar heights, 103 Hz in contrastive focus and 100 Hz in broad focus, but the valley in contrastive focus occurs earlier than it does in broad focus. The peak again occurs within the tonic syllable in contrastive focus, at a height of 157 Hz, but the pitch track is lost in the post-tonic syllable in broad focus, though it reaches 150 Hz before the coda /s/.

### 5.1.2 Intonational contours in Cantel

Sample pitch tracks of broad and contrastive focus produced by Cantel speakers are seen in Figure 5.2. Figure 5.2a contrasts (*mejor si no comemos*) *comida chatarra* '(it's better if we don't eat) junk food' with *comida chatarra* 'junk food', produced in isolation. In both cases the constituent *chatarra* is produced in utterance-final position. The tonic syllable /ta/ is longer in contrastive focus, 184 ms, than in broad focus, 127 ms. The height and location of the valley are not visible due to the onset /t/. The pitch peak occurs within the tonic syllable in the contrastive focus example, at 302 Hz, and slightly after the tonic syllable in the example of broad focus, at 226 Hz.

Figure 5.2b compares the broad focus utterance *un perro* (*que tengo*) 'a dog (that I have)' with the contrastive focus utterance *un perro* 'a dog', produced in isolation. The tonic syllable /pe/ was marginally longer in contrastive focus, 137 ms, than in broad focus, 126 ms. Again, the height and location of the valley are not visible, due to the onset /p/. In both contexts, the peak occurs within the tonic syllable, though in broad focus the constituent is not in utterance-final position. The peak is higher in contrastive focus 196 Hz, than in broad focus, 163 Hz.

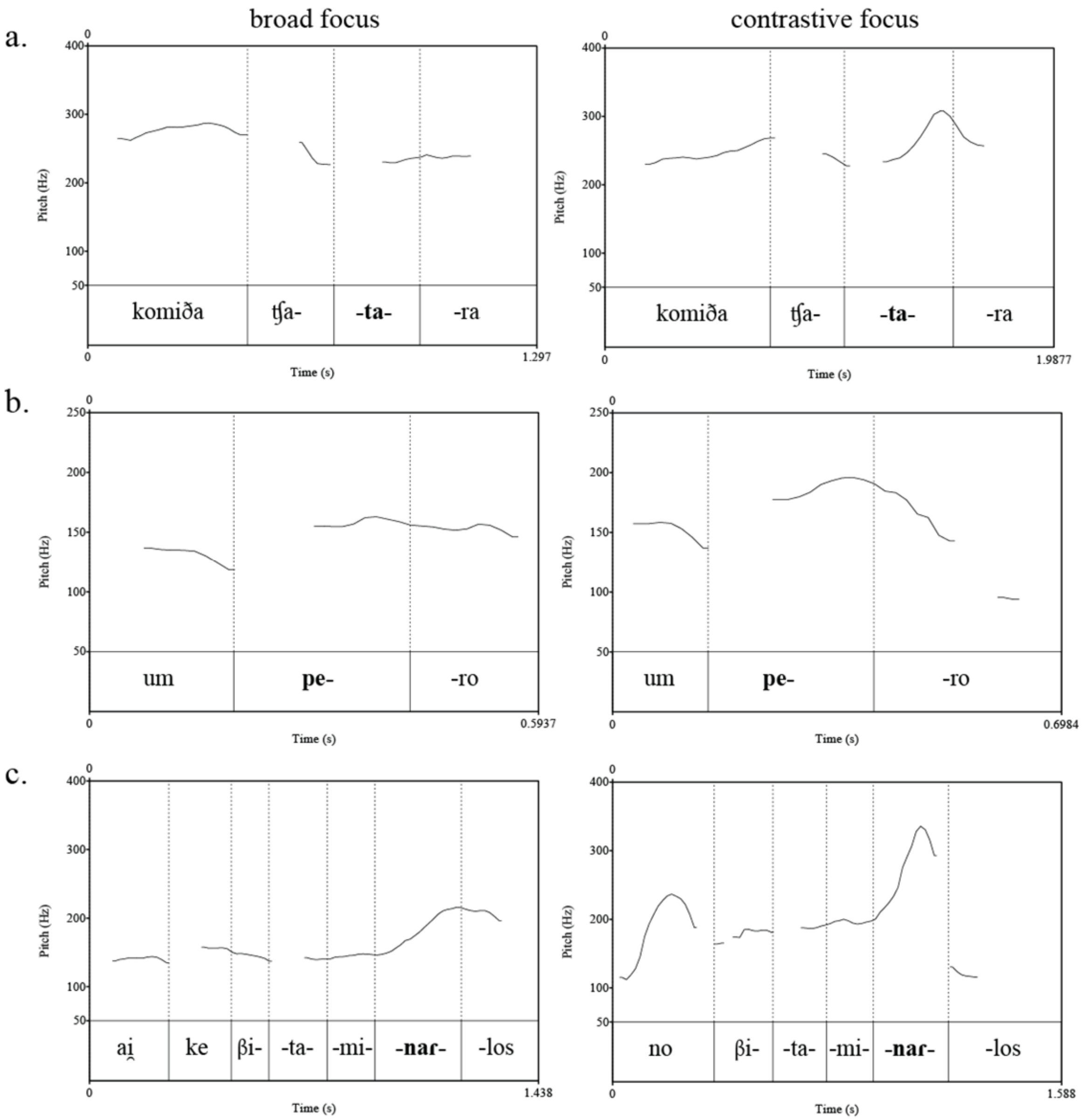


Figure 5.2: Sample pitch tracks from speakers CF2 (a), CM4 (b) and CM5 (c), on the left is a broad focus utterance and on the right is the corresponding contrastive focus utterance.

In Figure 5.2c, the broad focus utterance *hay que vitaminarlos* (*y luego tratarlos con medicamiento especial*) 'one must give them vitamins (and then treat them with special medicine)' is compared to the contrastive focus utterance *no, vitaminarlos* 'no, give them vitamins', produced in isolation. The tonic syllable /naɾ/ is longer in contrastive focus, 296 ms, than in broad focus, 238 ms. The valley in both contexts is located at the beginning of the tonic syllable but it is higher in contrastive focus, 187 Hz, than in broad focus, 151 Hz; though it should be noted that the entire contrastive focus phrase appears to be produced at a higher pitch in this example. Finally, the peak occurs in the tonic syllable in both examples, even though *vitaminarlos* is not in utterance-final position in the broad focus context; the peak is higher in contrastive focus, 336 Hz, than in broad focus, 215 Hz.

### 5.1.3 Discussion of sociolinguistic data

While uncontrolled, the examples of contrastive focus elicited in the Spanish sociolinguistic interviews demonstrate several features of prosodic focus marking in the Spanish of these bilinguals. However, the use of these features differed according to uncontrolled variables such as utterance length and position, or could not be fully analyzed due to voiceless consonants in the constituent. Overall, these examples demonstrate a tendency for a focus constituent to be marked in some way when compared to the same constituent in broad focus. However, controlled data allow for a more in-depth analysis which would help describe how this prosodic marking occurs in the Spanish of these bilinguals.

## 5.2 PRODUCTION TASK

The production task controls the variables that impeded an in-depth acoustic analysis in the data from the sociolinguistic interviews. The methodology of this task, the materials used, the procedure, and the methods of analysis are all outlined in Chapter 3 (see Section 3.4). In contrast to the K'ichee' materials, the Spanish target words in the production task consisted of two types of stress patterns: oxytone and paroxytone. The production task elicited a total of 3,840 tokens, 1,920 of each stress pattern: 119 oxytones (6.2%) and 95 paroxytones (4.9%) were discarded due to reasons such as non-responses, incorrect responses or placing the target word at the end of an utterance.

As both the *in situ* and clefted syntactic structures of contrastive focus marking in Spanish are well documented in the literature, an analysis of the syntactic structure used to mark contrastive focus is not included in this study. However, the distribution of the syntactic structure used by the speakers to mark contrastive focus in both stress patterns is reported in Tables 5.1 for Nahualá and Table 5.2 for Cantel. It should be noted that while the constituent is in the same location in the broad focus and *in situ* contrastive focus utterances, the same constituent is the fourth of six or seven words in the clefted contrastive focus utterances analyzed in this study: *fue la señora* ***alemana*** *quien/la que lloró* 'it was the German woman who cried'.

| | oxytones | | paroxytones | |
|---|---|---|---|---|
| **Speaker** | **in situ** | **clefted** | **in situ** | **clefted** |
| NF1 | 34 (100%) | - | 37 (100%) | - |
| NF2 | 36 (100%) | - | 40 (100%) | - |
| NF3 | 39 (100%) | - | 40 (100%) | - |
| NF4 | 40 (100%) | - | 40 (100%) | - |
| NF5 | 40 (100%) | - | 40 (100%) | - |
| NF6 | 37 (100%) | - | 40 (100%) | - |
| NM1 | 29 (72.5%) | 11 (27.5%) | 40 (100%) | - |
| NM2 | 40 (100%) | - | 40 (100%) | - |
| NM3 | - | 35 (100%) | 18 (45%) | 22 (50%) |
| NM4 | 16 (45.7%) | 19 (54.3%) | 16 (40%) | 24 (60%) |
| NM5 | 37 (100%) | - | 38 (100%) | - |
| NM6 | - | 35 (100%) | 17 (42.5%) | 23 (57.5%) |
| **Total** | **348 (77.7%)** | **100 (22.3%)** | **406 (86.6%)** | **63 (13.4%)** |

Table 5.1: Number of occurrences of each syntactic structure of contrastive focus in the Spanish production task for Nahualá speakers.

| | oxytones | | paroxytones | |
|---|---|---|---|---|
| **Speaker** | **in situ** | **clefted** | **in situ** | **clefted** |
| CF1 | 38 (100%) | - | 39 (97.5%) | 1 (2.5 %) |
| CF2 | 15 (37.5%) | 25 (62.5%) | 11 (33.3%) | 22 (66.7%) |
| CF3 | 35 (100%) | - | 38 (100%) | - |
| CF4 | 35 (100%) | - | 40 (100%) | - |
| CF5 | 36 (100%) | - | 40 (100%) | - |
| CF6 | 40 (100%) | - | 39 (100%) | - |
| CM1 | 37 (100%) | - | 38 (100%) | - |
| CM2 | 13 (32.5%) | 27 (67.5%) | 12 (33.3%) | 24 (66.7%) |
| CM3 | 37 (100%) | - | 37 (100%) | - |
| CM4 | 32 (100%) | - | 40 (100%) | - |
| CM5 | 40 (100%) | - | 40 (100%) | - |
| CM6 | 36 (100%) | - | 39 (100%) | - |
| **Total** | **394 (88.3%)** | **52 (11.7%)** | **413 (89.8%)** | **47 (10.2%)** |

Table 5.2: Number of occurrences of each syntactic structure of contrastive focus in the Spanish production task for Cantel speakers.

Similar to the analysis of the production task data in K'ichee, the acoustic data were analyzed via a series of Linear Mixed Models with Pragmatic Condition, Gender, and Dialect as factors (with Broad Focus, Male, and Nahualá as reference levels), Age as a continuous covariate, the measurement of the particular acoustic feature being analyzed as the dependent variable, and Speaker and Token as random effects.[51,52] Pragmatic Condition was divided into three levels: broad focus, *in situ* contrastive focus and clefted contrastive focus; and the main effects were further analyzed via Bonferroni pairwise comparisons. The individual speaker analyses were analyzed via a series of one-way ANOVAs with Pragmatic Condition as the independent variable and the particular acoustic measure as the dependent variable, since Token demonstrated very little variation in the group analyses, it was not included in the individual speaker analyses. Following the same threshold as the analysis of K'ichee' in Chapter 4, a Bonferroni pairwise comparison was only performed on an individual speaker if that speaker produced at least 5 tokens of each type of syntactic structure of contrastive focus. While the group means and standard deviations are presented here, the individual speaker means and standard deviations for each measurement are reported in Appendix D.

Figures 5.3-5.6 demonstrate the average pitch contour of the tonic syllable of the oxytone target word in different pragmatic contexts across all of the utterances of the speakers and Figures 5.7-5.10 demonstrate the same for the tonic syllable paroxytones target word.[53] These average pitch contours take into account all of the acoustic features

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[51] Again, language dominance was not included as a factor in order to avoid multicollinearality with Dialect, with which it was highly correlated.

[52] The final Hessian matrix was not positive for Token although all convergence criteria were satisfied for Oxytones: all measurements except Peak Alignment and Valley Height; and for Paroxytones: all measurements except Peak Alignment.

[53] The post-tonic syllable is not included in the average pitch contours of the paroxytones in Figures 5.7-5.10. Even though the data show that the pitch contour continues to rise and often peaks in the post-tonic

of contrastive focus mentioned in Section 3.4.5 and, as seen in these figures, the bilinguals in this study demonstrate a greater excursion of their pitch contours in contrastive focus than in broad focus in Spanish. The following subsections are dedicated to the individual analyses of each of the acoustic features of focus marking outlined in Section 3.4.5, duration, peak height, peak alignment, valley height, valley alignment, rise, and slope, in order to define exactly how these greater pitch excursions occur in both oxytones and paroxytones.

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syllables of tonic words with a paroxytone stress pattern, the post-tonic syllables of the target words differed in structure and length and averages would not be reliable for these average pitch contours.

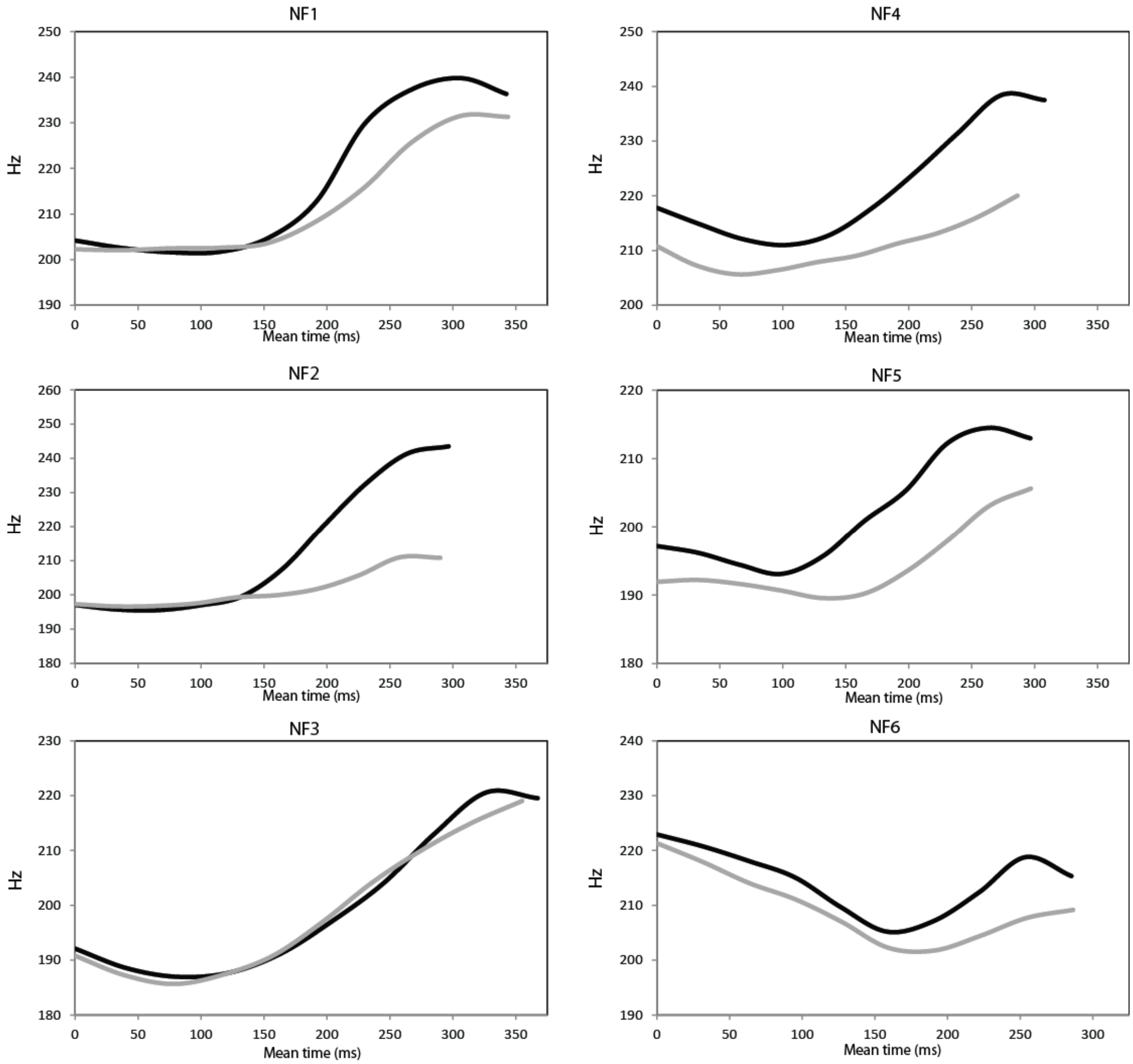


Figure 5.3: Nahualá female speakers: average pitch contours of the oxytone tonic syllable in broad focus (gray line) and *in situ* contrastive focus (black line) conditions.

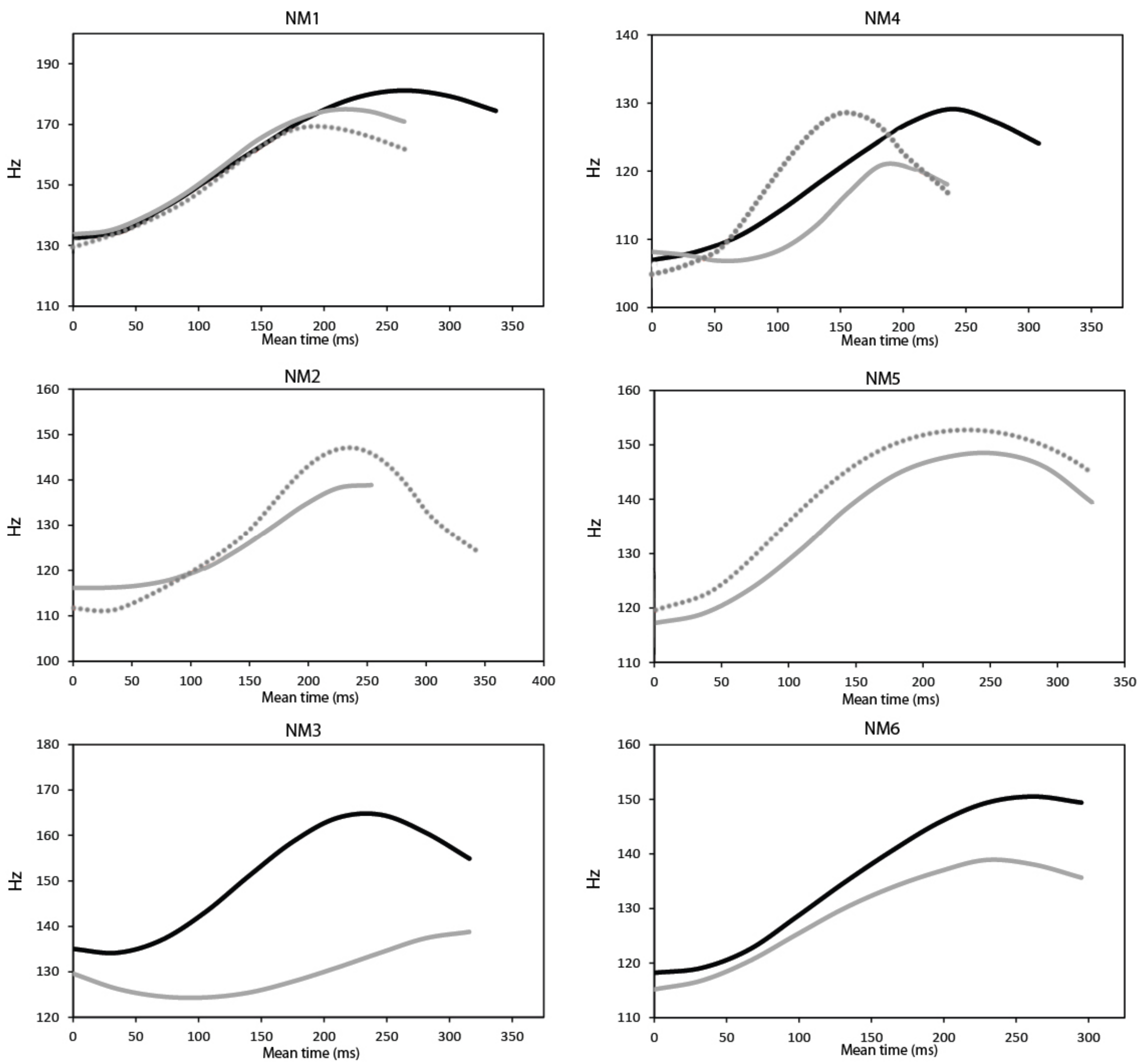


Figure 5.4: Nahualá male speakers: average pitch contours of the oxytone tonic syllable in broad focus (solid gray line), *in situ* contrastive focus (solid black line), and clefted contrastive focus (dotted gray line) conditions.

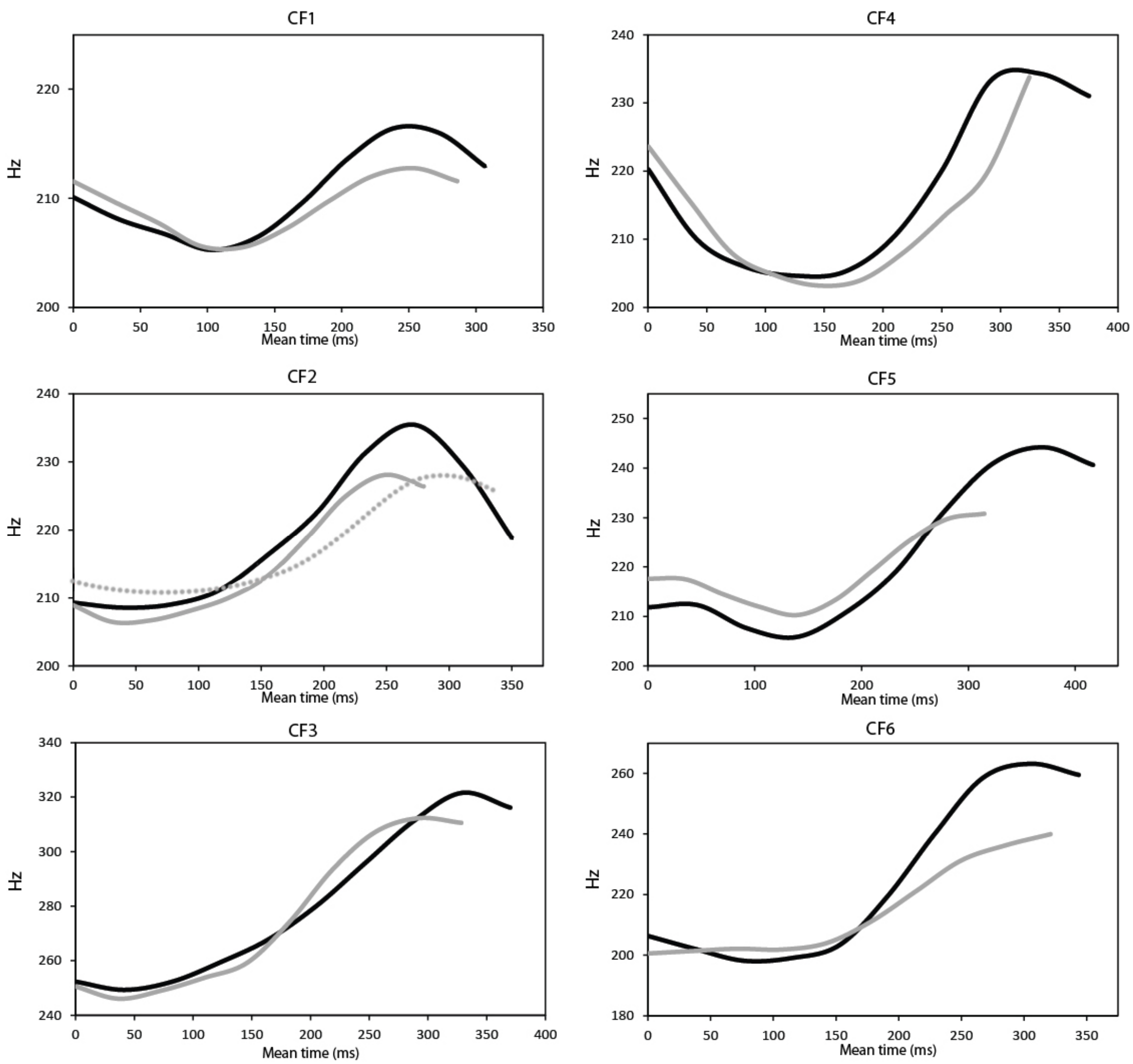


Figure 5.5: Cantel female speakers: average pitch contours of the oxytone tonic syllable in broad focus (solid gray line), *in situ* contrastive focus (solid black line), and clefted contrastive focus (dotted gray line, only speaker CF2) conditions.

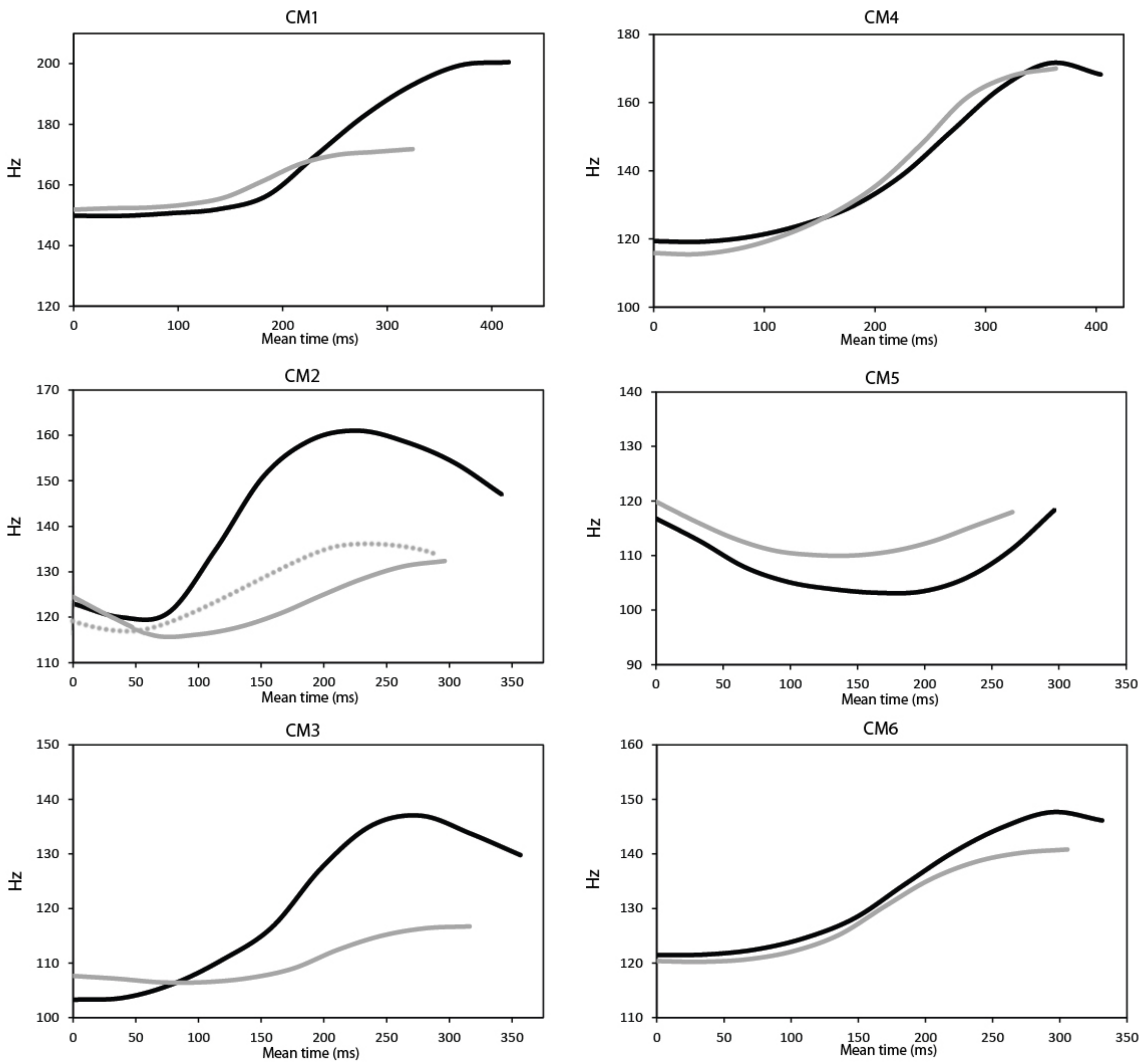


Figure 5.6: Cantel male speakers: average pitch contours of the oxytone tonic syllable in broad focus (solid gray line), *in situ* contrastive focus (solid black line), and clefted contrastive focus (dotted gray line, only speaker CM2) conditions.

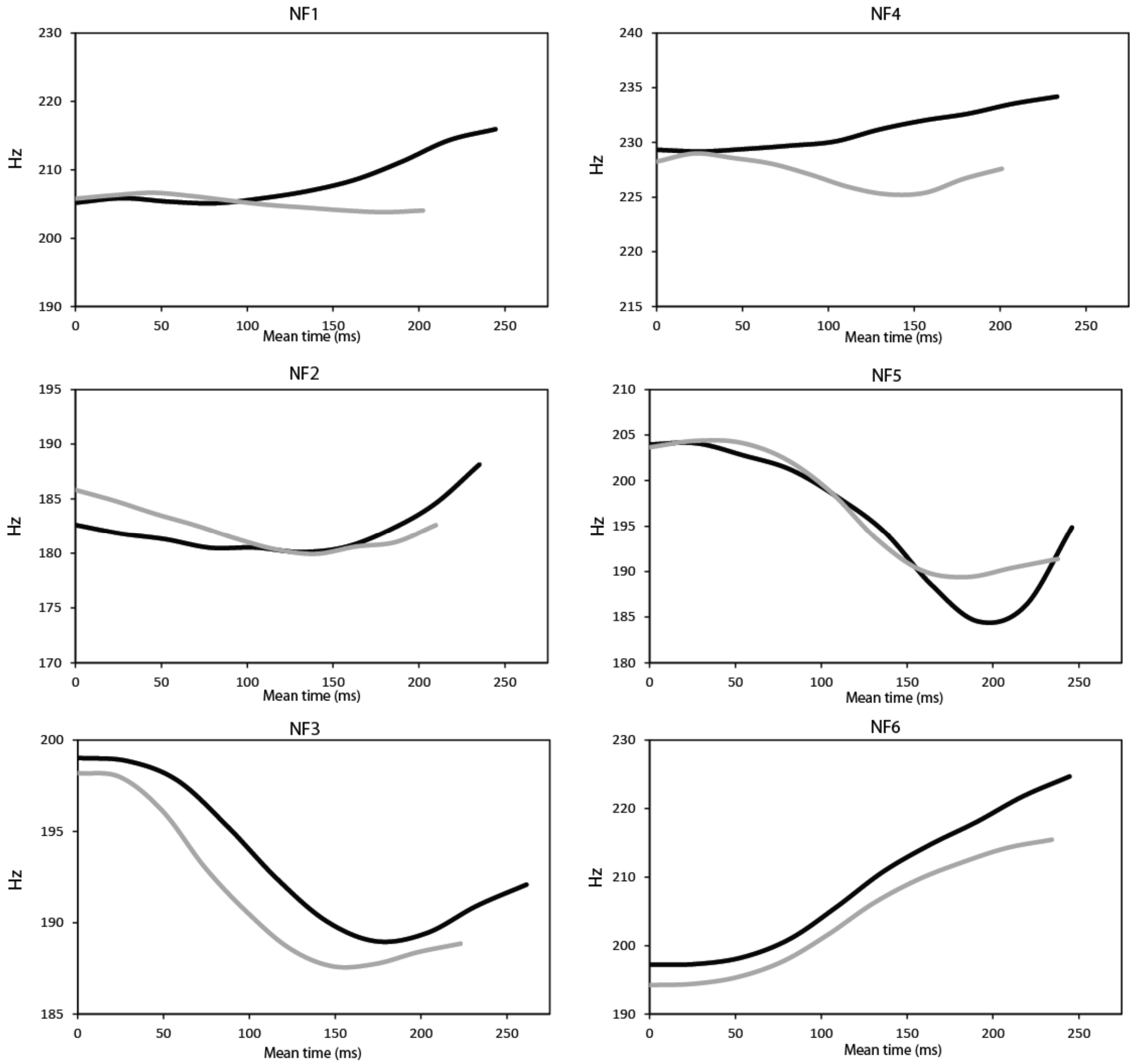


Figure 5.7: Nahualá female speakers: average pitch contours of the paroxytone tonic syllable in broad focus (gray line) and *in situ* contrastive focus (black line) conditions.

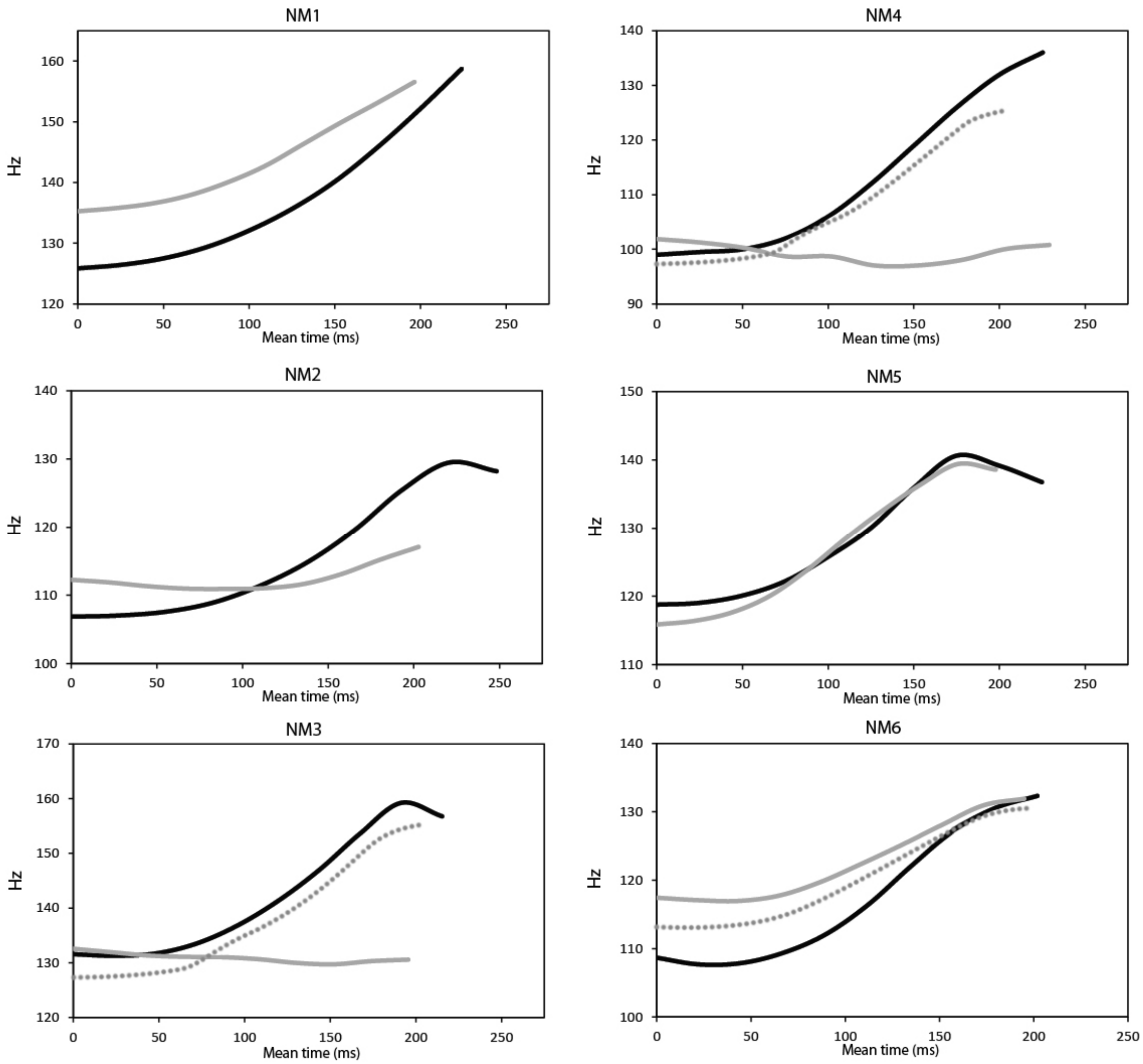


Figure 5.8: Nahualá male speakers: average pitch contours of the paroxytone tonic syllable in broad focus (solid gray line), *in situ* contrastive focus (solid black line), and clefted contrastive focus (dotted gray line) conditions.

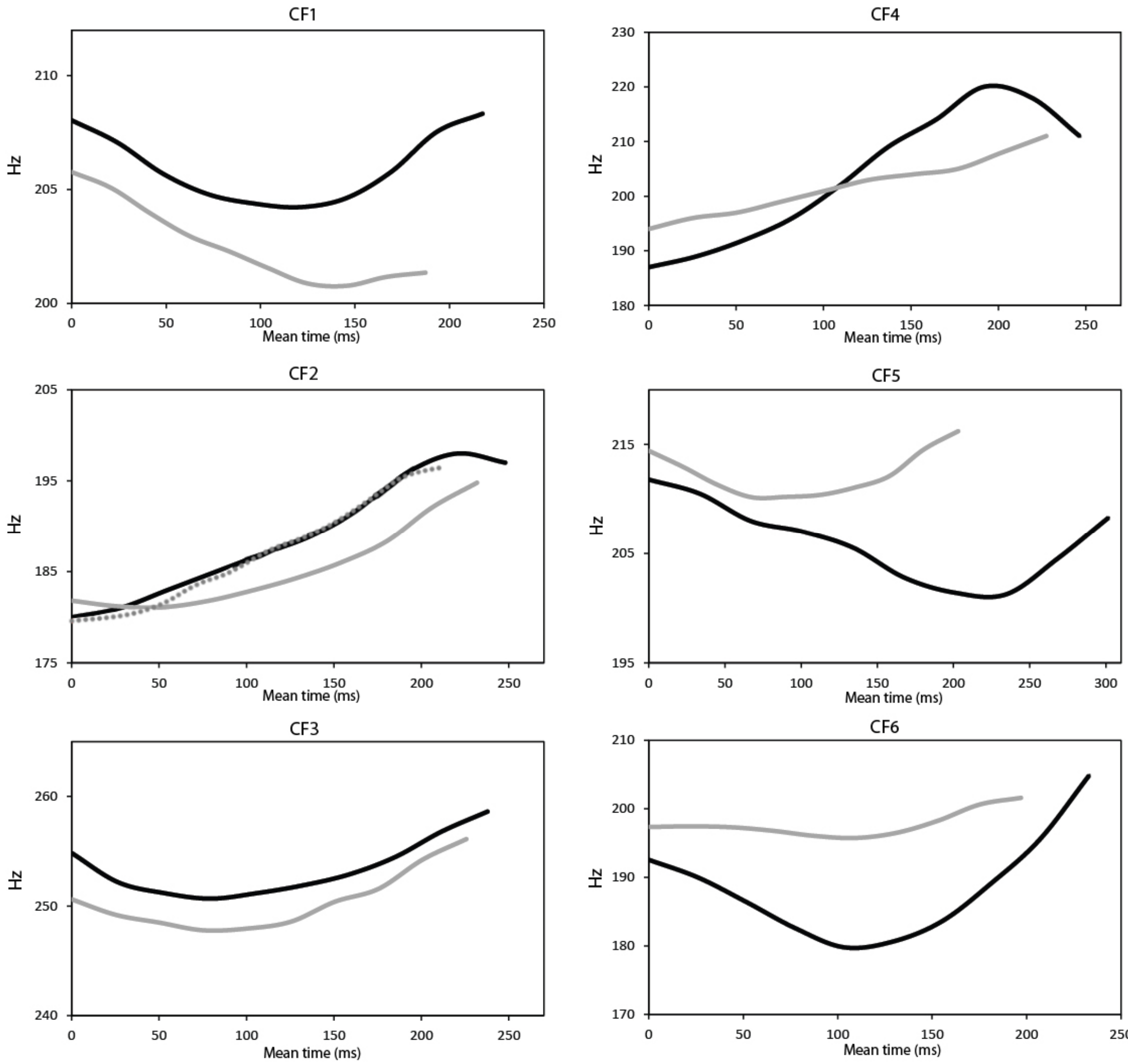


Figure 5.9: Cantel female speakers: average pitch contours of the paroxytone tonic syllable in broad focus (solid gray line), *in situ* contrastive focus (solid black line), and clefted contrastive focus (dotted black line, only speaker CF2) conditions.

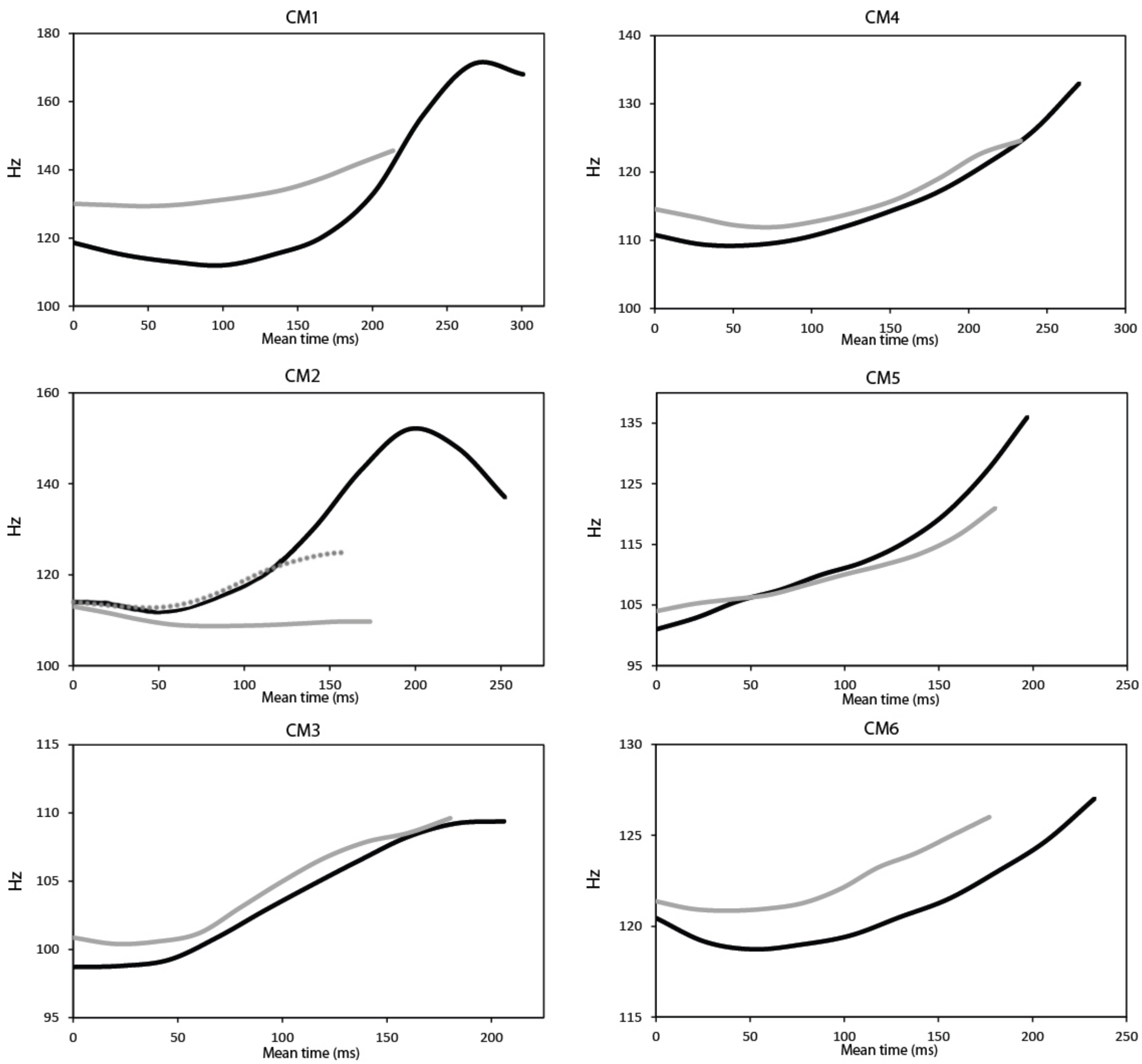


Figure 5.10: Cantel male speakers: average pitch contours of the paroxytone tonic syllable in broad focus (solid gray line), *in situ* contrastive focus solid (black line), and clefted contrastive focus (dotted gray line, only speaker CM2) conditions.

## 5.2.1 Duration

### *5.2.1.1 Oxytones*

The group means, Linear Mixed Model results, and Bonferroni pairwise comparison results are shown in Tables 5.3-5.5 and illustrated in Figure 5.11.

| Means (SD)- Oxytones Duration (ms) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 322 (62) | 313 (71) | 302 (59) | 334 (70) |
| Broad Focus | 304 (59) | 313 (56) | 296 (56) | 292 (55) | 317 (62) |
| In Situ Contrastive Focus | 342 (70) | 341 (62) | 344 (58) | 326 (59) | 359 (60) |
| Clefted Contrastive Focus | 282 (56) | 253 (82) | 284 (70) | 252 (67) | 285 (71) |

Table 5.3: Mean (SD) of Oxytone Duration (ms) across all factors.

| Linear Mixed Model- Oxytone Duration | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **275 (21.3)** | $\mathbf{F_{(1, 25.055)} = 253.852}$, $\boldsymbol{p} < .001$ | **230** | **319** |
| **Pragmatic Condition** | **29.3 (11.1)** | $\mathbf{F_{(2, 1663.61)} = 4.219}$, $\boldsymbol{p} < .05$ | **12.1** | **86.3** |
| Gender | 17.3 (12.3) | $F_{(1, 29.761)} = .209$, $p = .651$, n.s. | -7.9 | 42.9 |
| **Dialect** | **25.4 (11.7)** | $\mathbf{F_{(1, 25.859)} = 6.341}$, $\boldsymbol{p} < .05$ | **.35** | **48.7** |
| Age | .21 (.47) | $F_{(1, 24.226)} = .307$, $p = .584$, n.s. | -.67 | 1.1 |
| Pragmatic Condition * Gender | -21.1 (6.4) | $F_{(2, 1659.61)} = 1.265$, $p = .283$, n.s. | -20.7 | 38.9 |
| **Pragmatic Condition * Dialect** | **9.1 (5.2)** | $\mathbf{F_{(2, 1657.499)} = 8.182}$, $\boldsymbol{p} < .001$ | **6.7** | **13.9** |
| Pragmatic Condition * Age | .37 (.21) | $F_{(2, 1644.62)} = 1.904$, $p = .149$, n.s. | -1.2 | 6.9 |
| Random Effects | | | | |
| Residual | 3152 (109.8) | - | - | - |
| Speaker | 724.6 (245.1) | - | - | - |
| Token | .0000 (.0000) | - | - | - |
| Model Information Criteria (BIC) = 18327.571 | | | | |

Table 5.4: Results of Linear Mixed Model of Oxytone Duration: significant results are in bold.

| Bonferroni Pairwise Comparisons- Oxytone Duration | |
|---|---|
| Comparison | Significance |
| ***in situ* > broad focus** | $\boldsymbol{p} < .001$ |
| ***in situ* > clefted** | $\boldsymbol{p} < .001$ |
| **clefted < broad focus** | $\boldsymbol{p} < .001$ |

Table 5.5: Results of Bonferroni pairwise comparisons of Pragmatic Condition of Oxytone Duration: significant results are in bold.

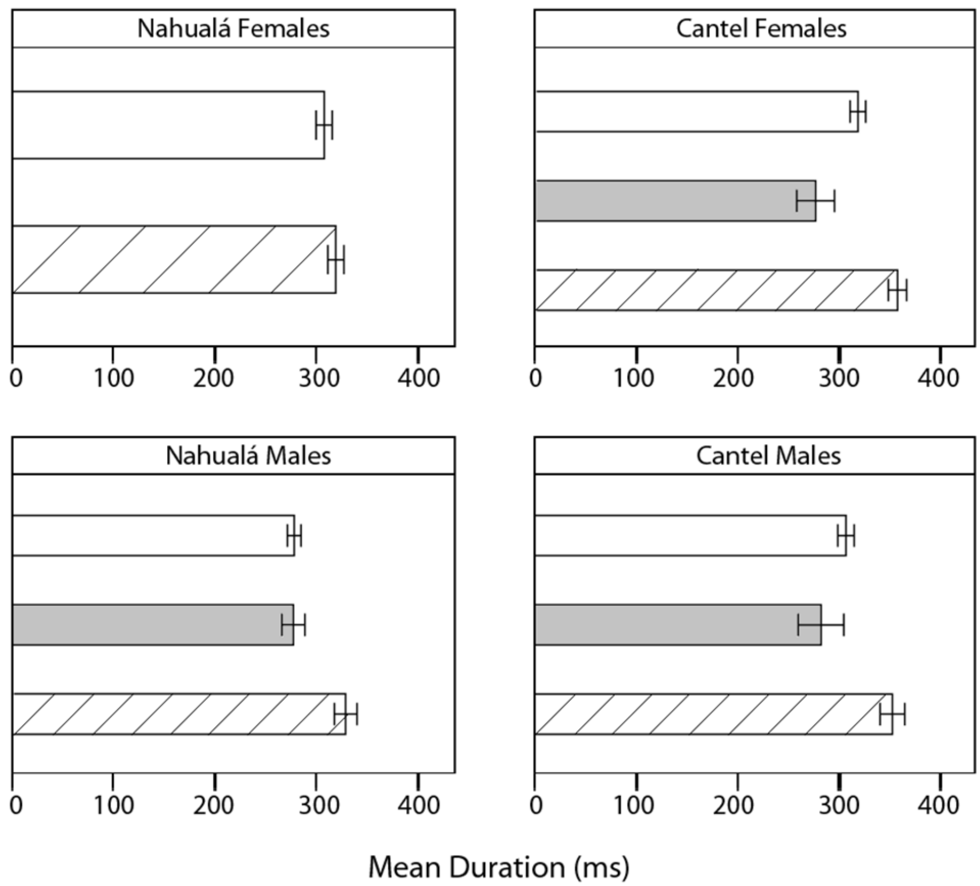


Figure 5.11: Bar graphs of mean duration of oxytone tonic syllable (ms) for all speaker groups in Spanish in all pragmatic conditions: broad focus (white), clefted contrastive focus (gray) and *in situ* contrastive focus (diagonal lines). 95% confidence interval bars included.

The results of oxytone duration reveal a significant main effect of Dialect and Pragmatic Condition. Cantel bilinguals produced longer tonic syllables than Nahualá bilinguals across all three pragmatic conditions and the pairwise comparisons of Pragmatic Condition demonstrates that the *in situ* contrastive focus constituent was significantly longer than both the broad focus constituent and the clefted contrastive focus constituent and that the broad focus constituent was actually longer than the clefted contrastive focus constituent. The significant interaction between Pragmatic Condition and Dialect reveals that even though Cantel bilinguals already have longer tonic syllables across all three pragmatic conditions they still mark contrastive focus constituents with a longer duration than Nahualá bilinguals when compared to the duration of broad focus.

| Individual Speaker ANOVAs- Oxytones Duration | | | | | |
|---|---|---|---|---|---|
| **NF1** | NF2 | NF3 | NF4 | NF5 | NF6 |
| **$F_{(1, 70)}$ = 9.107, $p < .01$** | $F_{(1, 69)}$ = .296, $p = .588$, n.s. | $F_{(1, 76)}$ = .987, $p = .324$, n.s. | $F_{(1, 74)}$ = 3.251, $p = .076$, n.s. | $F_{(1, 78)}$ = .055, $p = .815$, n.s. | $F_{(1, 74)}$ = .009, $p = .923$, n.s. |
| **NM1*** | **NM2** | NM3 | **NM4*** | **NM5** | NM6 |
| **$F_{(2, 77)}$ = 14.158, $p < .001$** | **$F_{(1, 78)}$ = 69.244, $p < .001$** | $F_{(1, 68)}$ = .003, $p = .991$, n.s. | **$F_{(2, 67)}$ = 13.988, $p < .001$** | **$F_{(1, 72)}$ = 14.906, $p < .001$** | $F_{(1, 67)}$ = 2.535, $p = .116$, n.s. |
| **CF1** | **CF2*** | **CF3** | **CF4** | **CF5** | **CF6** |
| **$F_{(1, 73)}$ = 4.282, $p < .05$** | **$F_{(2, 77)}$ = 8.605, $p < .001$** | **$F_{(1, 61)}$ = 9.169, $p < .01$** | **$F_{(1, 68)}$ = 13.665, $p < .001$** | **$F_{(1, 76)}$ = 81.708, $p < .001$** | **$F_{(1, 78)}$ = 4.988, $p < .05$** |
| **CM1** | **CM2*** | **CM3** | **CM4** | **CM5** | **CM6** |
| **$F_{(1, 73)}$ = 38.361, $p < .001$** | **$F_{(2, 75)}$ = 4.568, $p < .05$** | **$F_{(1, 72)}$ = 4.226, $p < .05$** | **$F_{(1, 65)}$ = 12.027, $p < .001$** | **$F_{(1, 64)}$ = 7.794, $p < .01$** | **$F_{(1, 76)}$ = 7.89, $p < .01$** |

Table 5.6: Results from the ANOVAs of oxytone duration for all 24 speakers; significant results are in bold and indicate that the individual speaker had a longer duration in the contrastive focus condition. An asterisk signifies that the speaker produced more than one syntactic structure for contrastive focus and is further analyzed where there is a significant main effect in the Bonferroni pairwise comparisons in Table 5.7.

The individual speaker results of the ANOVAs of duration are shown in Table 5.6 and the corresponding Bonferroni pairwise comparisons are in Table 5.7. The results of the individual speaker analyses further demonstrate the significant interaction found in the group analysis as they demonstrate that all but seven speakers mark contrastive focus with a longer duration in Spanish words with an oxytone stress pattern: the seven speakers that did not were from Nahualá. Of these speakers that did not significantly mark contrastive focus via duration, speakers NM3 and NM6 only produced clefted contrastive focus and not *in situ* contrastive focus during the production task. Five of the six Nahualá females did not significantly lengthen the tonic syllable in *in situ* contrastive focus, suggesting that they have transferred the phonological restrictions of duration from K'ichee' to Spanish since there is no such restriction on duration in Spanish; all 12 Cantel speakers use a longer duration to mark contrastive focus. The Bonferroni pairwise comparisons demonstrate that *in situ* contrastive focus is marked with a longer duration than both clefted contrastive focus and broad focus; the latter two were not significantly different for three of the four speakers analyzed. However, for speaker NM4, broad focus was significantly longer than clefted contrastive focus.

| Bonferroni Pairwise Comparisons- Oxytones Duration | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM1 | ***in situ* > broad focus** | **$p < .001$** |
| | ***in situ* > clefted** | **$p < .001$** |
| | clefted ≈ broad focus | $p = .715$ |
| NM4 | ***in situ* > broad focus** | **$p < .001$** |
| | ***in situ* > clefted** | **$p < .01$** |
| | **broad focus > clefted** | **$p < .05$** |
| CF2 | ***in situ* > broad focus** | **$p < .001$** |
| | ***in situ* > clefted** | **$p < .05$** |
| | clefted ≈ broad focus | $p = 1.00$ |
| CM2 | ***in situ* > broad focus** | **$p < .001$** |
| | ***in situ* > clefted** | **$p < .001$** |
| | clefted ≈ broad focus | $p = .904$ |

Table 5.7: Bonferroni pairwise comparisons of oxytone duration for the speakers that produced more than one type of syntactic structure to mark contrastive focus. Significant results are in bold.

#### *5.2.1.2 Paroxytones*

Tables 5.8-5.10 and Figure 5.12 present the data for Paroxytone Duration.

| Means (SD)- Paroxytones Duration (ms) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 231 (36) | 210 (46) | 219 (50) | 222 (34) |
| Broad Focus | 208 (33) | 219 (62) | 196 (63) | 211 (61) | 205 (61) |
| In Situ Contrastive Focus | 239 (47) | 250 (63) | 225 (64) | 235 (62) | 240 (62) |
| Clefted Contrastive Focus | 197 (31) | 216 (72) | 185 (75) | 209 (78) | 192 (91) |

Table 5.8: Mean (SD) of Paroxytone Duration (ms) across all factors.

| Linear Mixed Model- Paroxytone Duration | | | 95% CI | |
|---|---|---|---|---|
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **189 (15.6)** | **$F_{(1, 83.214)}$ = 140.488, *p* < .001** | **151** | **223** |
| **Pragmatic Condition** | **70.8 (37.5)** | **$F_{(2, 1873.964)}$ = 3.886, *p* < .05** | **2.8** | **144** |
| **Gender** | **22.3 (9.1)** | **$F_{(1, 26.415)}$ = 7.182, *p* < .05** | **3.4** | **41.3** |
| Dialect | -6.0 (8.7) | $F_{(1, 30.778)}$ = .39, *p* = .537, n.s. | -23.9 | 12.1 |
| Age | .24 (.31) | $F_{(1, 95.619)}$ = .26, *p* = .611, n.s. | -.41 | .89 |
| Pragmatic Condition * Gender | 2.7 (3.4) | $F_{(2, 1875.34)}$ = .518, *p* = .596, n.s. | -3.9 | 9.2 |
| Pragmatic Condition * Dialect | -10.7 (13.4) | $F_{(2, 1875.203)}$ = .512, *p* = .587, n.s. | -37.2 | 15.5 |
| Pragmatic Condition * Age | -1.09 (1.04) | $F_{(2, 1873.75)}$ = 1.832, *p* = .126, n.s. | -3.9 | .14 |
| Random Effects | | | | |
| Residual | 1052 (34.48) | - | - | - |
| Speaker | 424.3 (138.5) | - | - | - |
| Token | .0000 (.0000) | - | - | - |
| Model Information Criteria (BIC) = 18615.378 | | | | |

Table 5.9: Results of Linear Mixed Model of Paroxytone Duration: significant results are in bold.

| Bonferroni Pairwise Comparisons- Paroxytone Duration | |
|---|---|
| Comparison | Significance |
| ***in situ* > broad focus** | ***p* < .001** |
| ***in situ* > clefted** | ***p* < .001** |
| clefted ≈ broad focus | *p* = .424 |

Table 5.10: Results of Bonferroni pairwise comparisons of Pragmatic Condition of Paroxytone Duration: significant results are in bold.

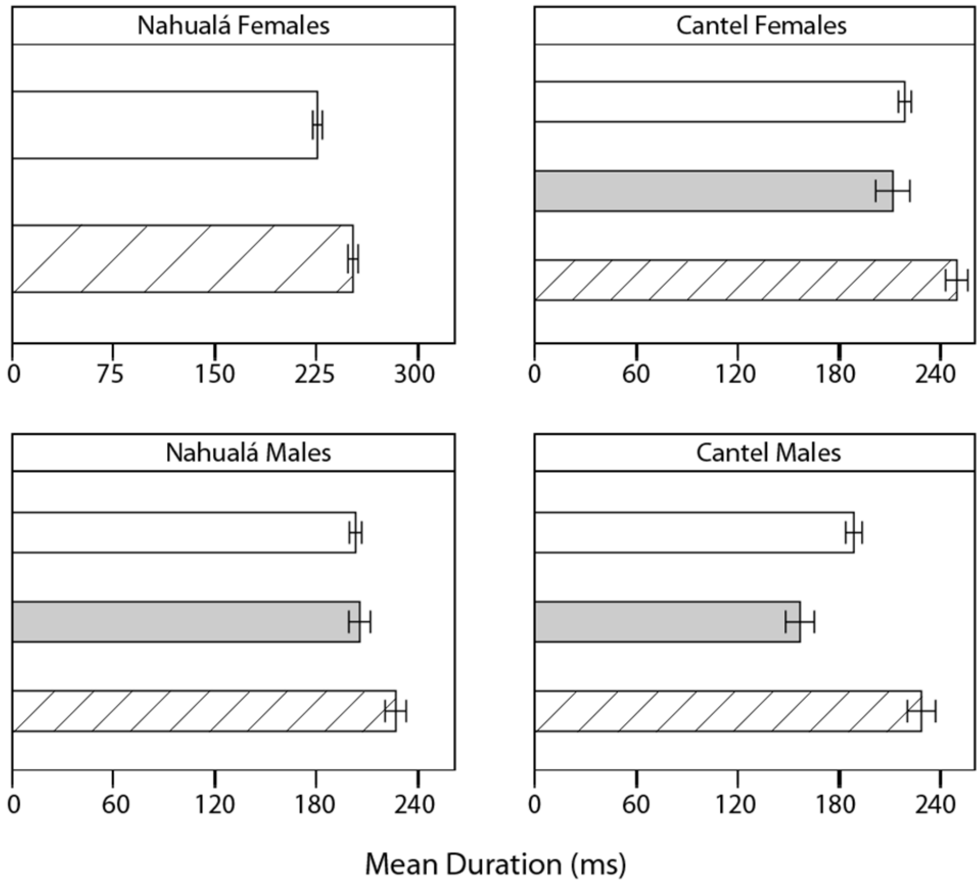


Figure 5.12: Bar graphs of mean duration of paroxytone tonic syllable (ms) for all speaker groups in Spanish in all pragmatic conditions: broad focus (white), clefted contrastive focus (gray) and *in situ* contrastive focus (diagonal lines). 95% confidence interval bars included.

The results of Paroxytone Duration demonstrate a significant main effect of Gender and Pragmatic Condition. Similar to the findings on duration in K'ichee', females produced longer tonic syllables across all three pragmatic conditions than males. The pairwise comparison of Pragmatic Condition demonstrates that *in situ* contrastive focus is significantly longer than the other two pragmatic conditions.

| Individual Speaker ANOVAs- Paroxytones Duration | | | | | |
|---|---|---|---|---|---|
| **NF1** | **NF2** | **NF3** | **NF4** | NF5 | **NF6** |
| **$F_{(1, 75)}$ = 50.451, $p$ < .001** | **$F_{(1, 76)}$ = 15.456, $p$ < .001** | **$F_{(1, 77)}$ = 53.677, $p$ < .001** | **$F_{(1, 78)}$ = 43.262, $p$ < .001** | $F_{(1, 78)}$ = 2.459, $p$ = .120, n.s. | **$F_{(1, 78)}$ = 3.792, $p$ < .05** |
| **NM1** | **NM2** | **NM3*** | **NM4*** | **NM5** | NM6* |
| **$F_{(1, 77)}$ = 22.042, $p$ < .001** | **$F_{(1, 76)}$ = 50.882, $p$ < .001** | **$F_{(2, 77)}$ = .5.773, $p$ < .01** | **$F_{(2, 78)}$ = 5.410, $p$ < .01** | **$F_{(1, 75)}$ = 6.555, $p$ < .05** | $F_{(2, 78)}$ = .418, $p$ = .66, n.s. |
| **CF1** | **CF2*** | **CF3** | **CF4** | **CF5** | **CF6** |
| **$F_{(1, 73)}$ = 14.947, $p$ < .001** | **$F_{(2, 72)}$ = 5.067, $p$ < .01** | **$F_{(1, 76)}$ = 4.022, $p$ < .05** | **$F_{(1, 76)}$ = 10.392, $p$ < .01** | **$F_{(1, 73)}$ = 57.057, $p$ < .001** | **$F_{(1, 74)}$ = 23.772, $p$ < .001** |
| **CM1** | **CM2*** | **CM3** | **CM4** | **CM5** | **CM6** |
| **$F_{(1, 70)}$ = 39.477, $p$ < .001** | **$F_{(2, 73)}$ = 34.803, $p$ < .001** | **$F_{(1, 74)}$ = 4.294, $p$ < .05** | **$F_{(1, 77)}$ = 21.290, $p$ < .001** | **$F_{(1, 76)}$ = 10.339, $p$ < .01** | **$F_{(1, 73)}$ = 15.617, $p$ < .001** |

Table 5.11: Results from the ANOVAs of paroxytone duration for all 24 speakers; significant results are in bold and indicate that the individual speaker had a longer duration in the contrastive focus condition. An asterisk signifies that the speaker produced more than one syntactic structure for contrastive focus and is further analyzed where there is a significant main effect in the Bonferroni pairwise comparisons in Table 5.12.

The individual speaker analyses and pairwise comparisons are presented in Tables 5.11 and 5.12. In contrast to the results of duration in the oxytone stress pattern, 22 of 24 speakers significantly marked contrastive focus with a longer duration; the two that did not were still from Nahualá: speakers NF5 and NM6. These results suggest that the influence of the phonological restriction on duration from Nahualá K'ichee' to Nahualá Spanish is less likely in a non-final stress pattern that does not exist in K'ichee', or is at least quite rare. The Bonferroni pairwise comparisons indicate that *in situ* contrastive focus was produced with a significantly longer duration than broad focus by all four speakers who demonstrated a significant main effect and it was significantly longer than clefted contrastive focus for two speakers. For speaker NM3, clefted contrastive focus was also significantly longer than broad focus.

| Bonferroni Pairwise Comparisons- Paroxytones Duration | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM3 | ***in situ* > broad focus** | ***p* < .01** |
| | *in situ* ≈ clefted | *p* = 1.00 |
| | **clefted > broad focus** | ***p* < .05** |
| NM4 | ***in situ* > broad focus** | ***p* < .01** |
| | *in situ* ≈ clefted | *p* = .095 |
| | clefted ≈ broad focus | *p* = 1.00 |
| NM6 | -no significant main effect- | |
| CF2 | ***in situ* > broad focus** | ***p* < .01** |
| | ***in situ* > clefted** | ***p* < .05** |
| | clefted ≈ broad focus | *p* = .469 |
| CM2 | ***in situ* > broad focus** | ***p* < .001** |
| | ***in situ* > clefted** | ***p* < .001** |
| | clefted ≈ broad focus | *p* = .296 |

Table 5.12: Bonferroni pairwise comparisons of paroxytone duration for the speakers that produced more than one type of syntactic structure to mark contrastive focus and demonstrated a significant main effect. Significant results are in bold.

### 5.2.2 Peak Height

#### *5.2.2.1 Oxytones*

The group means, Linear Mixed Model results, and Bonferroni pairwise comparison results for Oxytone Peak Height are presented in Tables 5.13-5.15 and illustrated in Figure 5.13.

| Means (SD)- Oxytone Peak Height (st) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 95.1 (2.7) | 86.5 (3.1) | 90.7 (4.9) | 90.7 (5.5) |
| Broad Focus | 90.9 (5.3) | 94.3 (8.2) | 86.1 (4.4) | 90.4 (4.2) | 90.5 (4.1) |
| In Situ Contrastive Focus | 91.8 (4.2) | 95.9 (4.2) | 87.1 (5.2) | 92.1 (4.1) | 92.1 (4.0) |
| Clefted Contrastive Focus | 89.3 (4.7) | 93.1 (4.3) | 85.8 (4.2) | 88.6 (6.7) | 89.7 (5.8) |

Table 5.13: Mean (SD) of Oxytone Peak Height (st) across all factors.

| Linear Mixed Model- Oxytone Peak Height | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **85.5 (1.1)** | **$F_{(1, 24.491)}$ = 9490.169, $p$ < .001** | **83.3** | **87.7** |
| **Pragmatic Condition** | **3.9 (.53)** | **$F_{(2, 1664.458)}$ = 8.492, $p$ < .01** | **.07** | **5.1** |
| **Gender** | **8.9 (.61)** | **$F_{(1, 28.629)}$ = 131.222, $p$ < .001** | **7.7** | **10.3** |
| Dialect | -.05 (.58) | $F_{(1, 25.209)}$ = .456, $p$ = .506, n.s. | -1.3 | 1.2 |
| Age | .03 (.02) | $F_{(1, 23.759)}$ = .611, $p$ = .442, n.s. | -.02 | .07 |
| **Pragmatic Condition * Gender** | **-4.8 (.89)** | **$F_{(2, 1662.223)}$ = 16.332, $p$ < .001** | **-6.6** | **-3.1** |
| Pragmatic Condition * Dialect | 1.2 (.71) | $F_{(2, 1660.69)}$ = 1.497, $p$ = .224, n.s. | -.35 | 7.5 |
| Pragmatic Condition * Age | .002 (.01) | $F_{(2, 1664.036)}$ = .827, $p$ = .437, n.s. | -.07 | .02 |
| Random Effects | | | | |
| Residual | 6.921 (.2411) | - | - | - |
| Speaker | 1.818 (.6095) | - | - | - |
| Token | .0000 (.0000) | - | - | - |
| Model Information Criteria (BIC) = 8119.536 | | | | |

Table 5.14: Results of Linear Mixed Model of Oxytone Peak Height: significant results are in bold.

| Bonferroni Pairwise Comparisons- Oxytone Peak Height | |
|---|---|
| Comparison | Significance |
| ***in situ* > broad focus** | ***p* < .001** |
| ***in situ* > clefted** | ***p* < .001** |
| **clefted < broad focus** | ***p* < .01** |

Table 5.15: Results of Bonferroni pairwise comparisons of Pragmatic Condition of Oxytone Peak Height: significant results are in bold.

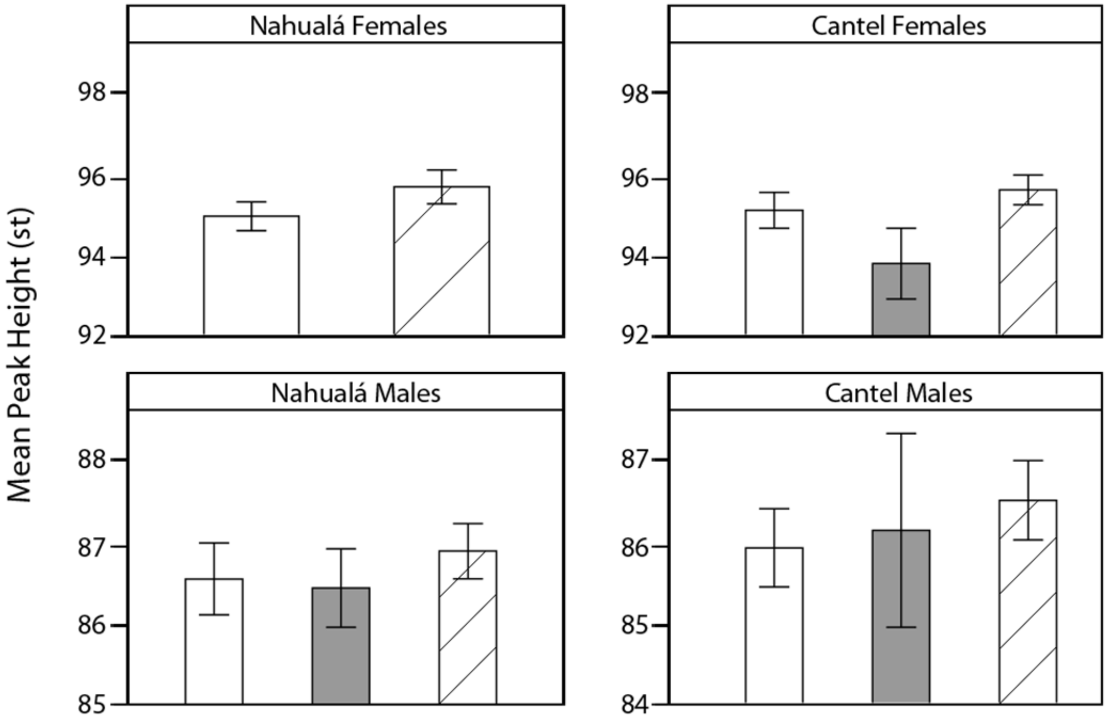


Figure 5.13: Bar graphs of mean peak height for oxytone tonic syllables (st) for all speaker groups in Spanish in all pragmatic conditions: broad focus (white), clefted contrastive focus (gray) and *in situ* contrastive focus (diagonal lines). 95% confidence interval bars included.

The results for Oxytone Peak Height reveal a main effect of Gender and Pragmatic Condition; as expected, females had a higher overall peak height than males and, according to the pairwise comparisons, *in situ* contrastive focus constituents had significantly higher peaks than the other two pragmatic conditions, though broad focus actually had higher peaks than clefted contrastive focus. The significant interaction between Gender and Pragmatic Condition reveals that, while both males and females significantly mark *in situ* contrastive focus, females do so to a greater degree.

| Individual Speaker ANOVAs- Oxytones Peak Height | | | | | |
|---|---|---|---|---|---|
| NF1 | **NF2** | NF3 | **NF4** | NF5 | NF6 |
| $F_{(1, 70)}$ = 1.373, $p$ = .245, n.s. | **$F_{(1, 69)}$ = 12.673, $p < .001$** | $F_{(1, 76)}$ = .333, $p$ = .566, n.s. | **$F_{(1, 74)}$ = 43.874, $p < .001$** | $F_{(1, 78)}$ = 2.458, $p$ = .121, n.s. | $F_{(1, 74)}$ = 2.628, $p$ = .110, n.s. |
| NM1* | **NM2** | NM3 | NM4* | NM5 | **NM6** |
| $F_{(2, 77)}$ = 2.003, $p$ = .142, n.s. | **$F_{(1, 78)}$ = 7.769, $p < .01$** | $F_{(1, 68)}$ = 2.229, $p$ = .14, n.s. | $F_{(2, 67)}$ = .677, $p$ = .512, n.s. | $F_{(1, 72)}$ = 2.071, $p$ = .155, n.s. | **$F_{(1, 67)}$ = 7.211, $p < .01$** |
| CF1 | **CF2*** | CF3 | **CF4** | **CF5** | **CF6** |
| $F_{(1, 73)}$ = .111, $p$ = .741, n.s. | **$F_{(2, 77)}$ = 19.772, $p < .001$** | $F_{(1, 61)}$ = 3.24, $p$ = .077, n.s. | **$F_{(1, 68)}$ = 5.7, $p < .05$** | **$F_{(1, 76)}$ = 17.757, $p < .001$** | **$F_{(1, 78)}$ = 5.999, $p < .05$** |
| **CM1** | **CM2*** | CM3 | CM4 | **CM5** | **CM6** |
| **$F_{(1, 73)}$ = 8.776, $p < .01$** | **$F_{(2, 75)}$ = 4.39, $p < .05$** | $F_{(1, 72)}$ = .001, $p$ = .974, n.s. | $F_{(1, 65)}$ = 3.194, $p$ = .079, n.s. | **$F_{(1, 64)}$ = 5.09, $p < .05$** | **$F_{(1, 76)}$ = 3.912, $p < .05$** |

Table 5.16: Results from the ANOVAs of oxytone peak height for all 24 speakers; significant results are in bold and indicate that the individual speaker had a higher peak in the contrastive focus condition. An asterisk signifies that the speaker produced more than one syntactic structure for contrastive focus and is further analyzed where there is a significant main effect in the Bonferroni pairwise comparisons in Table 5.17.

| Bonferroni Pairwise Comparisons- Oxytones Peak Height | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM1 | -no significant main effect- | |
| NM4 | -no significant main effect- | |
| CF2 | ***in situ* > broad focus** | **$p < .01$** |
| | ***in situ* > clefted** | **$p < .05$** |
| | **clefted > broad focus** | **$p < .01$** |
| CM2 | ***in situ* > broad focus** | **$p < .001$** |
| | *in situ* ≈ clefted | $p$ = .211 |
| | **clefted > broad focus** | **$p < .01$** |

Table 5.17: Bonferroni pairwise comparisons of oxytone peak height for the speakers that produced more than one type of syntactic structure to mark contrastive focus and demonstrated a significant main effect. Significant results are in bold.

Tables 5.16 and 5.17 present the findings of the individual speaker ANOVAs and the corresponding pairwise comparisons. Similar to the findings for peak height in K'ichee' presented in Chapter 4, several speakers did not produce significantly higher peaks in contrastive focus conditions than in broad focus conditions; 12 of the 24 bilinguals did produce significantly higher peaks, 8 of the 12 were from Cantel. The Bonferroni pairwise comparisons for the two speakers who demonstrated a main effect show that both speakers produced significantly higher peaks in the two contrastive focus structures than in broad focus, speaker CF2 also produced significantly higher peaks in *in situ* contrastive focus than in clefted contrastive focus.

#### *5.2.2.2 Paroxytones*

Tables 5.18-5.20 present the results of the analyses of the Paroxytone Peak Height. The results demonstrate a significant main effect of Gender and Pragmatic Condition. Again, females had higher overall peak heights across all three pragmatic conditions than males. The results of the Bonferroni pairwise comparisons reveal that the *in situ* contrastive focus condition had higher peaks than the broad focus condition; none of the other pairwise comparisons reached significance. All three interactions were significant. The Pragmatic Condition*Gender interaction revealed that males marked clefted contrastive focus via peak height to a greater degree than females whereas the Pragmatic Condition*Dialect interaction showed that Cantel speakers marked both contrastive focus structures with higher peaks than Nahualá speakers. These interactions are illustrated in Figure 5.14, where it is shown that the Nahualá females produced the least amount of difference in peak height between broad and *in situ* contrastive focus. The significant interaction between Pragmatic Condition and Age reveals that older speakers mark contrastive focus with higher peaks than younger speakers, though, as previously stated, the majority of the older speakers were male and this interaction is not entirely independent of the Pragmatic Condition*Gender interaction.

| Means (SD)- Paroxytone Peak Height (st) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 93.3 (2.0) | 84.4 (2.8) | 89.1 (4.7) | 89.8 (5.5) |
| Broad Focus | 88.8 (5.2) | 93.1 (3.8) | 84.0 (3.9) | 88.5 (3.5) | 88.6 (3.8) |
| In Situ Contrastive Focus | 89.7 (3.9) | 94.2 (3.9) | 85.3 (4.0) | 88.8 (3.8) | 91.1 (3.8) |
| Clefted Contrastive Focus | 89.0 (4.4) | 93.2 (4.2) | 84.7 (4.7) | 88.3 (3.8) | 89.4 (6.3) |

Table 5.18: Mean (SD) of Paroxytone Peak Height (st) across all factors.

| Linear Mixed Model- Paroxytone Peak Height | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **84.1 (1)** | **$F_{(1, 90.906)}$ = 5167.473, $p$ < .001** | **82.1** | **86.2** |
| **Pragmatic Condition** | **1.4 (.38)** | **$F_{(2, 1874.082)}$ = 5.427, $p$ < .01** | **.62** | **2.1** |
| **Gender** | **9.3 (.57)** | **$F_{(1, 27.022)}$ = 202.647, $p$ < .001** | **8.2** | **10.5** |
| Dialect | 2.3 (.54) | $F_{(1, 31.856)}$ = 1.821, $p$ = .187, n.s. | -.89 | 1.3 |
| Age | -.01 (.02) | $F_{(1, 104.955)}$ = 1.492, $p$ = .225, n.s. | -.05 | .04 |
| **Pragmatic Condition * Gender** | **-.77 (.22)** | **$F_{(2, 1874.88)}$ = 7.88, $p$ < .001** | **-1.2** | **-.34** |
| **Pragmatic Condition * Dialect** | **-1.1 (.2)** | **$F_{(2, 1875.056)}$ = 16.985, $p$ < .001** | **-1.5** | **-.72** |
| **Pragmatic Condition * Age** | **.21 (.07)** | **$F_{(2, 1873.798)}$ = 5.709, $p$ < .01** | **.08** | **.34** |
| Random Effects | | | | |
| Residual | 4.421(.1448) | - | - | - |
| Speaker | 1.621 (.5316) | - | - | - |
| Token | .0000 (.0000) | - | - | - |
| Model Information Criteria (BIC) = 8308.845 | | | | |

Table 5.19: Results of Linear Mixed Model of Paroxytone Peak Height: significant results are in bold.

| Bonferroni Pairwise Comparisons- Paroxytone Peak Height | |
|---|---|
| Comparison | Significance |
| ***in situ* > broad focus** | **$p$ < .05** |
| *in situ* ≈ clefted | $p$ = 1.00 |
| clefted ≈ broad focus | $p$ = .323 |

Table 5.20: Results of Bonferroni pairwise comparisons of Pragmatic Condition of Oxytone Peak Height: significant results are in bold.

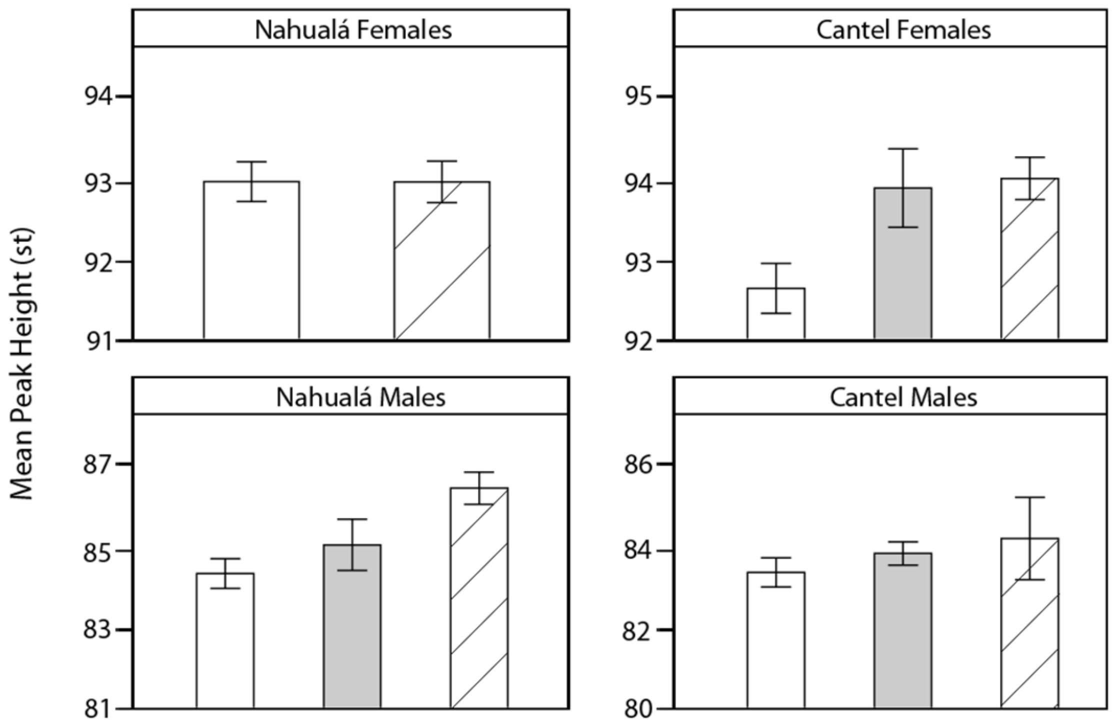


Figure 5.14: Bar graphs of mean peak height for paroxytone tonic syllables (st) for all speaker groups in Spanish in all pragmatic conditions: broad focus (white), clefted contrastive focus (gray) and *in situ* contrastive focus (diagonal lines). 95% confidence interval bars included.

The individual speaker ANOVAs are shown in Table 5.21. Similar to the results for oxytone peak height, only 11 of 24 bilinguals marked contrastive focus with a significantly higher pitch peak. The Bonferroni pairwise comparisons presented in Table 5.22 show that all three speakers that demonstrated a significant main effect marked *in situ* contrastive focus with a significantly higher pitch peak than broad focus, and speaker CF2 also marked *in situ* contrastive focus with a significantly higher peak than clefted contrastive focus. There were no other significant differences.

| Individual Speaker ANOVAs- Paroxytones Peak Height | | | | | |
|---|---|---|---|---|---|
| NF1 | NF2 | NF3 | NF4 | **NF5** | **NF6** |
| $F_{(1, 75)}$ = .272, $p$ = .604, n.s. | $F_{(1, 76)}$ = 1.653, $p$ = .202, n.s. | $F_{(1, 77)}$ = 2.533, $p$ = .116, n.s. | $F_{(1, 78)}$ = 1.916, $p$ = .17, n.s. | **$F_{(1, 78)}$ = 11.527, $p < .01$** | **$F_{(1, 78)}$ = 20.982, $p < .001$** |
| NM1 | **NM2** | NM3* | **NM4*** | **NM5** | **NM6*** |
| $F_{(1, 77)}$ = 2.747, $p$ = .101, n.s. | **$F_{(1, 76)}$ = 19.502, $p < .001$** | $F_{(2, 77)}$ = .323, $p$ = .725, n.s. | **$F_{(2, 78)}$ = 5.219, $p < .01$** | **$F_{(1, 75)}$ = 135.918, $p < .001$** | **$F_{(2, 78)}$ = 15.841, $p < .001$** |
| CF1 | **CF2*** | **CF3** | CF4 | **CF5** | CF6 |
| $F_{(1, 73)}$ = 2.254, $p$ = .112, n.s. | **$F_{(2, 72)}$ = 20.519, $p < .001$** | **$F_{(1, 76)}$ = 5.935, $p < .05$** | $F_{(1, 76)}$ = 1.726, $p$ = .193, n.s. | **$F_{(1, 73)}$ = 7.666, $p < .01$** | $F_{(1, 74)}$ = 3.613, $p$ = .061, n.s. |
| **CM1** | CM2* | CM3 | CM4 | **CM5** | CM6 |
| **$F_{(1, 70)}$ = 18.48, $p < .001$** | $F_{(2, 73)}$ = 1.607, $p$ = .208, n.s. | $F_{(1, 74)}$ = 1.257, $p$ = .266, n.s. | $F_{(1, 77)}$ = .025, $p$ = .876, n.s. | **$F_{(1, 76)}$ = 4.421, $p < .05$** | $F_{(1, 73)}$ = 1.334, $p$ = .252, n.s. |

Table 5.21: Results from the ANOVAs of paroxytone peak height for all 24 speakers; significant results are in bold and indicate that the individual speaker had a higher peak in the contrastive focus condition. An asterisk signifies that the speaker produced more than one syntactic structure for contrastive focus and is further analyzed where there is a significant main effect in the Bonferroni pairwise comparisons in Table 5.22.

| Bonferroni Pairwise Comparisons- Paroxytones Peak Height | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM3 | -no significant main effect- | |
| NM4 | ***in situ* > broad focus** | **$p < .01$** |
| | *in situ* ≈ clefted | $p$ = .095 |
| | clefted ≈ broad focus | $p$ = 1.00 |
| NM6 | ***in situ* > broad focus** | **$p < .01$** |
| | *in situ* ≈ clefted | $p$ = .218 |
| | clefted ≈ broad focus | $p$ = .495 |
| CF2 | ***in situ* > broad focus** | **$p < .001$** |
| | ***in situ* > clefted** | **$p < .001$** |
| | clefted ≈ broad focus | $p$ = 1.00 |
| CM2 | -no significant main effect- | |

Table 5.22: Bonferroni pairwise comparisons of paroxytone peak height for the speakers that produced more than one type of syntactic structure of contrastive focus and demonstrated a significant main effect. Significant results are in bold.

### 5.2.3 Peak Alignment

#### *5.2.3.1 Oxytones*

The group means and results of the Linear Mixed Model and corresponding Bonferroni pairwise comparisons for Oxytone Peak Alignment are presented in Tables 5.23-5.25 and illustrated, separated by gender and dialect, in the boxplots in Figure 5.15.

| Means (SD)- Oxytone Peak Alignment | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | .81 (.13) | .76 (.17) | .78 (.17) | .8 (.15) |
| Broad Focus | .86 (.14) | .86 (.16) | .85 (.15) | .85 (.15) | .86 (.15) |
| In Situ Contrastive Focus | .71 (.12) | .73 (.16) | .67 (.16) | .69 (.16) | .71 (.15) |
| Clefted Contrastive Focus | .72 (.15) | .76 (.38) | .70 (.22) | .7 (.3) | .74 (.25) |

Table 5.23: Mean (SD) of Oxytone Peak Alignment across all factors.

| Linear Mixed Model- Oxytone Peak Alignment | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **.9 (.04)** | **$F_{(1, 28.438)}$ = 436.745, *p* < .001** | **.82** | **.98** |
| **Pragmatic Condition** | **-.38 (.05)** | **$F_{(2, 1639.299)}$ = 80.707, *p* < .001** | **-.48** | **-.28** |
| Gender | .01 (.02) | $F_{(1, 36.331)}$ = 3.44, *p* = .072, n.s. | -.03 | .06 |
| Dialect | .01 (.02) | $F_{(1, 29.668)}$ = 1.747, *p* = .196, n.s. | -.03 | .06 |
| Age | -.001 (.001) | $F_{(1, 27.065)}$ = 1.627, *p* = .213, n.s. | -.003 | .001 |
| **Pragmatic Condition * Gender** | **.08 (.01)** | **$F_{(2, 1619.135)}$ = 13.338, *p* < .001** | **.05** | **.11** |
| Pragmatic Condition * Dialect | .01 (.01) | $F_{(2, 1612.52)}$ = 1.031, *p* = .357, n.s. | -.01 | .04 |
| **Pragmatic Condition * Age** | **.005 (.001)** | **$F_{(2, 1653.561)}$ = 19.213, *p* < .001** | **.003** | **.007** |
| Random Effects | | | | |
| Residual | .0169 (.0006) | - | - | - |
| Speaker | .0022 (.0008) | - | - | - |
| Token | .0001 (.0004) | - | - | - |
| Model Information Criteria (BIC) = -1925.325 | | | | |

Table 5.24: Results of Linear Mixed Model of Oxytone Peak Alignment: significant results are in bold.

| Bonferroni Pairwise Comparisons- Oxytone Peak Alignment | |
|---|---|
| Comparison | Significance |
| ***in situ* < broad focus** | ***p* < .001** |
| *in situ* ≈ clefted | *p* = 1.00 |
| **clefted < broad focus** | ***p* < .001** |

Table 5.25: Results of Bonferroni pairwise comparisons of Pragmatic Condition of Oxytone Peak Height: significant results are in bold.

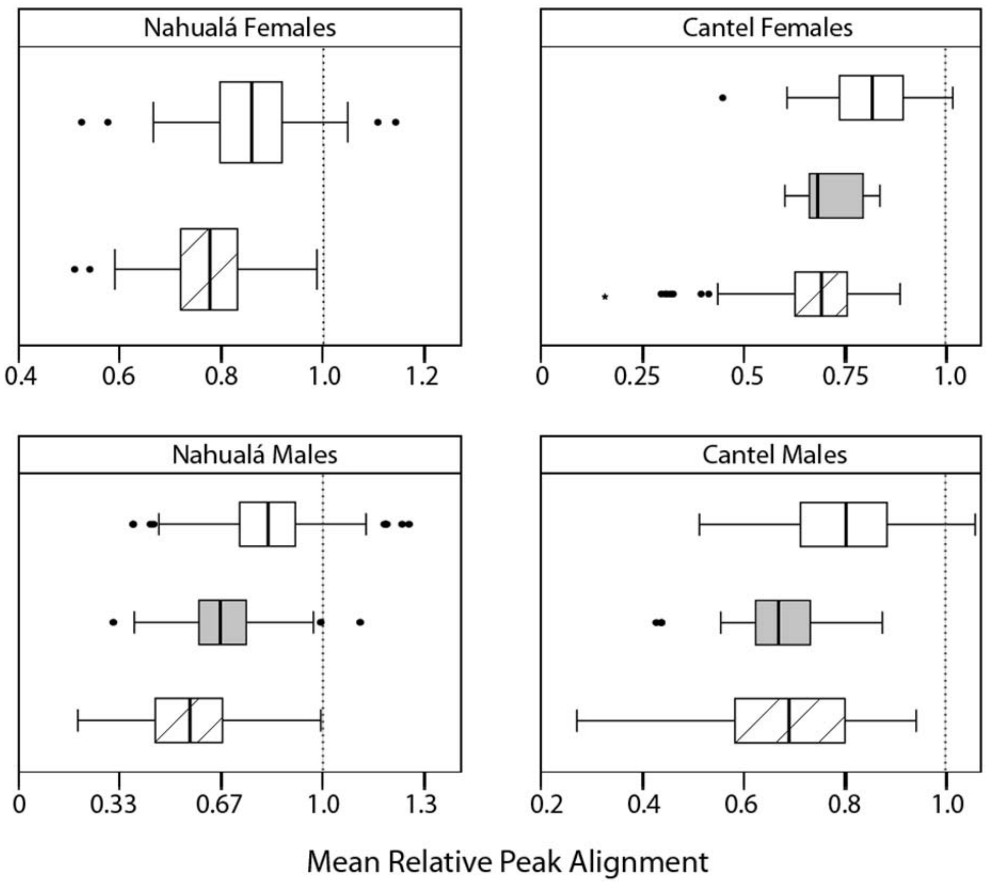


Figure 5.15: Boxplots of mean relative peak alignment for oxytones among all speaker groups in Spanish in all pragmatic conditions: broad focus (white), clefted contrastive focus (gray), and *in situ* contrastive focus (diagonal lines). A lower number indicates an earlier peak and the dotted line indicates a relative alignment score of 1.0, i.e., the end of the tonic syllable.

These results demonstrate a significant main effect of Pragmatic Condition and the corresponding pairwise comparisons reveal that both *in situ* and clefted contrastive focus conditions had significantly earlier peaks than broad focus. The significant interaction between Gender and Pragmatic Condition reveals that, while there are no between-gender differences in broad focus, males tend to have an earlier peak alignment in both contrastive focus conditions than females and the significant interaction between Age and Pragmatic Condition parallels these results; older speakers, who were mostly males, produced earlier peaks in the contrastive focus conditions than younger speakers.

| Individual Speaker ANOVAs- Oxytones Peak Alignment | | | | | |
|---|---|---|---|---|---|
| **NF1** | **NF2** | **NF3** | NF4 | **NF5** | **NF6** |
| **$F_{(1, 70)}$ = 14.029, *p* < .001** | **$F_{(1, 69)}$ = 13.567, *p* < .001** | **$F_{(1, 76)}$ = 25.671, *p* < .001** | $F_{(1, 74)}$ = 2.9189, *p* = .092, n.s. | **$F_{(1, 78)}$ = 15.628, *p* < .001** | **$F_{(1, 74)}$ = 28.375, *p* < .001** |
| **NM1*** | **NM2** | **NM3** | **NM4*** | **NM5** | **NM6** |
| **$F_{(2, 77)}$ = 10.47, *p* < .001** | **$F_{(1, 78)}$ = 76.429, *p* < .001** | **$F_{(1, 68)}$ = 27.008, *p* < .001** | **$F_{(2, 67)}$ = 30.688, *p* < .001** | **$F_{(1, 72)}$ = 13.564, *p* < .001** | **$F_{(1, 67)}$ = 24.733, *p* < .001** |
| **CF1** | **CF2*** | **CF3** | **CF4** | **CF5** | **CF6** |
| **$F_{(1, 73)}$ = 33.113, *p* < .001** | **$F_{(2, 77)}$ = 14.041, *p* < .001** | **$F_{(1, 61)}$ = 27.136, *p* < .001** | **$F_{(1, 68)}$ = 18.154, *p* < .001** | **$F_{(1, 76)}$ = 7.739, *p* < .01** | **$F_{(1, 78)}$ = 48.865, *p* < .001** |
| **CM1** | **CM2*** | **CM3** | **CM4** | **CM5** | **CM6** |
| **$F_{(1, 73)}$ = 21.091, *p* < .001** | **$F_{(2, 75)}$ = 19.227, *p* < .001** | **$F_{(1, 72)}$ = 31.963, *p* < .001** | **$F_{(1, 65)}$ = 5.235, *p* < .05** | **$F_{(1, 64)}$ = 4.238, *p* < .05** | **$F_{(1, 76)}$ = 21.674, *p* < .001** |

Table 5.26: Results from the ANOVAs of oxytone peak alignment for all 24 speakers; significant results are in bold and indicate that the individual speaker had an earlier peak in the contrastive focus condition. An asterisk signifies that the speaker produced more than one syntactic structure for contrastive focus and is further analyzed in the Bonferroni pairwise comparisons in Table 5.27.

Analogous to the findings of peak alignment in K'ichee', the individual speaker results presented in Table 5.26 demonstrate that every speaker, with the exception of NF4, marks contrastive focus on oxytones with a significantly earlier peak. Likewise, the pairwise comparisons in Table 5.27 reveal that these four bilinguals marked *in situ* contrastive focus with earlier peaks than broad focus. Three of the four speakers also produced clefted contrastive focus peaks that were earlier than broad focus peaks.

| Bonferroni Pairwise Comparisons- Oxytones Peak Alignment | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM1 | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < clefted** | ***p* < .01** |
| | clefted ≈ broad focus | *p* = 1.00 |
| NM4 | ***in situ* < broad focus** | ***p* < .001** |
| | *in situ* ≈ clefted | *p* = 1.00 |
| | **clefted < broad focus** | ***p* < .001** |
| CF2 | ***in situ* < broad focus** | ***p* < .001** |
| | *in situ* ≈ clefted | *p* = 1.00 |
| | **clefted < broad focus** | ***p* < .001** |
| CM2 | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < clefted** | ***p* < .001** |
| | **clefted < broad focus** | ***p* < .001** |

Table 5.27: Bonferroni pairwise comparisons of oxytone peak alignment for the speakers that produced more than one type of syntactic structure to mark contrastive focus. Significant results are in bold.

### *5.2.3.2 Paroxytones*

The means and results of the Linear Mixed Model and corresponding Bonferroni pairwise comparisons of Paroxytone Peak Alignment are presented in Tables 5.28-5.30. These results, separated by gender and dialect, are illustrated in the boxplots in Figure 5.16.

| Means (SD)- Paroxytone Peak Alignment | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 1.35 (.31) | 1.21 (.36) | 1.24 (.31) | 1.31 (.37) |
| Broad Focus | 1.41 (.30) | 1.44 (.50) | 1.38 (.50) | 1.33 (.49) | 1.49 (.49) |
| In Situ Contrastive Focus | 1.15 (.35) | 1.23 (.50) | 1.02 (.51) | 1.13 (.49) | 1.12 (.49) |
| Clefted Contrastive Focus | 1.23 (.45) | 1.26 (.89) | 1.22 (.60) | 1.21 (.86) | 1.27 (.73) |

Table 5.28: Mean (SD) of Paroxytone Peak Alignment across all factors.

| Linear Mixed Model- Paroxytone Peak Alignment | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **1.47 (.13)** | **$F_{(1, 84.981)}$ = 68.445, *p* < .001** | **1.2** | **1.7** |
| **Pragmatic Condition** | **-.48 (.05)** | **$F_{(2, 1874.003)}$ = 87.58, *p* < .001** | **-.58** | **-.39** |
| Gender | .07 (.07) | $F_{(1, 26.548)}$ = 1.961, *p* = .173, n.s. | -.08 | .21 |
| Dialect | .16 (.07) | $F_{(1, 31.02)}$ = .805, *p* = .376, n.s. | -.02 | .3 |
| Age | -.004 (.002) | $F_{(1, 97.766)}$ = .001, *p* = .97, n.s. | -.009 | .001 |
| **Pragmatic Condition * Gender** | **.14 (.03)** | **$F_{(2, 1875.256)}$ = 14.28, *p* < .001** | **.09** | **.2** |
| **Pragmatic Condition * Dialect** | **-.17 (.03)** | **$F_{(2, 1875.186)}$ = 23.345, *p* < .001** | **-.22** | **-.12** |
| **Pragmatic Condition * Age** | **.005 (.001)** | **$F_{(2, 1873.769)}$ = 18.787, *p* < .001** | **.004** | **.007** |
| Random Effects | | | | |
| Residual | .0678 (.0022) | - | - | - |
| Speaker | .0267 (.0087) | - | - | - |
| Token | .0000 (.0000) | - | - | - |
| Model Information Criteria (BIC) = 444.193 | | | | |

Table 5.29: Results of Linear Mixed Model of Paroxytone Peak Alignment: significant results are in bold.

| Bonferroni Pairwise Comparisons- Paroxytone Peak Alignment | |
|---|---|
| Comparison | Significance |
| ***in situ* < broad focus** | ***p* < .001** |
| ***in situ* < clefted** | ***p* < .01** |
| **clefted < broad focus** | ***p* < .001** |

Table 5.30: Results of Bonferroni pairwise comparisons of Pragmatic Condition of Paroxytone Peak Height: significant results are in bold.

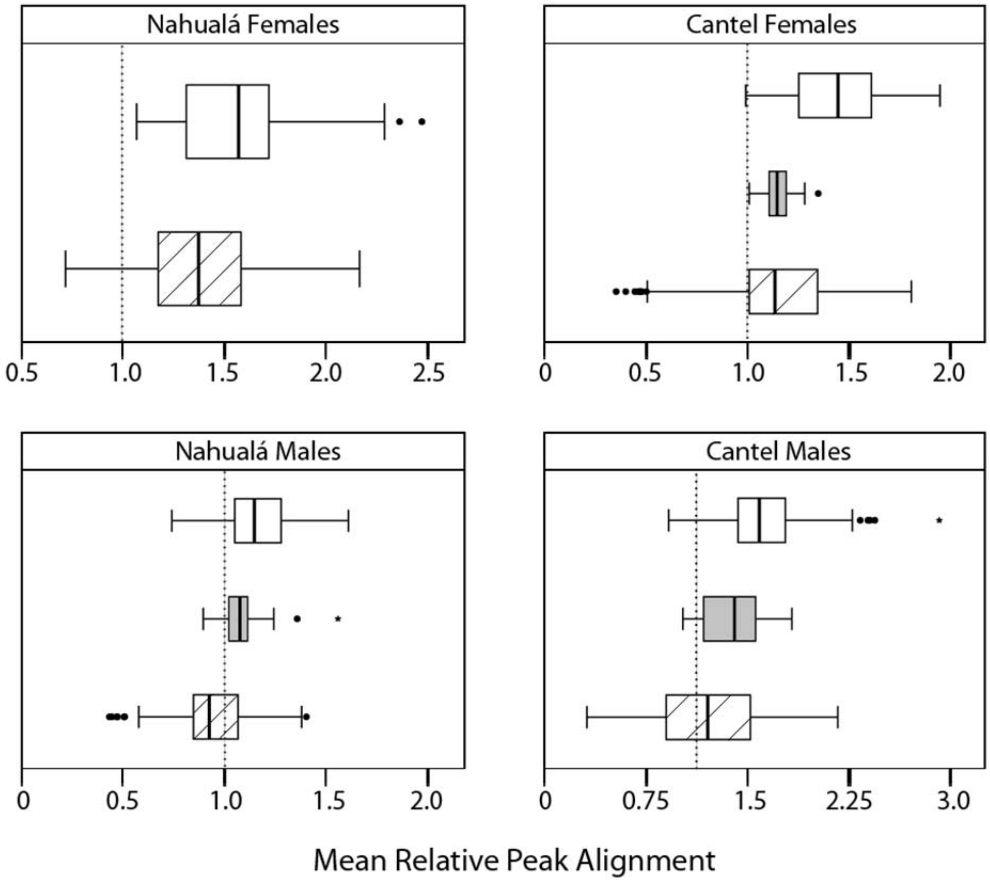


Figure 5.16: Boxplots of mean relative peak alignment for paroxytones among all speaker groups in Spanish in all pragmatic conditions: broad focus (white), clefted contrastive focus (gray), and *in situ* contrastive focus (diagonal lines). A lower number indicates an earlier peak and the dotted line indicates a relative alignment score of 1.0, i.e., the end of the tonic syllable.

The results of the analyses indicate a significant main effect of Pragmatic Condition and the pairwise comparisons reveal a 'focus prominence hierarchy' where *in situ* contrastive focus has significantly earlier peaks than both clefted contrastive focus and broad focus and clefted contrastive focus has significantly earlier peaks than broad focus. However, although there was earlier peak alignment in contrastive focus conditions, the earlier peaks were not always early enough to be aligned within the tonic syllable, except *in situ* contrastive focus for the Nahualá males (see Figure 5.16).

All three interactions were significant. The Pragmatic Condition*Gender interaction demonstrates that, similar to K'ichee' and Spanish Oxytones, males tend to have earlier peaks in contrastive focus than females. The Pragmatic Condition*Dialect interaction shows that, whereas speakers from both dialects have similar peak alignments in contrastive focus conditions, the speakers from Nahualá tend to produce earlier peaks in broad focus than those from Cantel, which supports previous findings (Baird, submitted). Finally, the Pragmatic Condition*Age interaction parallels the findings of the Pragmatic Condition*Gender interaction: the older speakers (mostly males) tend to have earlier peaks in contrastive focus conditions.

The individual speaker analyses presented in Table 5.31 reveal that 22 of 24 speakers produced significantly earlier peaks in a contrastive focus condition than in broad focus. Overall, only one speaker, NM5, had a peak alignment within the tonic syllable in broad focus (M: .96, SD: .31) and only 8 of 24 speakers had a mean peak alignment less than 1.0 in the *in situ* contrastive focus context, further illustrating that a significantly earlier peak alignment in *in situ* contrastive focus among these bilinguals does not necessarily indicate that the peak occurs within the tonic syllable.[54]

[54] A mean relative peak alignment less than 1.0 was only found in the *in situ* contrastive focus context among the following speakers in this study: NM2 (M: 0.91, SD: 0.1), NM3 (M 0.8, SD: 0.19), NM4 (0.97, SD: 0.18), NM5 (M: 0.81, SD: 0.18), CF2 (M: 0.91, SD: 0.21), CF4 (M: 0.79, SD: 0.28), CM1 (M: 0.91, SD: 0.29), CM2 (M: 0.74, SD: 0.08) (see Appendix D).

| Individual Speaker ANOVAs- Paroxytones Peak Alignment | | | | | |
|---|---|---|---|---|---|
| **NF1** | **NF2** | **NF3** | **NF4** | NF5 | **NF6** |
| **$F_{(1, 75)}$ = 29.339, $p$ < .001** | **$F_{(1, 76)}$ = 16.53, $p$ < .001** | **$F_{(1, 77)}$ = 23.322, $p$ < .001** | **$F_{(1, 78)}$ = 21.947, $p$ < .001** | $F_{(1, 78)}$ = 3.632, $p$ = .089, n.s. | **$F_{(1, 78)}$ = 13.04, $p$ < .001** |
| NM1 | **NM2** | **NM3*** | **NM4*** | **NM5** | **NM6*** |
| $F_{(1, 77)}$ = 3.1, $p$ = .104, n.s. | **$F_{(1, 76)}$ = 191.906, $p$ < .001** | **$F_{(2, 77)}$ = 31.474, $p$ < .001** | **$F_{(2, 78)}$ = 15.375, $p$ < .001** | **$F_{(1, 75)}$ = 7.098, $p$ < .01** | **$F_{(2, 78)}$ = 4.155, $p$ < .05** |
| **CF1** | **CF2*** | **CF3** | **CF4** | **CF5** | **CF6** |
| **$F_{(1, 73)}$ = 6.577, $p$ < .01** | **$F_{(2, 72)}$ =24.573, $p$ < .001** | **$F_{(1, 76)}$ = 18.033, $p$ < .001** | **$F_{(1, 76)}$ = 135.95, $p$ < .001** | **$F_{(1, 73)}$ = 12.947, $p$ < .01** | **$F_{(1, 74)}$ = 56.746, $p$ < .001** |
| **CM1** | **CM2*** | **CM3** | **CM4** | **CM5** | **CM6** |
| **$F_{(1, 70)}$ = 52.184, $p$ < .001** | **$F_{(2, 73)}$ = 66.892, $p$ < .001** | **$F_{(1, 74)}$ = 15.095, $p$ < .001** | **$F_{(1, 77)}$ = 7.593, $p$ < .01** | **$F_{(1, 76)}$ = 30.924, $p$ < .001** | **$F_{(1, 73)}$ = 15.617, $p$ < .001** |

Table 5.31: Results from the ANOVAs of paroxytone peak alignment for all 24 speakers; significant results are in bold and indicate that the individual speaker had an earlier peak in the contrastive focus condition. An asterisk signifies that the speaker produced more than one syntactic structure for contrastive focus and is further analyzed where there is a significant main effect in the Bonferroni pairwise comparisons in Table 5.32.

The corresponding Bonferroni pairwise comparisons presented in Table 5.32 demonstrate that all five speakers that produced more than one syntactic structure for contrastive focus marked *in situ* contrastive focus with the earliest peaks. Four of the five speakers present a 'focus prominence hierarchy' pattern where *in situ* contrastive focus had the earliest peaks, followed by clefted contrastive focus peaks, and then broad focus peaks.

| Bonferroni Pairwise Comparisons- Paroxytones Peak Alignment | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM3 | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < clefted** | ***p* < .01** |
| | **clefted < broad focus** | ***p* < .001** |
| NM4 | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < clefted** | ***p* < .05** |
| | **clefted < broad focus** | ***p* < .05** |
| NM6 | ***in situ* < broad focus** | ***p* < .05** |
| | *in situ* ≈ clefted | *p* = .215 |
| | clefted ≈ broad focus | *p* = 1.00 |
| CF2 | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < clefted** | ***p* < .05** |
| | **clefted < broad focus** | ***p* < .001** |
| CM2 | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < clefted** | ***p* < .001** |
| | **clefted < broad focus** | ***p* < .001** |

Table 5.32: Bonferroni pairwise comparisons of paroxytone peak alignment for the speakers that produced more than one type of syntactic structure to mark contrastive focus. Significant results are in bold.

### 5.2.4 Valley Height

#### *5.2.4.1 Oxytones*

Tables 5.33-5.35 present the means, Linear Mixed Model results, and Bonferroni pairwise comparisons for the analyses of Oxytone Valley Height.

| Means (SD)- Oxytone Valley Height (st) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 91.1 (2.0) | 81.7 (2.2) | 86.3 (4.8) | 86.0 (5.5) |
| Broad Focus | 86.8 (5.2) | 91.4 (3.6) | 82.4 (4.1) | 86.9 (3.5) | 86.7 (3.4) |
| In Situ Contrastive Focus | 83.9 (3.8) | 87.7 (3.6) | 81.2 (3.6) | 86.1 (3.5) | 83.8 (5.0) |
| Clefted Contrastive Focus | 86.5 (5.2) | 91.2 (6.0) | 81.8 (3.5) | 86.3 (3.5) | 86.4 (4.5) |

Table 5.33: Mean (SD) of Oxytone Valley Height (st) across all factors.

| Linear Mixed Model- Oxytone Valley Height | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **80.9 (.89)** | **$F_{(1, 22.746)} = 1230.454$, $p < .001$** | **78.9** | **82.8** |
| **Pragmatic Condition** | **-.04 (.69)** | **$F_{(2, 1655.078)} = 6.089$, $p < .01$** | **-.07** | **-.01** |
| **Gender** | **9.6 (.52)** | **$F_{(1, 25.309)} = 231.502$, $p < .001$** | **8.5** | **10.7** |
| Dialect | .05 (.49) | $F_{(1, 23.204)} = 2.647$, $p = .117$, n.s. | -.97 | 1.1 |
| Age | .02 (.02) | $F_{(1, 22.279)} = .672$, $p = .421$, n.s. | -.01 | .06 |
| **Pragmatic Condition * Gender** | **-4.4 (.60)** | **$F_{(2, 1656.02)} = 30.701$, $p < .001$** | **-5.6** | **-3.3** |
| **Pragmatic Condition * Dialect** | **2.5 (.47)** | **$F_{(2, 1655.09)} = 14.966$, $p < .001$** | **1.6** | **3.5** |
| Pragmatic Condition * Age | -.01 (.02) | $F_{(2, 1652.54)} = 2.239$, $p = .107$, n.s. | -.04 | .02 |
| Random Effects | | | | |
| Residual | 3.193 (.1115) | - | - | - |
| Speaker | 1.351 (.4441) | - | - | - |
| Token | .0008 (.0094) | - | - | - |
| Model Information Criteria (BIC) = 6838.471 | | | | |

Table 5.34: Results of Linear Mixed Model of Oxytone Valley Height: significant results are in bold.

| Bonferroni Pairwise Comparisons- Oxytone Valley Height | |
|---|---|
| Comparison | Significance |
| ***in situ* < broad focus** | ***p* < .001** |
| ***in situ* < clefted** | ***p* < .001** |
| clefted ≈ broad focus | *p* = 1.00 |

Table 5.35: Results of Bonferroni pairwise comparisons of Pragmatic Condition of Oxytone Valley Height: significant results are in bold.

These results demonstrate a significant main effect of both Gender and Pragmatic Condition. As expected, females had overall higher peaks than males. The pairwise comparisons of Pragmatic Condition show that *in situ* contrastive focus had lower valleys than both clefted contrastive focus and broad focus.

There were two significant interactions: Pragmatic Condition*Gender and Pragmatic Condition*Dialect. The former reveals that, when compared to the height in broad focus, females marked *in situ* contrastive focus with lower valleys than males and the latter indicates that Cantel speakers marked *in situ* contrastive focus with lower valleys than Nahualá speakers. These results are illustrated in Figure 5.17.

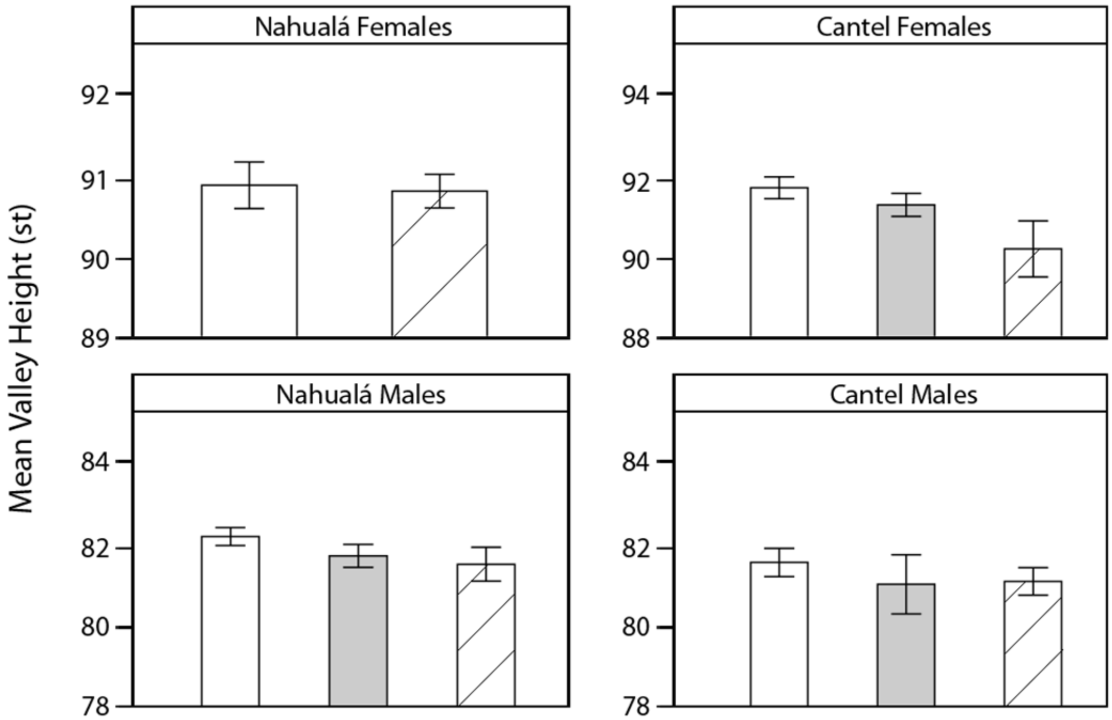


Figure 5.17: Bar graphs of mean valley height of oxytone tonic syllable (st) for all speaker groups in Spanish in all pragmatic conditions: broad focus (white), clefted contrastive focus (gray), and *in situ* contrastive focus (diagonal lines). 95% confidence interval bars included.

The individual speaker analyses in Table 5.36 show that 14 of 24 speakers mark contrastive focus with a significantly lower valley than in broad focus; the differences in valley height for speaker CM3 approach significance. The pairwise comparisons in Table 5.37 reveal that all 3 speakers that produced more than one syntactic structure of contrastive focus and had an overall significant main effect marked *in situ* contrastive focus with a lower valley than in broad focus.; speakers NM1 and CF2 did not have any significant differences in the comparisons involving the valleys of clefted contrastive focus, while speaker CM2 actually marked broad focus with a lower valley than clefted contrastive focus. Overall, these results indicate that, similar to the findings in K'ichee', the use of a lower valley to mark contrastive focus in Spanish oxytones varies among these bilinguals.

| Individual Speaker ANOVAs- Oxytones Valley Height | | | | | |
|---|---|---|---|---|---|
| NF1 | **NF2** | **NF3** | NF4 | NF5 | **NF6** |
| $F_{(1, 69.21)}$ = .095, *p* = .759, n.s. | **$F_{(1, 70.32)}$ = 17.736, *p* < .001** | **$F_{(1, 76.19)}$ = 7.278, *p* < .01** | $F_{(1, 74.87)}$ = 2.581, *p* = .113, n.s. | $F_{(1, 78.09)}$ = 2.186, *p* = .144, n.s. | **$F_{(1, 74.75)}$ = 4.298, *p* < .05** |
| **NM1*** | **NM2** | NM3 | NM4* | NM5 | **NM6** |
| **$F_{(2, 77.31)}$ = 5.742, *p* < .05** | **$F_{(1, 76.62)}$ = 17.817, *p* < .001** | $F_{(1, 68.35)}$ = 1.315, *p* = .255, n.s. | $F_{(2, 66.72)}$ = .244, *p* = .784, n.s. | $F_{(1, 72.46)}$ = .365, *p* = .548, n.s. | **$F_{(1, 67.98)}$ = 9.192, *p* < .01** |
| **CF1** | **CF2*** | CF3 | CF4 | **CF5** | **CF6** |
| **$F_{(1, 73.24)}$ = 6.636, *p* < .05** | **$F_{(2, 76.05)}$ = 9.862, *p* < .001** | $F_{(1, 60.83)}$ = 1.737, *p* = .193, n.s. | $F_{(1, 69.38)}$ = .881, *p* = .351, n.s. | **$F_{(1, 65.94)}$ = 5.897, *p* < .05** | **$F_{(1, 77.04)}$ = 24.009, *p* < .001** |
| **CM1** | **CM2*** | CM3 | **CM4** | CM5 | **CM6** |
| **$F_{(1, 73.26)}$ = 18.485, *p* < .001** | **$F_{(2, 75.62)}$ = 19.277, *p* < .001** | $F_{(1, 72.13)}$ = 3.845, *p* = .054, n.s. | **$F_{(1, 65.61)}$ = 10.652, *p* < .01** | $F_{(1, 64.39)}$ = .001, *p* = .979, n.s. | **$F_{(1, 66.92)}$ = 8.969, *p* < .01** |

Table 5.36: Results from the ANOVAs of oxytone valley height for all 24 speakers; significant results are in bold and indicate that the individual speaker had a lower valley in the contrastive focus condition. An asterisk signifies that the speaker produced more than one syntactic structure for contrastive focus and is further analyzed where there is a significant main effect in the Bonferroni pairwise comparisons in Table 5.37.

| Bonferroni Pairwise Comparisons- Oxytones Valley Height | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM1 | ***in situ* < broad focus** | ***p* < .001** |
| | *in situ* ≈ clefted | $p = .111$ |
| | clefted ≈ broad focus | $p = 1.00$ |
| NM4 | - no significant main effect- | |
| CF2 | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < clefted** | ***p* < .01** |
| | clefted ≈ broad focus | $p = .127$ |
| CM2 | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < clefted** | ***p* < .001** |
| | **broad focus < clefted** | ***p* < .001** |

Table 5.37: Bonferroni pairwise comparisons of oxytone peak alignment for the speakers that produced more than one type of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

#### *5.2.4.2 Paroxytones*

The results of the analyses of Paroxytone Valley Height are similar to those of Oxytone Valley Height. There is a significant main effect of both Gender and Pragmatic Condition: again, females had higher overall valleys than males and the pairwise comparisons revealed that *in situ* contrastive focus had significantly lower valleys than both clefted contrastive focus and broad focus, there were no significant differences between the latter two.

All three interactions were significant. The Pragmatic Condition*Gender interaction shows that females mark clefted contrastive focus more than males whereas the Pragmatic Condition*Dialect interaction indicates that Cantel speakers mark *in situ* contrastive focus more than Nahualá speakers. Again, the Pragmatic Condition*Age interaction parallels the Pragmatic Condition*Gender as younger speakers marked *in situ* contrastive focus with lower valleys than older speakers, who were mostly males. The means and overall results of the Linear Mixed Model and Bonferroni pairwise comparisons are presented in Tables 5.38-5.40 and illustrated in Figure 5.18.

| Means (SD)- Paroxytone Valley Height (st) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 91.1 (2.0) | 81.2 (2.1) | 86.2 (5.0) | 86.2 (5.7) |
| Broad Focus | 86.5 (5.4) | 91.3 (3.9) | 81.4 (3.8) | 86.3 (3.7) | 86.4 (3.7) |
| In Situ Contrastive Focus | 83.3 (4.1) | 89.8 (3.5) | 81.0 (3.8) | 86.0 (3.7) | 84.9 (3.7) |
| Clefted Contrastive Focus | 86.4 (5.2) | 90.7 (6.0) | 81.4 (4.3) | 86.3 (5.9) | 85.8 (5.1) |

Table 5.38: Mean (SD) of Paroxytone Valley Height (st) across all factors.

| Linear Mixed Model- Paroxytone Valley Height | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **81.6 (.95)** | **$F_{(1, 61.846)}$ = 5916.247, *p* < .001** | **79.6** | **83.6** |
| **Pragmatic Condition** | **-13.4 (.19)** | **$F_{(2, 1872.657)}$ = 26.402, *p* < .001** | **-17.2** | **-9.6** |
| **Gender** | **10 (.55)** | **$F_{(1, 24.545)}$ = 267.02, *p* < .001** | **8.8** | **11.1** |
| Dialect | .12 (.52) | $F_{(1, 27.566)}$ = .804, *p* = .378, n.s. | -.97 | 1.2 |
| Age | -.01 (.02) | $F_{(1, 69.741)}$ = 1.265, *p* = .268, n.s. | -.05 | .03 |
| **Pragmatic Condition * Gender** | **-1.5 (.59)** | **$F_{(2, 1875.054)}$ = 4.343, *p* < .05** | **-2.7** | **-.38** |
| **Pragmatic Condition * Dialect** | **-1.5 (.69)** | **$F_{(2, 1874.302)}$ = 4.079, *p* < .05** | **-2.9** | **-.21** |
| **Pragmatic Condition * Age** | **.04 (.05)** | **$F_{(2, 1872.583)}$ = 4.206, *p* < .05** | **.03** | **.05** |
| Random Effects | | | | |
| Residual | 2.764 (.0906) | - | - | - |
| Speaker | 1.563 (.5060) | - | - | - |
| Token | .0000 (.0000) | - | - | - |
| Model Information Criteria (BIC) = 7432.816 | | | | |

Table 5.39: Results of Linear Mixed Model of Paroxytone Valley Height: significant results are in bold.

| Bonferroni Pairwise Comparisons- Paroxytone Valley Height | |
|---|---|
| Comparison | Significance |
| ***in situ* < broad focus** | ***p* < .001** |
| ***in situ* < clefted** | ***p* < .001** |
| clefted ≈ broad focus | *p* = 1.00 |

Table 5.40: Results of Bonferroni pairwise comparisons of Pragmatic Condition of Paroxytone Valley Height: significant results are in bold.

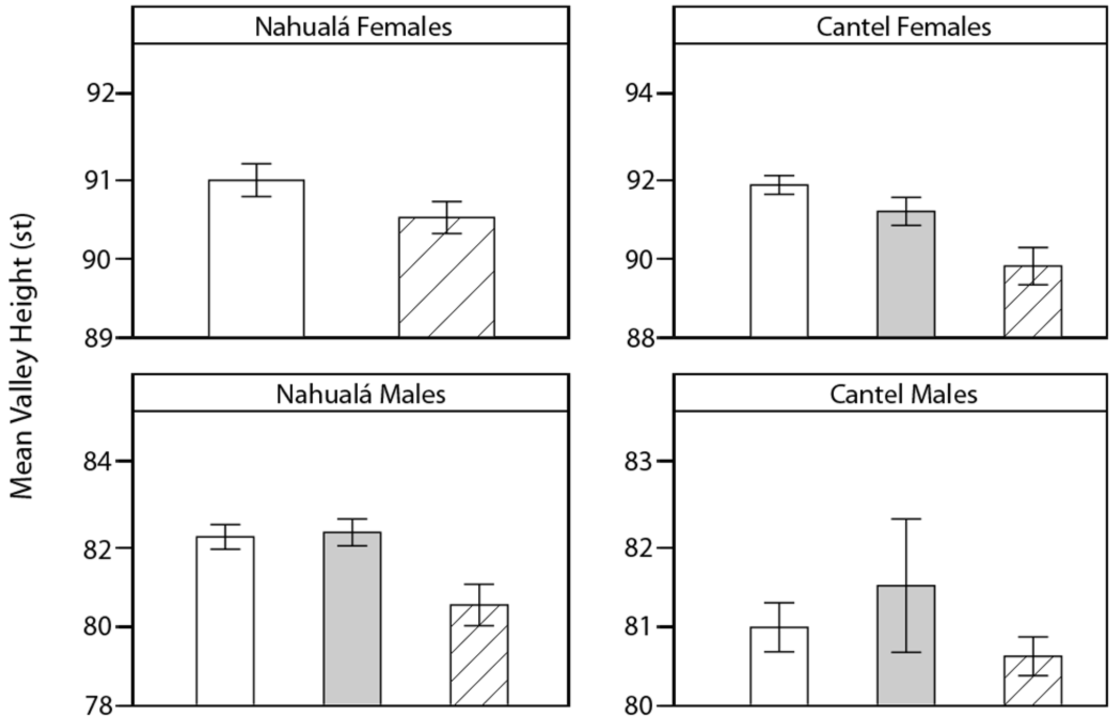


Figure 5.18: Bar graphs of mean valley height of paroxytone tonic syllable (st) for all speaker groups in Spanish in all pragmatic conditions: broad focus (white), clefted contrastive focus (gray) and *in situ* contrastive focus (diagonal lines). 95% confidence interval bars included.

The individual speaker results of valley height in Spanish paroxytones are presented in Table 5.41. In comparison with the results of valley height in both K'ichee' and Spanish oxytones, there is less between-speaker variation for Spanish paroxytones, as 18 of 24 speakers marked contrastive focus with significantly lower valleys. The pairwise comparisons in Table 5.42 demonstrate that the four bilinguals that produced more than one syntactic structure of contrastive focus and demonstrated a significant main effect marked *in situ* contrastive focus with lower valleys than in broad focus; three of the four also marked *in situ* contrastive focus with lower valleys than clefted contrastive focus and two speakers, NM3 and NM6, had significantly lower valleys in clefted contrastive focus than in broad focus.

| Individual Speaker ANOVAs- Paroxytones Valley Height | | | | | |
|---|---|---|---|---|---|
| **NF1** | **NF2** | **NF3** | NF4 | **NF5** | **NF6** |
| **$F_{(1, 75)}$ = 5.125, $p < .05$** | **$F_{(1, 76)}$ = 9.362, $p < .01$** | **$F_{(1, 77)}$ = 16.208, $p < .001$** | $F_{(1, 78)}$ = 1.992, $p = .162$, n.s. | **$F_{(1, 78)}$ = 40.378, $p < .001$** | **$F_{(1, 78)}$ = 14.82, $p < .001$** |
| **NM1** | **NM2** | **NM3*** | **NM4*** | **NM5** | **NM6*** |
| **$F_{(1, 77)}$ = 10.848, $p < .001$** | **$F_{(1, 76)}$ = 17.53, $p < .001$** | **$F_{(2, 77)}$ = 34.352, $p < .001$** | **$F_{(2, 78)}$ = 18.214, $p < .001$** | **$F_{(1, 75)}$ = 33.093, $p < .001$** | **$F_{(2, 78)}$ = 10.301, $p < .001$** |
| CF1 | **CF2*** | **CF3** | **CF4** | **CF5** | **CF6** |
| $F_{(1, 73)}$ = .142, $p = .868$, n.s. | **$F_{(2, 72)}$ =14.267, $p < .001$** | **$F_{(1, 76)}$ = 5.461, $p < .05$** | **$F_{(1, 76)}$ = 4.124, $p < .05$** | **$F_{(1, 73)}$ = 14.604, $p < .01$** | **$F_{(1, 74)}$ = 48.691, $p < .001$** |
| **CM1** | CM2* | CM3 | CM4 | **CM5** | CM6 |
| **$F_{(1, 70)}$ = 18.097, $p < .001$** | $F_{(2, 73)}$ = 3.012, $p = .056$, n.s. | $F_{(1, 74)}$ = 2.288, $p = .135$, n.s. | $F_{(1, 77)}$ = 2.092, $p = .152$, n.s. | **$F_{(1, 76)}$ = 6.219, $p < .05$** | $F_{(1, 73)}$ = 1.584, $p = .212$, n.s. |

Table 5.41: Results from the ANOVAs of paroxytone valley height for all 24 speakers; significant results are in bold and indicate that the individual speaker had a lower valley in the contrastive focus condition. An asterisk signifies that the speaker produced more than one syntactic structure for contrastive focus and is further analyzed where there is a significant main effect in the Bonferroni pairwise comparisons in Table 5.42.

| Bonferroni Pairwise Comparisons- Paroxytones Valley Height | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM3 | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < clefted** | ***p* < .01** |
| | **clefted < broad focus** | ***p* < .01** |
| NM4 | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < clefted** | ***p* < .001** |
| | clefted ≈ broad focus | *p* = 1.00 |
| NM6 | ***in situ* < broad focus** | ***p* < .05** |
| | *in situ* ≈ clefted | *p* = .734 |
| | **clefted < broad focus** | ***p* < .001** |
| CF2 | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < clefted** | ***p* < .001** |
| | clefted ≈ broad focus | *p* = 1.00 |
| CM2 | -no significant main effect- | |

Table 5.42: Bonferroni pairwise comparisons of paroxytone peak alignment for the speakers that produced more than one type of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

## 5.2.5 Valley Alignment

### *5.2.5.1 Oxytones*

The means, results of the Linear Mixed Model, and results of the corresponding Bonferroni pairwise comparisons of Oxytone Valley Alignment are presented in Tables 5.43-5.45 and Figure 5.19.

| Means (SD)- Oxytone Valley Alignment | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | .38 (.17) | .22 (.15) | .27 (.21) | .32 (.16) |
| Broad Focus | .30 (.18) | .43 (.26) | .25 (.19) | .33 (.25) | .30 (.23) |
| In Situ Contrastive Focus | .25 (.16) | .35 (.21) | .17 (.18) | .31 (.28) | .26 (.19) |
| Clefted Contrastive Focus | .29 (.19) | .36 (.21) | .24 (.17) | .35 (.29) | .27 (.22) |

Table 5.43: Mean (SD) of Oxytone Valley Alignment across all factors.

| Linear Mixed Model- Oxytone Valley Alignment | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **.33 (.12)** | **$F_{(1, 20.414)}$ = 10.06, *p* < .01** | **.09** | **.58** |
| **Pragmatic Condition** | **-.38 (.04)** | **$F_{(2, 1651.289)}$ = 15.497, *p* < .001** | **-.45** | **-.31** |
| **Gender** | **.11 (.07)** | **$F_{(1, 20.776)}$ = 7.679, *p* < .05** | **.04** | **.25** |
| Dialect | .01 (.06) | $F_{(1, 20.483)}$ = 1.008, *p* = .327, n.s. | -.13 | .14 |
| Age | -.002 (.002) | $F_{(1, 20.347)}$ = .001, *p* = .981, n.s. | -.007 | .003 |
| **Pragmatic Condition * Gender** | **.25 (.03)** | **$F_{(2, 1651.82)}$ = 28.293, *p* < .001** | **.17** | **.29** |
| **Pragmatic Condition * Dialect** | **.13 (.02)** | **$F_{(2, 1651.935)}$ = 23.543, *p* < .001** | **.08** | **.18** |
| **Pragmatic Condition * Age** | **.006 (.001)** | **$F_{(2, 1650.394)}$ = 24.015, *p* < .001** | **.004** | **.007** |
| Random Effects | | | | |
| Residual | .0082 (.0002) | - | - | - |
| Speaker | .0245 (.0078) | - | - | - |
| Token | .0000 (.0000) | - | - | - |
| Model Information Criteria (BIC) = -3068.572 | | | | |

Table 5.44: Results of Linear Mixed Model of Oxytone Valley Alignment: significant results are in bold.

| Bonferroni Pairwise Comparisons- Oxytone Valley Alignment | |
|---|---|
| Comparison | Significance |
| ***in situ* < broad focus** | ***p* < .05** |
| *in situ* ≈ clefted | *p* = .131 |
| clefted ≈ broad focus | *p* = .801 |

Table 5.45: Results of Bonferroni pairwise comparisons of Pragmatic Condition of Oxytone Valley Alignment: significant results are in bold.

There was a significant main effect of both Gender and Pragmatic Condition. Similar to valley alignment in K'ichee', males produce valleys that were, overall, aligned earlier than those produced by females. The pairwise comparisons of Pragmatic Condition indicate only one significant difference: *in situ* contrastive focus had earlier valleys than broad focus.

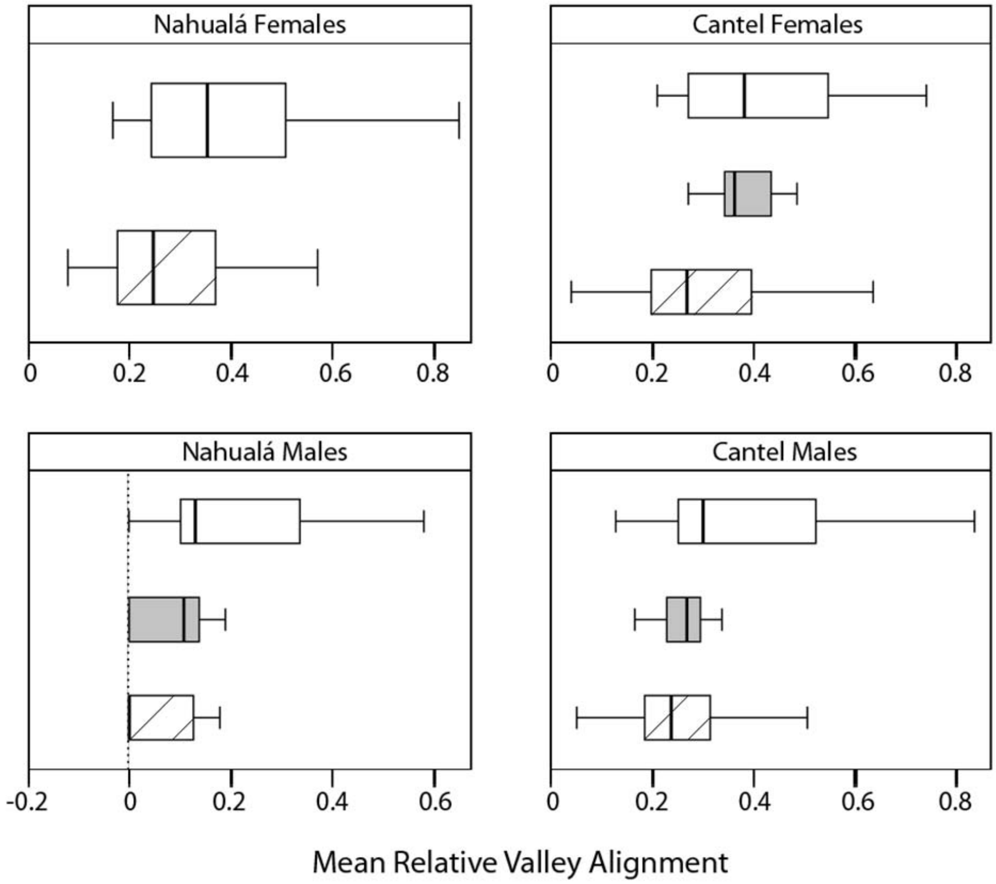


Figure 5.19: Boxplots of mean relative valley alignment for oxytones among all speaker groups in Spanish in all pragmatic conditions: broad focus (white), clefted contrastive focus (gray), and *in situ* contrastive focus (diagonal lines). A lower number indicates an earlier valley and the dotted line in Nahualá males indicates a relative valley alignment score of 0, i.e., the beginning of the tonic syllable.

All three interactions were significant: the Pragmatic Condition*Gender interaction demonstrates that females tend to mark clefted contrastive focus with earlier valleys, compared to the alignment of their broad focus valleys, than males, the Pragmatic Condition*Dialect interaction indicates that Cantel bilinguals also tend to mark clefted contrastive focus with earlier valleys, when compared the alignment of the their broad focus valleys, than Nahualá bilinguals, and that younger speakers also tend to mark the valleys earlier. However, similar to valley alignment in K'ichee', Nahualá males tend to have the earliest valley alignment across pragmatic conditions (see Figure 5.19). This early valley alignment, near the beginning of the tonic syllable in the broad focus condition, would not allow for as much phonetic space to produce an earlier valley in a contrastive focus condition as it does among the other speaker groups: there were no examples of valleys occurring before the onset of the tonic syllable among these speakers.

| Individual Speaker ANOVAs- Oxytones Valley Alignment | | | | | |
|---|---|---|---|---|---|
| **NF1** | NF2 | **NF3** | **NF4** | **NF5** | **NF6** |
| **$F_{(1, 70)}$ = 66.791, $p < .001$** | $F_{(1, 69)}$ = .017, $p$ = .897, n.s. | **$F_{(1, 76)}$ = 23.756, $p < .001$** | **$F_{(1, 74)}$ = 41.461, $p < .001$** | **$F_{(1, 78)}$ = 40.102, $p < .001$** | **$F_{(1, 74)}$ = 12.88, $p < .001$** |
| NM1* | **NM2** | **NM3** | **NM4*** | **NM5** | NM6 |
| $F_{(2, 77)}$ = 2.633, $p$ = .109, n.s. | **$F_{(1, 78)}$ = 14.209, $p < .001$** | **$F_{(1, 68)}$ = 37.721, $p < .001$** | **$F_{(2, 67)}$ = 83.816, $p < .001$** | **$F_{(1, 72)}$ = 95.347, $p < .001$** | $F_{(1, 67)}$ = .035, $p$ = .852, n.s. |
| **CF1** | **CF2*** | **CF3** | CF4 | **CF5** | **CF6** |
| **$F_{(1, 73)}$ = 6.6, $p < .05$** | **$F_{(2, 77)}$ = 220.364, $p < .001$** | **$F_{(1, 61)}$ = 168.431, $p < .001$** | $F_{(1, 68)}$ = .821, $p$ = .368, n.s. | **$F_{(1, 76)}$ = 168.159, $p < .001$** | **$F_{(1, 78)}$ = 5.391, $p < .05$** |
| **CM1** | **CM2*** | **CM3** | **CM4** | **CM5** | **CM6** |
| **$F_{(1, 73)}$ = 87.017, $p < .001$** | **$F_{(2, 75)}$ = 4.953, $p < .05$** | **$F_{(1, 72)}$ = 119.623, $p < .001$** | **$F_{(1, 65)}$ = 70.344, $p < .001$** | **$F_{(1, 64)}$ = 22.927, $p < .001$** | **$F_{(1, 76)}$ = 6.696, $p < .05$** |

Table 5.46: Results from the ANOVAs of oxytone valley alignment for all 24 speakers; significant results are in bold and indicate that the individual speaker had an earlier valley in the contrastive focus condition. An asterisk signifies that the speaker produced more than one syntactic structure for contrastive focus and is further analyzed where there is a significant main effect in the Bonferroni pairwise comparisons in Table 5.47.

Table 5.46 presents the individual speaker analyses of valley alignment in oxytones; 20 of 24 speakers marked contrastive focus with a significantly earlier valley. The corresponding Bonferroni pairwise comparisons in Table 5.47 reveal that, while the three speakers that produced more than one syntactic structure of contrastive focus and had a significant main effect demonstrate different patterns in the valley alignment of clefted contrastive focus, all three mark *in situ* contrastive focus with earlier peaks than broad focus. These results indicate that, similar to K'ichee', an earlier valley alignment is used to mark prosodic contrastive focus in Spanish oxytones by these bilinguals, with a few exceptions.

| Bonferroni Pairwise Comparisons- Oxytones Valley Alignment | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM1 | - no significant main effect- | |
| NM4 | ***in situ* < broad focus** | **$p < .001$** |
| | *in situ* ≈ clefted | $p < 1.00$ |
| | **clefted < broad focus** | **$p < .001$** |
| CF2 | ***in situ* < broad focus** | **$p < .001$** |
| | ***in situ* < clefted** | **$p < .001$** |
| | **clefted < broad focus** | **$p < .001$** |
| CM2 | ***in situ* < broad focus** | **$p < .05$** |
| | *in situ* ≈ clefted | $p = .683$ |
| | clefted ≈ broad focus | $p = 1.00$ |

Table 5.47: Bonferroni pairwise comparisons of oxytone peak alignment for the speakers that produced more than one type of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

### *5.2.5.2 Paroxytones*

The means and results of the Linear Mixed Model and corresponding Bonferroni pairwise comparisons of Paroxytone Valley Alignment are presented in Tables 5.48-5.50 and Figure 5.20.

| Means (SD)- Paroxytone Valley Alignment | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | .50 (.24) | .32 (.20) | .45 (.23) | .32 (.23) |
| Broad Focus | .46 (.25) | .56 (.25) | .42 (.26) | .55 (.28) | .37 (.27) |
| In Situ Contrastive Focus | .28 (.19) | .41 (.21) | .14 (.14) | .40 (.20) | .14 (.21) |
| Clefted Contrastive Focus | .39 (.23) | .49 (.26) | .26 (.24) | .46 (.29) | .34 (.24) |

Table 5.48: Mean (SD) of Paroxytone Valley Alignment across all factors.

| Linear Mixed Model- Paroxytone Valley Alignment | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **.68 (.15)** | **$F_{(1, 23.734)}$ = 11.328, $p$ < .001** | **.37** | **.99** |
| **Pragmatic Condition** | **-1.2 (.10)** | **$F_{(2, 1864.572)}$ = 280.418, $p$ < .001** | **-1.4** | **-.96** |
| **Gender** | **.08 (.08)** | **$F_{(1, 20.821)}$ = 5.286, $p$ < .05** | **.01** | **.25** |
| Dialect | -.18 (.08) | $F_{(1, 20.506)}$ = 3.992, $p$ = .059, n.s. | -.35 | .01 |
| Age | -.004 (.002) | $F_{(1, 24.309)}$ = 3.466, $p$ = .075, n.s. | -.01 | .002 |
| **Pragmatic Condition * Gender** | **.15 (.01)** | **$F_{(2, 1865.231)}$ = 141.55, $p$ < .001** | **.13** | **.17** |
| **Pragmatic Condition * Dialect** | **-.15 (.04)** | **$F_{(2, 1864.965)}$ = 100.361, $p$ < .001** | **-.22** | **-.08** |
| **Pragmatic Condition * Age** | **.03 (.002)** | **$F_{(2, 1864.586)}$ = 58.261, $p$ < .001** | **.02** | **.03** |
| Random Effects | | | | |
| Residual | .0077 (.0003) | - | - | - |
| Speaker | .0388 (.0123) | - | - | - |
| Token | .0000 (.0000) | - | - | - |
| Model Information Criteria (BIC) = -3597.116 | | | | |

Table 5.49: Results of Linear Mixed Model of Paroxytone Valley Alignment: significant results are in bold.

| Bonferroni Pairwise Comparisons- Paroxytone Valley Alignment | |
|---|---|
| Comparison | Significance |
| ***in situ* < broad focus** | ***p* < .001** |
| ***in situ* < clefted** | ***p* < .001** |
| **clefted < broad focus** | ***p* < .001** |

Table 5.50: Results of Bonferroni pairwise comparisons of Pragmatic Condition of Paroxytone Valley Alignment: significant results are in bold.

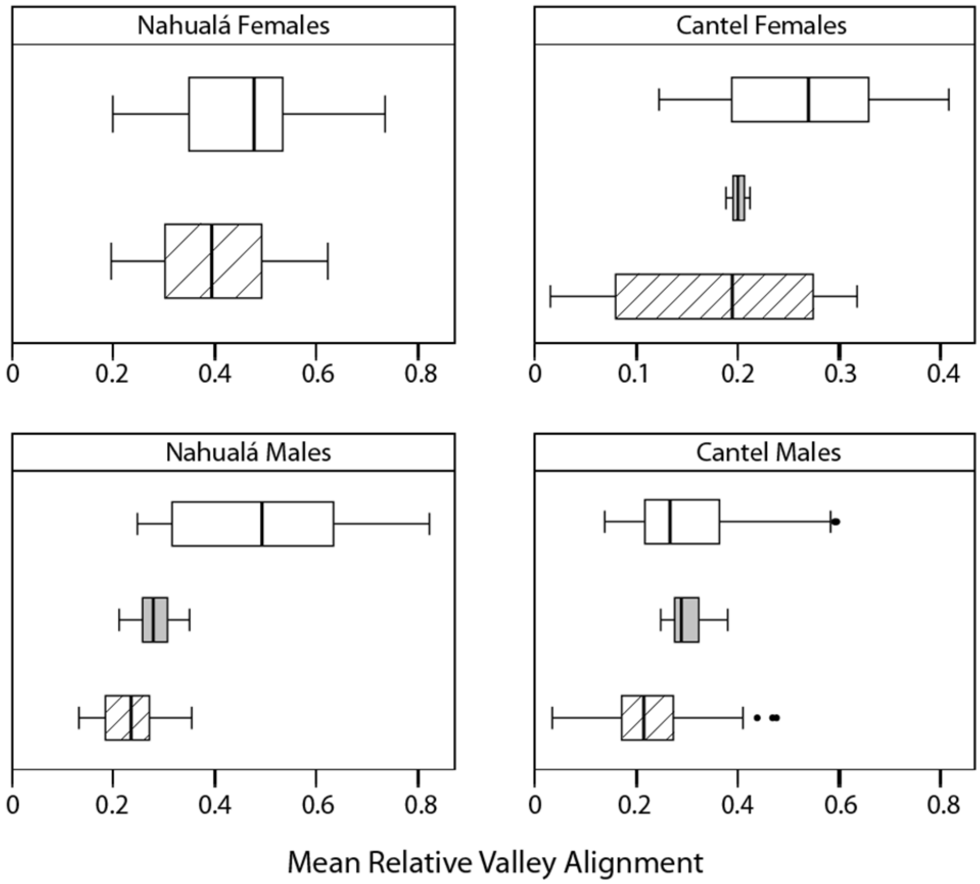


Figure 5.20: Boxplots of mean relative valley alignment for paroxytones among all speaker groups in Spanish in all pragmatic conditions: broad focus (white), clefted contrastive focus (gray), and *in situ* contrastive focus (diagonal lines). A lower number indicates an earlier valley.

The results of Paroxytone Valley Alignment reveal a significant main effect of both Gender and Pragmatic Condition; Dialect and Age also approach significance. Overall, males produced earlier valleys than females across all pragmatic conditions and the pairwise comparisons present a ‘focus prominence hierarchy’: *in situ* contrastive focus valleys were significantly earlier than valleys in both clefted contrastive focus and broad focus and valleys in clefted contrastive focus were earlier than in broad focus.

All three interactions were significant: the Pragmatic Condition*Gender interaction indicates that males tend to mark both contrastive focus conditions with earlier valleys, when compared the alignment of the broad focus valley, than females, the Pragmatic Condition*Dialect interaction also shows that Cantel bilinguals tend to mark contrastive focus valleys earlier than Nahualá bilinguals, again, when compared to the alignment of the broad focus valley, and the results of the Pragmatic Condition*Age interaction suggest that, similar to previous significant interactions, older speakers, who again are mostly males, tend to mark both contrastive focus conditions with earlier peaks than the younger speakers. Unlike the data from the oxytones, Nahualá males do not tend to have an early valley alignment near the onset of the tonic syllable, though Nahualá females demonstrate the latest valley alignment in *in situ* contrastive focus (see Figure 5.20).

The individual speaker analyses presented in Table 5.51 show that most bilinguals in this study, 22 of the 24, mark contrastive focus with an earlier valley alignment. The four speakers that produced more than one syntactic structure of contrastive focus and demonstrated a significant main effect are analyzed in the Bonferroni pairwise comparisons in Table 5.52: all marked both *in situ* and clefted contrastive focus with significantly earlier valleys than broad focus and speaker CM2 also marked *in situ* contrastive focus with earlier valleys than clefted contrastive focus.

| Individual Speaker ANOVAs- Paroxytones Valley Alignment | | | | | |
|---|---|---|---|---|---|
| **NF1** | **NF2** | NF3 | **NF4** | **NF5** | **NF6** |
| **$F_{(1, 75.17)}$ = 43.274, *p* < .001** | **$F_{(1, 75.67)}$ = 16.867, *p* < .001** | $F_{(1, 76.62)}$ = .036, *p* = .851, n.s. | **$F_{(1, 77.05)}$ = 69.321, *p* < .001** | $F_{(1, 77.15)}$ **= 4.02, *p* < .05** | **$F_{(1, 77.23)}$ = 4.061, *p* < .05** |
| **NM1** | **NM2** | **NM3*** | **NM4*** | **NM5** | NM6* |
| **$F_{(1, 76.91)}$ = 25.054, *p* < .001** | **$F_{(1, 75.28)}$ = 94.721, *p* < .001** | **$F_{(2, 76.58)}$ = 97.559, *p* < .001** | **$F_{(2, 77.19)}$ = 105.117, *p* < .001** | **$F_{(1, 74.4)}$ = 6.039, *p* < .05** | $F_{(2, 77.23)}$ = .219, *p* = .804, n.s. |
| **CF1** | **CF2*** | **CF3** | **CF4** | **CF5** | **CF6** |
| **$F_{(1, 72.22)}$ = 13.317, *p* < .001** | **$F_{(2, 71.69)}$ = 48.522, *p* < .001** | **$F_{(1, 75.52)}$ = 4.103, *p* < .05** | **$F_{(1, 76.43)}$ = 9.172, *p* < .01** | **$F_{(1, 73.2)}$ = 41.7, *p* < .001** | **$F_{(1, 73.54)}$ = 27.254, *p* < .001** |
| **CM1** | **CM2*** | **CM3** | **CM4** | **CM5** | **CM6** |
| **$F_{(1, 69.44)}$ = 38.934, *p* < .001** | **$F_{(2, 72.39)}$ = 98.041, *p* < .001** | **$F_{(1, 73.36)}$ = 4.556, *p* < .05** | **$F_{(1, 76.87)}$ = 96.418, *p* < .001** | **$F_{(1, 75.42)}$ = 99.779, *p* < .001** | **$F_{(1, 72.31)}$ = 24.048, *p* < .001** |

Table 5.51: Results from the ANOVAs of paroxytone valley alignment for all 24 speakers; significant results are in bold and indicate that the individual speaker had an earlier valley in the contrastive focus condition. An asterisk signifies that the speaker produced more than one syntactic structure for contrastive focus and is further analyzed where there is a significant main effect in the Bonferroni pairwise comparisons in Table 5.52.

| Bonferroni Pairwise Comparisons- Paroxytones Valley Alignment | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM3 | ***in situ* < broad focus** | ***p* < .001** |
| | *in situ* ≈ clefted | *p* = 1.00 |
| | **clefted < broad focus** | ***p* < .001** |
| NM4 | ***in situ* < broad focus** | ***p* < .001** |
| | *in situ* ≈ clefted | *p* = .587 |
| | **clefted < broad focus** | ***p* < .001** |
| NM6 | -no significant main effect- | |
| CF2 | ***in situ* < broad focus** | ***p* < .001** |
| | *in situ* ≈ clefted | *p* = .427 |
| | **clefted < broad focus** | ***p* < .001** |
| CM2 | ***in situ* < broad focus** | ***p* < .001** |
| | ***in situ* < clefted** | ***p* < .01** |
| | **clefted < broad focus** | ***p* < .001** |

Table 5.52: Bonferroni pairwise comparisons of paroxytone valley alignment for the speakers that produced more than one type of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

### 5.2.6 Rise

#### *5.2.6.1 Oxytones*

As mentioned in Section 3.4.5 and illustrated in the K'ichee' results in Section 4.2.2.6, the acoustic measurement for Rise is not independent of Peak and Valley Height, the two measurements from which it is calculated. A Pearson correlation analysis (two-tailed) demonstrates this as there is a significant correlation between Peak Height and Rise, r = .248, n = 1780, $p$ < .001, and between Valley Height and Rise, r = -.247, n = 1780, $p$ < .001. As with the data presented in Section 4.2.2.6 for K'ichee', a higher peak and a lower valley are correlated with a greater overall rise. These correlations are illustrated in Figures 5.21 and 5.22.

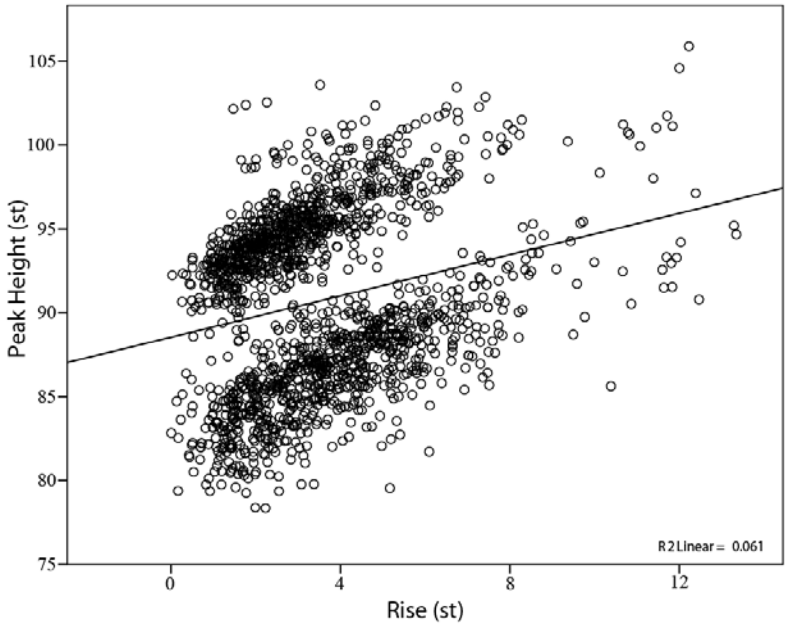


Figure 5.21: Overall oxytone Rise (st) as a function of Peak Height (st).

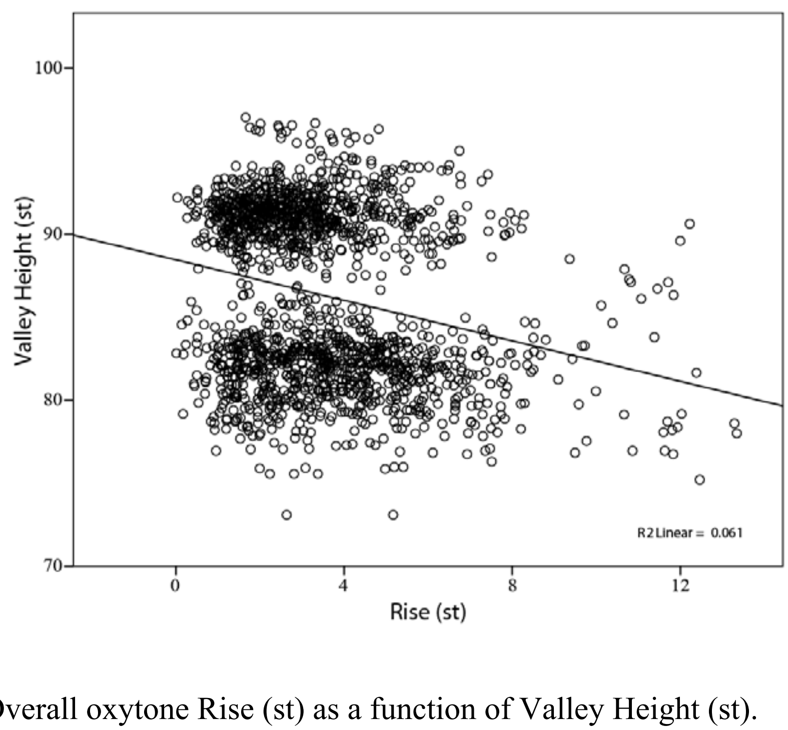


Figure 5.22: Overall oxytone Rise (st) as a function of Valley Height (st).

Tables 5.53 and 5.54 present the means and the results of the Linear Mixed Model of Oxytone Rise. The results indicate that there is no significant main effect of any factor and that there is only a significant interaction between Pragmatic Condition and Dialect: Cantel bilinguals marked *in situ* contrastive focus with a greater overall rise, when compared to the rise of broad focus, than Nahualá bilinguals. These results, separated by gender and dialect, can be seen in the boxplots in Figure 5.23.

| Means (SD)- Oxytone Rise (st) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 3.9 (2.4) | 4.8 (2.7) | 4.4 (2.4) | 4.4 (2.8) |
| Broad Focus | 4.4 (2.8) | 3.9 (3.2) | 4.7 (3.2) | 4.4 (3.2) | 4.3 (3.2) |
| In Situ Contrastive Focus | 4.5 (2.5) | 4.1 (3.3) | 4.8 (3.4) | 4.2 (3.3) | 4.7 (3.2) |
| Clefted Contrastive Focus | 4.6 (2.2) | 3.7 (7.2) | 4.6 (4.3) | 4.6 (5.8) | 4.4 (5.0) |

Table 5.53: Mean (SD) of Oxytone Rise (st) across all factors.

| Linear Mixed Model- Oxytone Rise | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **4.4 (.82)** | $\mathbf{F_{(1, 26.327)} = 32.946}$, ***p* < .001** | **2.7** | **6.1** |
| Pragmatic Condition | 1.2 (.93) | $F_{(2, 1659.476)} = .123$, $p = .885$, n.s. | -2.2 | 1.1 |
| Gender | -.59 (.47) | $F_{(1, 32.273)} = 2.755$, $p = .107$, n.s. | -1.6 | .39 |
| Dialect | -.06 (.45) | $F_{(1, 27.31)} = .381$, $p = .542$, n.s. | -.99 | .87 |
| Age | .007 (.016) | $F_{(1, 25.288)} = .016$, $p = .9$, n.s. | -.03 | .04 |
| Pragmatic Condition * Gender | -.26 (.28) | $F_{(2, 1650.385)} = .621$, $p = .538$, n.s. | -.81 | .28 |
| **Pragmatic Condition * Dialect** | **-1.2 (.65)** | $\mathbf{F_{(2, 1646.831)} = 3.637}$, ***p* < .05** | **-2.5** | **-.11** |
| Pragmatic Condition * Age | .003 (.009) | $F_{(2, 1664.632)} = .436$, $p = .647$, n.s. | -.01 | .02 |
| Random Effects | | | | |
| Residual | 5.866 (.2044) | - | - | - |
| Speaker | 1.054 (.3633) | - | - | - |
| Token | .0000 (.0000) | - | - | - |
| Model Information Criteria (BIC) = 7836.573 | | | | |

Table 5.54: Results of Linear Mixed Model of Oxytone Rise: significant results are in bold.

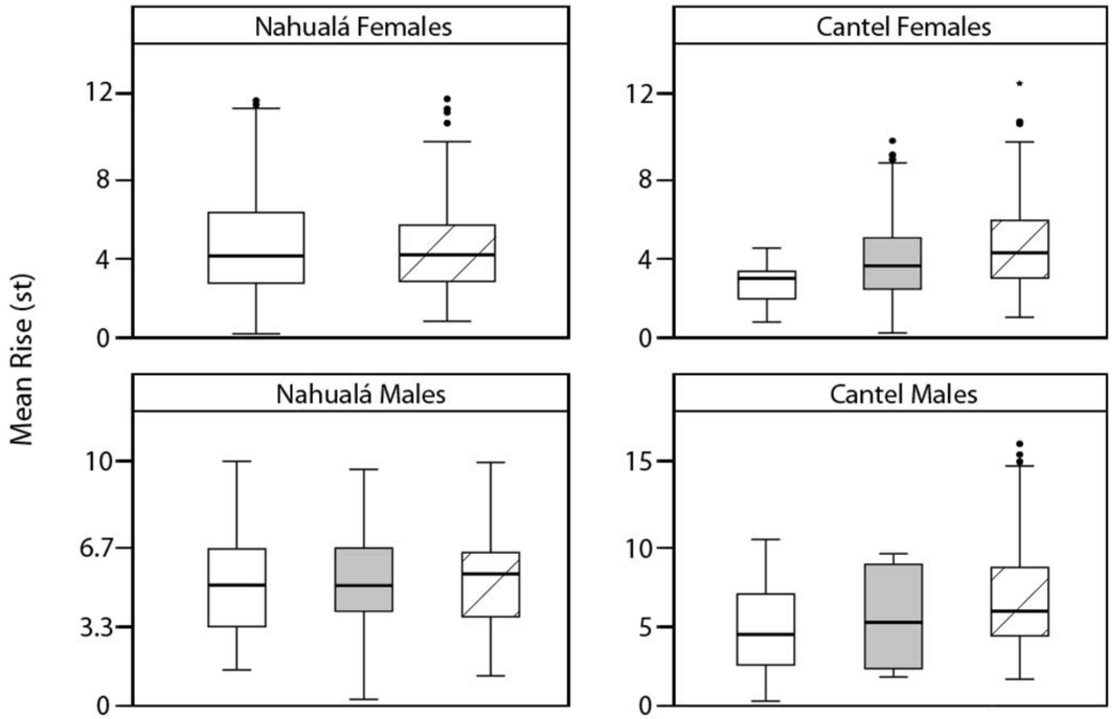


Figure 5.23: Boxplots of mean rise (st) for oxytones among all speaker groups in Spanish in all pragmatic conditions: broad focus (white), clefted contrastive focus (gray), and *in situ* contrastive focus (diagonal lines).

The individual speaker analyses are presented in Table 5.55. Only 7 of the 24 bilinguals produced significantly greater rises in contrastive focus than in broad focus. Of the speakers that produced more than one type of syntactic structure for contrastive focus, only speaker CF2 displayed a significant main effect; she marked *in situ* contrastive focus with a greater rise than broad focus but did not reach significance in either of the comparisons involving clefted contrastive focus (see Table 5.56). Overall, these findings are comparable to the findings on rise in K'ichee' reported in Chapter 4: the use of a greater rise to mark contrastive focus varies among these bilinguals.

| Individual Speaker ANOVAs- Oxytones Rise | | | | | |
|---|---|---|---|---|---|
| NF1 | **NF2** | NF3 | **NF4** | NF5 | NF6 |
| $F_{(1, 70)}$ = .325, $p$ = .571, n.s. | **$F_{(1, 69)}$ = 4.819, $p < .05$** | $F_{(1, 76)}$ = .62, $p$ = .434, n.s. | **$F_{(1, 74)}$ = 9.978, $p < .01$** | $F_{(1, 78)}$ = .704, $p$ = .404, n.s. | $F_{(1, 74)}$ = .167, $p$ = .684, n.s. |
| NM1* | **NM2** | NM3 | NM4* | NM5 | NM6 |
| $F_{(2, 77)}$ = .761, $p$ =.471, n.s. | **$F_{(1, 78)}$ = 12.781, $p < .001$** | $F_{(1, 68)}$ = .296, $p$ = .588, n.s. | $F_{(2, 67)}$ = .24, $p$ = .787, n.s. | $F_{(1, 72)}$ = 2.264, $p$ = .137, n.s. | $F_{(1, 67)}$ = .025, $p$ = .875, n.s. |
| CF1 | **CF2*** | CF3 | CF4 | **CF5** | CF6 |
| $F_{(1, 73)}$ = 1.957, $p$ = .167, n.s. | **$F_{(2, 77)}$ = 6.495, $p < .01$** | $F_{(1, 61)}$ = 2.879, $p$ = .095, n.s. | $F_{(1, 68)}$ = .482, $p$ = .49, n.s. | **$F_{(1, 76)}$ = 5.148, $p < .05$** | $F_{(1, 78)}$ = .318, $p$ = .575, n.s. |
| CM1 | CM2* | **CM3** | CM4 | CM5 | **CM6** |
| $F_{(1, 73)}$ = .047, $p$ = .829, n.s. | $F_{(2, 75)}$ = 1.144, $p$ = .324, n.s. | **$F_{(1, 72)}$ = 8.9, $p < .01$** | $F_{(1, 65)}$ = .007, $p$ = .933, n.s. | $F_{(1, 64)}$ = 1.766, $p$ = .167, n.s. | **$F_{(1, 76)}$ = 12.369, $p < .01$** |

Table 5.55: Results from the ANOVAs of oxytone rise for all 24 speakers; significant results are in bold and indicate that the individual speaker had a greater rise in the contrastive focus condition. An asterisk signifies that the speaker produced more than one syntactic structure for contrastive focus and is further analyzed where there is a significant main effect in the Bonferroni pairwise comparisons in Table 5.56.

| Bonferroni Pairwise Comparisons- Oxytones Rise | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM1 | - no significant main effect- | |
| NM4 | - no significant main effect- | |
| CF2 | ***in situ* > broad focus** | **$p < .01$** |
| | *in situ* ≈ clefted | $p$ = .200 |
| | clefted ≈ broad focus | $p$ = .069 |
| CM2 | -no significant main effect- | |

Table 5.56: Bonferroni pairwise comparisons of oxytone rise for the speakers that produced more than one type of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

### *5.2.6.2 Paroxytones*

A Pearson correlation analyses between Paroxytone Rise, Peak Height, and Valley Height revealed a significant correlation between Rise and Valley Height, r = -.307, n = 1895, $p < .001$, a lower valley was correlated with a greater overall rise, but not between Rise and Peak Height, r = .033, n = 1895, $p = .153$, n.s. The correlation between Rise and Valley Height is shown in Figure 5.24.

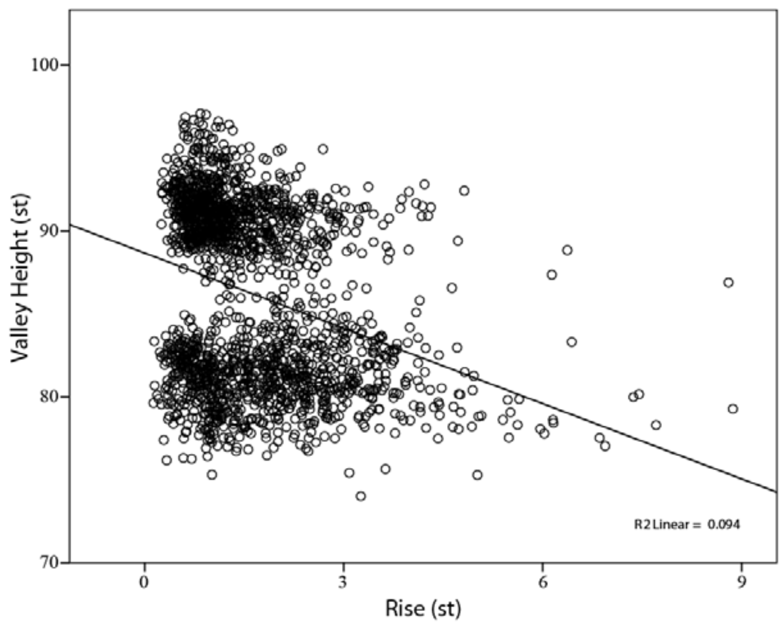


Figure 5.24: Overall paroxytone Rise (st) as a function of Valley Height (st).

The analyses of Paroxytone Rise, presented in Tables 5.57-5.59, reveal a main effect of Gender and Pragmatic Condition: males had an overall greater rise across pragmatic conditions and the pairwise comparisons demonstrate another 'focus prominence hierarchy', where *in situ* contrastive focus had a significantly greater rise than the other two conditions and clefted contrastive focus had a significantly greater rise than broad focus. These results, separated by dialect and gender, are illustrated in Figure 5.25.

| Means (SD)- Paroxytone Rise (st) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 2.3 (1.5) | 3.2 (.20) | 2.9 (.23) | 2.6 (1.8) |
| Broad Focus | 2.4 (1.6) | 2.0 (1.8) | 2.7 (1.8) | 2.3 (1.7) | 2.4 (1.7) |
| In Situ Contrastive Focus | 3.9 (2.3) | 3.3 (1.8) | 3.9 (2.7) | 3.8 (3.6) | 3.6 (3.7) |
| Clefted Contrastive Focus | 3.3 (1.9) | 2.5 (4.8) | 3.6 (1.8) | 3.4 (1.8) | 2.7 (1.7) |

Table 5.57: Mean (SD) of Paroxytone Rise (st) across all factors.

| Linear Mixed Model- Paroxytone Rise | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **2.5 (.44)** | **$F_{(1, 94.928)} = 42.472$, $p < .001$** | **1.6** | **3.4** |
| **Pragmatic Condition** | **1.6 (.29)** | **$F_{(2, 1834.494)} = 13.256$, $p < .001$** | **1.0** | **2.1** |
| **Gender** | **-.63 (.26)** | **$F_{(1, 42.392)} = 7.019$, $p < .05$** | **-1.2** | **-.11** |
| Dialect | .11 (.24) | $F_{(1, 59.955)} = .974$, $p = .328$, n.s. | -.39 | .61 |
| Age | .003 (.009) | $F_{(1, 345.05)} = 1.077$, $p = .351$, n.s. | -.02 | .02 |
| **Pragmatic Condition * Gender** | **-.49 (.17)** | **$F_{(2, 1796.731)} = 4.577$, $p < .05$** | **-.82** | **-.17** |
| **Pragmatic Condition * Dialect** | **-.81 (.15)** | **$F_{(2, 1815.06)} = 14.079$, $p < .001$** | **-1.1** | **-.51** |
| **Pragmatic Condition * Age** | **-.15 (.05)** | **$F_{(2, 1830.977)} = 4.405$, $p < .05$** | **-.24** | **-.05** |
| Random Effects | | | | |
| Residual | 2.558 (.0838) | - | - | - |
| Speaker | .2871 (.1013) | - | - | - |
| Token | .0000 (.0000) | - | - | - |
| Model Information Criteria (BIC) = 7256.498 | | | | |

Table 5.58: Results of Linear Mixed Model of Paroxytone Rise: significant results are in bold.

| Bonferroni Pairwise Comparisons- Paroxytone Rise | |
|---|---|
| Comparison | Significance |
| ***in situ* > broad focus** | **$p < .001$** |
| ***in situ* > clefted** | **$p < .05$** |
| **clefted > broad focus** | **$p < .001$** |

Table 5.59: Results of Bonferroni pairwise comparisons of Pragmatic Condition of Paroxytone Rise: significant results are in bold.

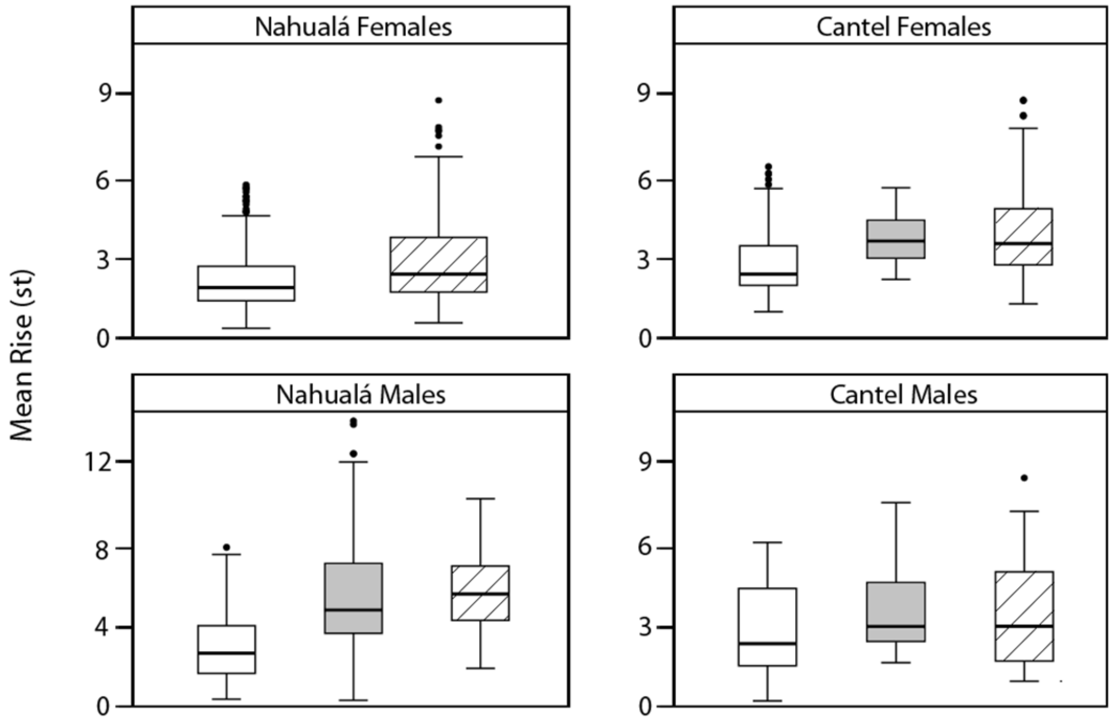


Figure 5.25: Boxplots of mean rise (st) for paroxytones among all speaker groups in Spanish in all pragmatic conditions: broad focus (white), clefted contrastive focus (gray), and *in situ* contrastive focus (diagonal lines).

All three interactions were significant; however, the only pragmatic condition to demonstrate any interaction was clefted contrastive focus. In the interaction between Pragmatic Condition and Gender, males tended to mark it to a greater degree when compared to the rise of the broad focus condition than females. In the Pragmatic Condition*Dialect interaction, Nahualá speakers tended to mark it with a greater rise than Cantel speakers. Finally, in the Pragmatic Condition*Age interaction, older speakers tended to mark it higher than younger speakers, again, when compared to the rise of their broad focus conditions.

| Individual Speaker ANOVAs- Paroxytones Rise | | | | | |
|---|---|---|---|---|---|
| **NF1** | NF2 | NF3 | NF4 | **NF5** | **NF6** |
| **$F_{(1, 75)}$ = 14.145, $p < .001$** | $F_{(1, 76)}$ = 1.367, $p = .246$, n.s. | $F_{(1, 77)}$ = .675, $p = .414$, n.s. | $F_{(1, 78)}$ = .017, $p = .896$, n.s. | **$F_{(1, 78)}$ = 5.353, $p < .05$** | **$F_{(1, 78)}$ = 10.515, $p < .01$** |
| NM1 | **NM2** | NM3* | **NM4*** | **NM5** | **NM6*** |
| $F_{(1, 77)}$ = 2.548, $p = .144$, n.s. | **$F_{(1, 76)}$ = 26.572, $p < .001$** | $F_{(2, 77)}$ = .697, $p = .507$, n.s. | **$F_{(2, 78)}$ = 26.443, $p < .001$** | **$F_{(1, 75)}$ = 172.252, $p < .001$** | **$F_{(2, 78)}$ = 14.504, $p < .001$** |
| **CF1** | CF2* | CF3 | CF4 | **CF5** | **CF6** |
| **$F_{(1, 73)}$ = 3.449, $p < .05$** | $F_{(2, 72)}$ = 1.615, $p = .206$, n.s. | $F_{(1, 76)}$ = .048, $p = .827$, n.s. | $F_{(1, 76)}$ = 1.002, $p = .32$, n.s. | **$F_{(1, 73)}$ = 7.465, $p < .01$** | **$F_{(1, 74)}$ = 16.352, $p < .001$** |
| CM1 | CM2* | CM3 | CM4 | **CM5** | **CM6** |
| $F_{(1, 70)}$ = .49, $p = .486$, n.s. | $F_{(2, 73)}$ = .376, $p = .688$, n.s. | $F_{(1, 74)}$ = .045, $p = .833$, n.s. | $F_{(1, 77)}$ = .819, $p = .368$, n.s. | **$F_{(1, 76)}$ = 4.562, $p < .05$** | **$F_{(1, 73)}$ = 8.64, $p < .01$** |

Table 5.60: Results from the ANOVAs of paroxytone rise for all 24 speakers; significant results are in bold and indicate that the individual speaker had a greater rise in the contrastive focus condition. An asterisk signifies that the speaker produced more than one syntactic structure for contrastive focus and is further analyzed where there is a significant main effect in the Bonferroni pairwise comparisons in Table 5.61.

The results of the individual speaker ANOVAs are presented in Table 5.60; 12 of 24 speakers marked contrastive focus with a significantly greater rise. For the speakers that produced more than one type of syntactic structure for contrastive focus, only two had a significant main effect and are analyzed in the Bonferroni pairwise comparisons in Table 5.61. Both speakers marked the two types of contrastive focus with a greater rise than broad focus but did not differentiate between the rises in *in situ* and clefted contrastive focus. These results are similar to the results of rise in K'ichee' and in

Spanish oxytones in that the use of a greater rise to mark contrastive focus varies according to speaker, though more speakers marked focus with a significantly greater rise in paroxytones than in oxytones.

| Bonferroni Pairwise Comparisons- Paroxytones Rise | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM3 | -no significant main effect- | |
| NM4 | ***in situ* > broad focus** | **$p < .001$** |
| | *in situ* ≈ clefted | $p = .146$ |
| | **clefted > broad focus** | **$p < .001$** |
| NM6 | ***in situ* > broad focus** | **$p < .001$** |
| | *in situ* ≈ clefted | $p = 1.00$ |
| | **clefted > broad focus** | **$p < .001$** |
| CF2 | -no significant main effect- | |
| CM2 | -no significant main effect- | |

Table 5.61: Bonferroni pairwise comparisons of paroxytone rise for the speakers that produced more than one type of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

### 5.2.7 Slope

#### *5.2.7.1 Oxytones*

Again, the acoustic measurement for Slope is calculated via the measurements for Duration and Rise. A Pearson correlation analysis (two-tailed) demonstrates a significant correlation between Duration and Slope, r = -.051, n = 1780, $p < .05$, but not between Rise and Slope, r = -.027, n = 1780, $p = .276$, n.s: a longer duration is correlated with a less steep slope, as seen in Figure 5.26.

The results of the analyses of Oxytone Slope do not reveal any significant main effects or interactions, though the Pragmatic Condition*Dialect interaction approaches significance: Nahualá speakers produced slopes that were steeper, albeit not significantly, than Cantel speakers in *in situ* contrastive focus. These results are presented in Tables 5.62 and 5.63 and illustrated in Figure 5.27.

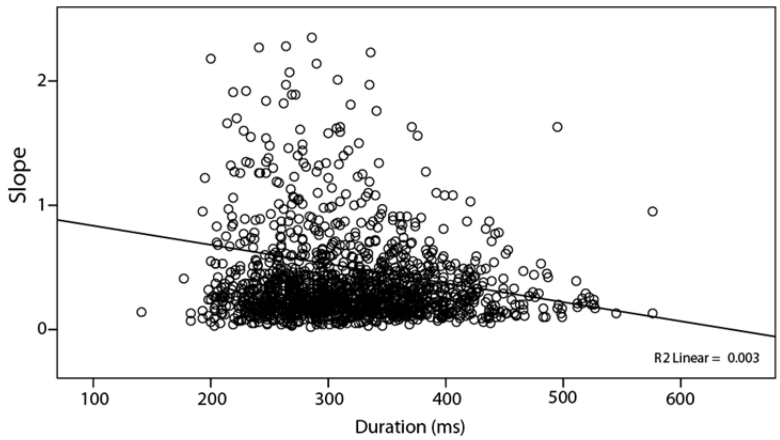


Figure 5.26: Oxytone Slope as a function of Duration (ms).

| Means (SD)- Oxytone Slope | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | .47 (.69) | .44 (.56) | .44 (.45) | .42 (.23) |
| Broad Focus | .47 (.54) | .49 (.82) | .48 (.23) | .46 (.75) | .45 (.29) |
| In Situ Contrastive Focus | .49 (.43) | .53 (.88) | .46 (.38) | .52 (.78) | .45 (.19) |
| Clefted Contrastive Focus | .36 (.27) | .38 (.81) | .35 (.43) | .34 (.29) | .37 (.22) |

Table 5.62: Mean (SD) of Oxytone Slope across all factors.

| Linear Mixed Model- Oxytone Slope | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| Intercept | .21 (.31) | $F_{(1, 58.216)} = 2.31$, $p = .134$, n.s. | -.40 | .83 |
| Pragmatic Condition | .32 (.39) | $F_{(2, 1111.02)} = 1.012$, $p = .364$, n.s. | -.44 | 1.1 |
| Gender | .52 (.18) | $F_{(1, 75.269)} = 2.526$, $p = .116$, n.s. | -.16 | .87 |
| Dialect | -.38 (.17) | $F_{(1, 55.343)} = .353$, $p = .555$, n.s. | -.72 | .04 |
| Age | .005 (.006) | $F_{(1, 54.371)} = .015$, $p = .902$, n.s. | -.003 | .017 |
| Pragmatic Condition * Gender | -.26 (.22) | $F_{(2, 808.897)} = .677$, $p = .508$, n.s. | -.68 | .18 |
| Pragmatic Condition * Dialect | .28 (.50) | $F_{(2, 821.455)} = 2.956$, $p = .053$, n.s. | -.7 | 1.3 |
| Pragmatic Condition * Age | -.008 (.007) | $F_{(2, 1339.667)} = .686$, $p = .504$, n.s. | -.24 | .05 |
| Random Effects | | | | |
| Residual | 3.925 (.1367) | - | - | - |
| Speaker | .0603 (.0376) | - | - | - |
| Token | .0000 (.0000) | - | - | - |
| Model Information Criteria (BIC) = 7129.499 | | | | |

Table 5.63: Results of Linear Mixed Model of Oxytone Slope.

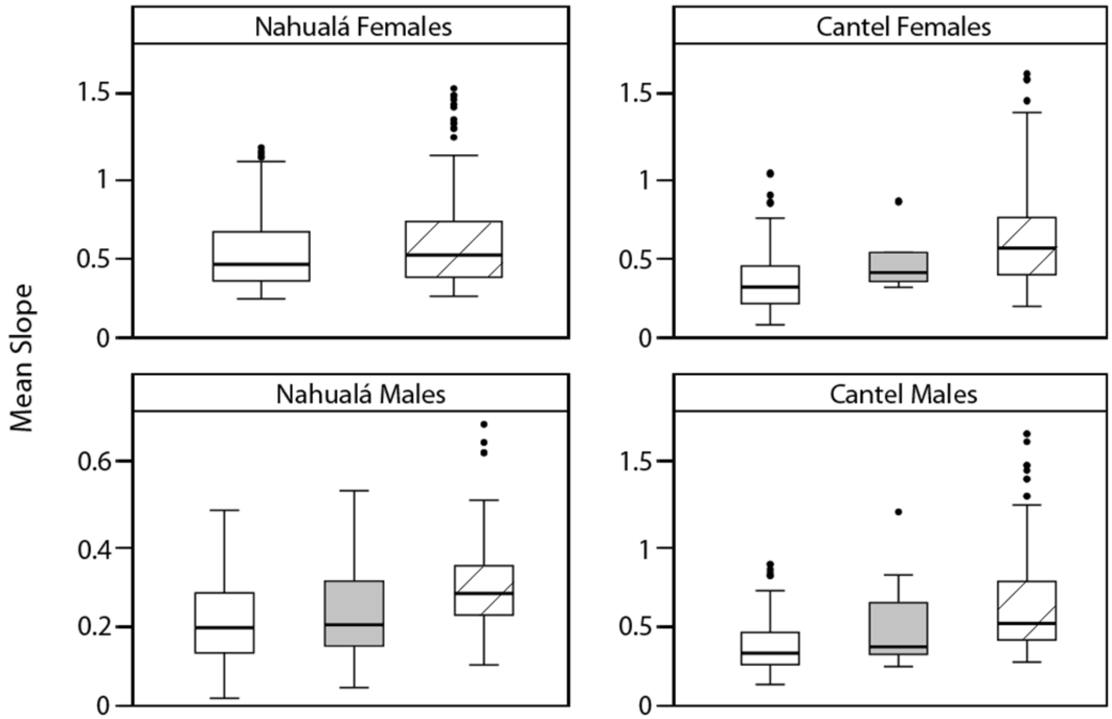


Figure 5.27: Boxplots of mean slope for oxytones among all speaker groups in Spanish in all pragmatic conditions: broad focus (white), clefted contrastive focus (gray), and *in situ* contrastive focus (diagonal lines). A higher number indicates a steeper slope.

The individual speaker analyses, reported in Table 5.64, demonstrate that only 9 of 24 speakers produced a significantly steeper slope in contrastive focus. The corresponding pairwise comparisons in Table 5.65 illustrate that, for the two speakers that produced more than one structure of contrastive focus and had a main effect, both mark *in situ* contrastive focus with a steeper slope than broad focus, though each speaker differs with the slope in clefted contrastive focus; CF2 has a steeper slope in clefted contrastive focus than in broad focus but no difference between the two contrastive focus conditions while CM2 displays the opposite, a steeper slope in *in situ* than in clefted contrastive focus and no difference between clefted contrastive focus and broad focus.

| Individual Speaker ANOVAs- Oxytones Slope | | | | | |
|---|---|---|---|---|---|
| NF1 | **NF2** | NF3 | **NF4** | NF5 | NF6 |
| $F_{(1, 69.21)}$ = .729, $p$ = .396, n.s. | **$F_{(1, 70.32)}$ = 3.844, $p$ < .05** | $F_{(1, 76.19)}$ = .457, $p$ = .501, n.s. | **$F_{(1, 74.87)}$ = 46.225, $p$ < .001** | $F_{(1, 78.09)}$ = .1.472, $p$ = .229, n.s. | $F_{(1, 74.75)}$ = .001, $p$ = .979, n.s. |
| NM1* | **NM2** | NM3 | NM4* | **NM5** | NM6 |
| $F_{(2, 77.31)}$ = 2.261, $p$ =.111, n.s. | **$F_{(1, 76.62)}$ = 22.024, $p$ < .001** | $F_{(1, 68.35)}$ = 1.745, $p$ = .191, n.s. | $F_{(2, 66.72)}$ = .2.925, $p$ = .061, n.s. | **$F_{(1, 72.46)}$ = 4.51, $p$ < .05** | $F_{(1, 67.98)}$ = .225, $p$ = .637, n.s. |
| CF1 | **CF2*** | CF3 | CF4 | **CF5** | **CF6** |
| $F_{(1, 73.24)}$ = 2.159, $p$ = .147, n.s. | **$F_{(2, 76.05)}$ = 11.948, $p$ < .001** | $F_{(1, 60.83)}$ = .163, $p$ = .688, n.s. | $F_{(1, 69.38)}$ = .641, $p$ = .426, n.s. | **$F_{(1, 65.94)}$ = 15.423, $p$ < .001** | **$F_{(1, 77.04)}$ = .18.358, $p$ < .001** |
| **CM1** | **CM2*** | CM3 | CM4 | CM5 | CM6 |
| **$F_{(1, 73.26)}$ = 6.095, $p$ < .05** | **$F_{(2, 75.62)}$ = 9.919, $p$ < .001** | $F_{(1, 72.13)}$ = .731, $p$ = .396, n.s. | $F_{(1, 65.61)}$ = .1.29, $p$ = .26, n.s. | $F_{(1, 64.39)}$ = 1.954, $p$ = .189, n.s. | $F_{(1, 66.92)}$ = .204, $p$ = .653, n.s. |

Table 5.64: Results from the ANOVAs of oxytone slope for all 24 speakers; significant results are in bold and indicate that the individual speaker had a steeper slope in the contrastive focus condition. An asterisk signifies that the speaker produced more than one syntactic structure for contrastive focus and is further analyzed where there is a significant main effect in the Bonferroni pairwise comparisons in Table 5.65.

| Bonferroni Pairwise Comparisons- Oxytones Slope | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM1 | - no significant main effect- | |
| NM4 | - no significant main effect- | |
| CF2 | ***in situ* > broad focus** | **$p$ < .001** |
| | *in situ* ≈clefted | $p$ = 1.00 |
| | **clefted > broad focus** | **$p$ < .01** |
| CM2 | ***in situ* > broad focus** | **$p$ < .001** |
| | ***in situ* > clefted** | **$p$ < .001** |
| | clefted ≈ broad focus | $p$ = .802 |

Table 5.65: Bonferroni pairwise comparisons of oxytone slope for the speakers that produced more than one type of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

### *5.2.7.2 Paroxytones*

The Pearson correlation analyses of Paroxytone Slope do not reveal a significant correlation with Duration, r = .006, n = 1895, *p* = .78, n.s., or with Rise, r = .042, n = 1895, *p* = .068, n.s.

The results of the Linear Mixed Model of Paroxytone Slope, presented in Table 5.67 along with the means in Table 5.66, did not reveal any significant main effects or interactions. These results, grouped by gender and dialect, are illustrated in Figure 5.28.

| Means (SD)- Paroxytone Slope | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | .016 (.05) | .016 (.07) | .021 (.09) | .017 (.06) |
| Broad Focus | .017 (.09) | .016 (.06) | .015 (.06) | .016 (.06) | .018 (.11) |
| In Situ Contrastive Focus | .020 (.11) | .021 (.09) | .019 (.12) | .022 (.13) | .019 (.11) |
| Clefted Contrastive Focus | .018 (.08) | .016 (.09) | .018 (.09) | .018 (.10) | .016 (.09) |

Table 5.66: Mean (SD) of Paroxytone Slope across all factors.

| Linear Mixed Model- Paroxytone Slope | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| Intercept | .009 (.02) | $F_{(1, 82.947)}$ = .441, *p* = .507, n.s. | -.02 | .04 |
| Pragmatic Condition | .07 (.13) | $F_{(2, 1875.017)}$ = .883, *p* = .364, n.s. | -.04 | .05 |
| Gender | .001 (.09) | $F_{(1, 74.977)}$ = .017, *p* = .896, n.s. | -.02 | .02 |
| Dialect | -.002 (.008) | $F_{(1, 75.786)}$ = .073, *p* = .787, n.s. | -.02 | .01 |
| Age | .0000 (.0003) | $F_{(1, 75.475)}$ = .086, *p* = .769, n.s. | -.0005 | .0006 |
| Pragmatic Condition * Gender | .004 (.01) | $F_{(2, 1874.767)}$ = .109, *p* = .896, n.s. | -.02 | .03 |
| Pragmatic Condition * Dialect | -.014 (.012) | $F_{(2, 1875.743)}$ = .726, *p* = .484, n.s. | -.04 | .01 |
| Pragmatic Condition * Age | -.002 (.004) | $F_{(2, 1874.842)}$ = .178, *p* = .837, n.s. | -.008 | .005 |
| Random Effects | | | | |
| Residual | .0163 (.0005) | - | - | - |
| Speaker | .0002 (.0001) | - | - | - |
| Token | .0002 (.0004) | - | - | - |
| Model Information Criteria (BIC) = -2309.805 | | | | |

Table 5.67: Results of Linear Mixed Model of Paroxytone Slope.

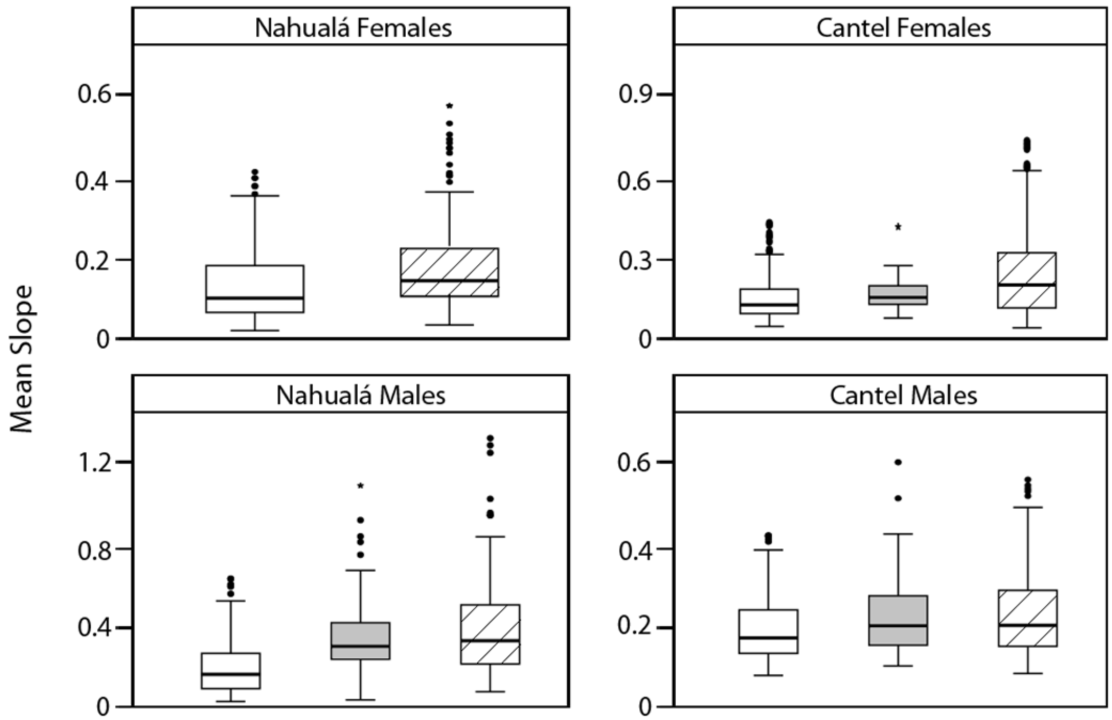


Figure 5.28: Boxplots of mean slope for paroxytones among all speaker groups in Spanish in all pragmatic conditions: broad focus (white), clefted contrastive focus (gray), and *in situ* contrastive focus (diagonal lines). A higher number indicates a steeper slope.

The individual speaker analyses of slope presented in Table 5.68 demonstrate that only 10 of 24 speakers marked contrastive focus with a significantly steeper slope than in broad focus. The data in Table 5.69 show that the two speakers that used more than one syntactic structure to mark contrastive focus and displayed a significant main effect both only had one significant difference in the pairwise comparisons; the slope in *in situ* was steeper than in broad focus. Like the results of rise, few speakers in this study used a steeper slope to mark contrastive focus in Spanish, though again, the number that did so for paroxytones was higher than for oxytones.

| Individual Speaker ANOVAs- Paroxytones Slope | | | | | |
|---|---|---|---|---|---|
| **NF1** | NF2 | NF3 | NF4 | NF5 | **NF6** |
| **$F_{(1, 75.17)}$ = 10.833, $p < .01$** | $F_{(1, 75.67)}$ = .254, $p = .616$, n.s. | $F_{(1, 76.62)}$ = .053, $p = .818$, n.s. | $F_{(1, 77.05)}$ = 1.155, $p = .286$, n.s. | $F_{(1, 77.15)}$ = 2.282, $p = .135$, n.s. | **$F_{(1, 77.23)}$ = 4.744, $p < .05$** |
| NM1 | **NM2** | NM3* | NM4* | **NM5** | **NM6*** |
| $F_{(1, 76.91)}$ = .366, $p = .547$, n.s. | **$F_{(1, 75.28)}$ = 8.671, $p < .01$** | $F_{(2, 76.58)}$ = .592, $p = .556$, n.s. | $F_{(2, 77.19)}$ = 3.194, $p = .079$, n.s. | **$F_{(1, 74.4)}$ = 26.97, $p < .001$** | **$F_{(2, 77.23)}$ = 9.606, $p < .001$** |
| CF1 | **CF2*** | CF3 | **CF4** | **CF5** | **CF6** |
| $F_{(1, 72.22)}$ = .07, $p = .932$, n.s. | **$F_{(2, 71.69)}$ = 4.76, $p < .05$** | $F_{(1, 75.52)}$ = .408, $p = .525$, n.s. | **$F_{(1, 76.43)}$ = 10.441, $p < .01$** | **$F_{(1, 73.2)}$ = 8.094, $p < .01$** | **$F_{(1, 73.54)}$ = 17.735, $p < .001$** |
| CM1 | CM2* | CM3 | CM4 | **CM5** | CM6 |
| $F_{(1, 69.44)}$ = 2.423, $p = .124$, n.s. | $F_{(2, 72.39)}$ = 1.861, $p = .163$, n.s. | $F_{(1, 73.36)}$ = .589, $p = .445$, n.s. | $F_{(1, 76.87)}$ = .102, $p = .75$, n.s. | **$F_{(1, 75.42)}$ = 4.654, $p < .05$** | $F_{(1, 72.31)}$ = 2.518, $p = .117$, n.s. |

Table 5.68: Results from the ANOVAs of paroxytone rise for all 24 speakers; significant results are in bold and indicate that the individual speaker had a greater rise in the contrastive focus condition. An asterisk signifies that the speaker produced more than one syntactic structure for contrastive focus and is further analyzed where there is a significant main effect in the Bonferroni pairwise comparisons in Table 5.69.

| Bonferroni Pairwise Comparisons- Paroxytones Slope | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM3 | -no significant main effect- | |
| NM4 | -no significant main effect- | |
| NM6 | ***in situ* > broad focus** | **$p < .001$** |
| | *in situ* ≈ clefted | $p = .174$ |
| | clefted ≈ broad focus | $p = .062$ |
| CF2 | ***in situ* > broad focus** | **$p < .01$** |
| | *in situ* ≈ clefted | $p = .17$ |
| | clefted ≈ broad focus | $p = .663$ |
| CM2 | -no significant main effect- | |

Table 5.69: Bonferroni pairwise comparisons of paroxytone slope for the speakers that produced more than one type of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

## 5.3 CORRELATIONS WITH BILINGUAL LANGUAGE DOMINANCE

Studies on Spanish have shown that language dominance can affect the intonational contours of bilinguals (Baird, submitted; O'Rourke, 2005, 2012b; Simonet, 2008, 2011) and the results from Chapter 4 demonstrated that there was a correlation between the BLP language dominance score and the degree of focus score for peak height and rise in the K'ichee' of these bilinguals; however, as noted in Section 3.5 and seen in the K'ichee' results in Chapter 4, there is a correlation between Dialect and the BLP language dominance score of each bilingual. This section provides an examination of the correlations between bilingual language dominance, as interpreted by the BLP language dominance score, and the degree of focus score for each of the acoustic characteristics of contrastive focus analyzed in the previous section.

The degree of focus score for each acoustic characteristic was assessed using the same methodology as in Chapter 4; for each speaker, the mean score of an acoustic feature in the broad focus condition was subtracted from the mean score of that same acoustic feature in a contrastive focus condition. Since the majority of the tokens of contrastive focus in the production task were of the *in situ* syntactic structure, the degree of focus scores were calculated as the mean from the broad focus responses subtracted from the mean from *in situ* contrastive focus responses for each acoustic measurement.[55] Following the same guidelines set forth for individual speaker Bonferroni pairwise comparisons in Section 5.2, a speaker needed to produce at least 5 tokens of *in situ* contrastive focus in order to be included in the correlation analysis. Proceeding in this

[55] A Pearson correlation analysis (two-tailed) was run on the BLP score and the degree of focus score using the 6 speakers who produced at least 5 oxytone tokens of clefted contrastive focus and the 5 speakers who produced at least 5 paroxytone tokens of clefted contrastive focus for all of the acoustic features but it never reached significance, which may in part be due to the low number of data points in the analyses.

way, 22 of 24 speakers were included in the oxytone correlation analysis and all 24 speakers were included in the paroxytone correlation analysis.

### 5.3.1 Oxytones

Table 5.70 presents the results of the Pearson correlation analyses (two-tailed) between the BLP score and the degree of focus score for each acoustic characteristic of prosodic focus marking. As seen in these analyses, there is a significant correlation between the BLP score and the degree of focus score for peak height, valley height, and rise; there was also a significant interaction of Pragmatic Condition*Dialect in the latter two. These three significant correlations are further illustrated in Figures 5.29-5.31. These results and the results of the previous section suggest that all of the speakers in this study mark contrastive focus on Spanish oxytones to similar degrees in terms of earlier pitch peaks and valleys regardless of bilingual language dominance; however, there is a tendency for the Spanish-dominant bilinguals, usually Cantel speakers, to mark contrastive focus on a Spanish oxytone with a higher peak, a lower valley, and a greater overall pitch rise, which, as seen in Section 5.2.6.1, are correlated to each other.

| Pearson correlation analyses with BLP score (two-tailed) | |
|---|---|
| Duration | r = .262, $p$ = .24, n.s. |
| **Peak Height** | **r = .505, $p$ < .05** |
| Peak Alignment | r = -.122, $p$ = .59, n.s. |
| **Valley Height** | **r = .527, $p$ < .05** |
| Valley Alignment | r = -.383, $p$ = .079, n.s. |
| **Rise** | **r = .423, $p$ < .05** |
| Slope | r = -.030, $p$ = .893, n.s. |

Table 5.70: Pearson correlation analyses between the BLP score and the corresponding acoustic measurement of prosodic focus marking in Spanish oxytones. In all analyses, n = 22 and significant results are in bold.

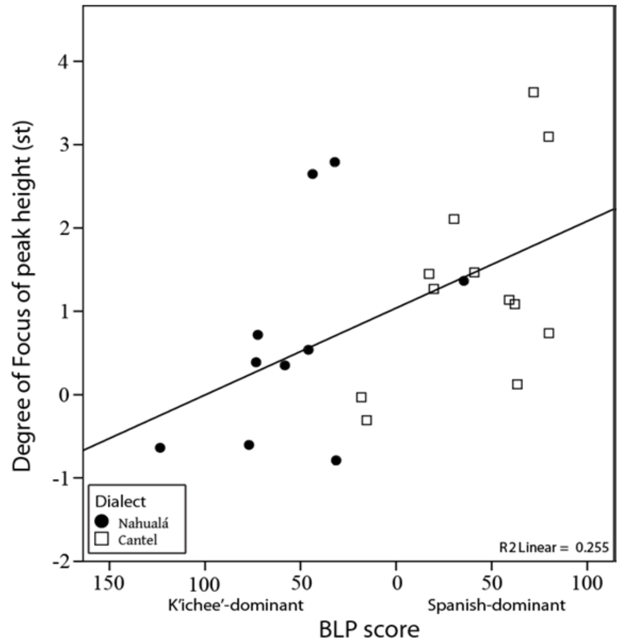


Figure 5.29 Oxytones: mean peak height in *in situ* contrastive focus (st) minus mean peak height in broad focus (st) as a function of the speakers' BLP score.

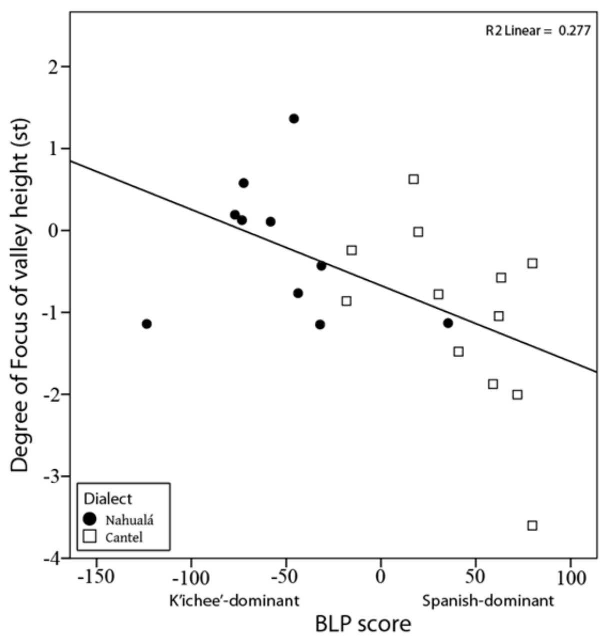


Figure 5.30 Oxytones: mean valley height in *in situ* contrastive focus (st) minus mean valley height in broad focus (st) as a function of the speakers' BLP score.

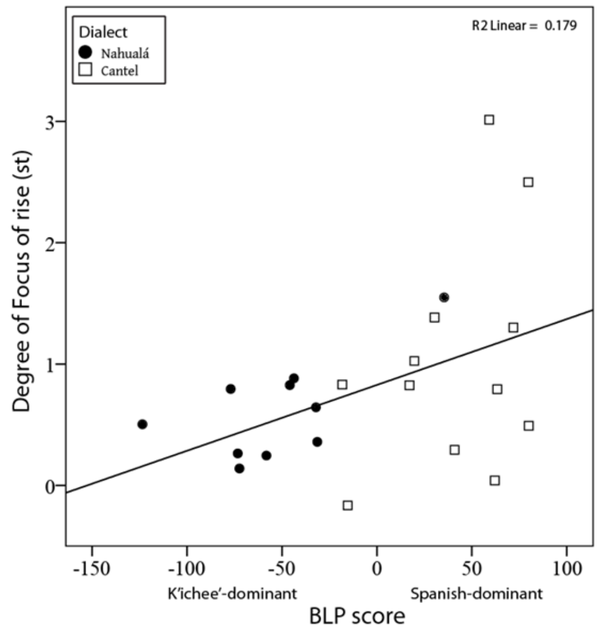


Figure 5.31 Oxytones: mean rise in *in situ* contrastive focus (st) minus mean rise in broad focus (st) as a function of the speakers' BLP score.

### 5.3.2 Paroxytones

The results of the Pearson correlation analyses (two-tailed) are presented in Table 5.71, which demonstrates that there is only a significant correlation between the BLP score and the degree of focus score for peak height (see Figure 5.32): there was also a significant interaction of Pragmatic Condition*Dialect for peak height. Unlike the analyses of K'ichee' and Spanish oxytones, there is not a significant correlation for rise, though it does approach significance. These results again suggest that the bilinguals in this study regularly mark contrastive focus in Spanish paroxytones with acoustic characteristics such as an earlier peak and an earlier valley and that these focus marking strategies are not correlated with bilingual language dominance, while marking contrastive focus with a higher pitch peak is correlated with language dominance, as interpreted by the BLP.

| Pearson correlation analyses with BLP score (two-tailed) | |
|---|---|
| Duration | r = .191, *p* = .371, n.s. |
| **Peak Height** | **r = .53, *p* < .01** |
| Peak Alignment | r = -.287, *p* = .174, n.s. |
| Valley Height | r = -272, *p* = .199, n.s. |
| Valley Alignment | r = -.163, *p* = .448, n.s. |
| Rise | r = .369, *p* = .078, n.s. |
| Slope | r = -.074, *p* = .731, n.s. |

Table 5.71: Pearson correlation analyses between the BLP score and the corresponding acoustic measurement of prosodic focus marking in Spanish paroxytones. In all analyses, n = 24 and significant results are in bold.

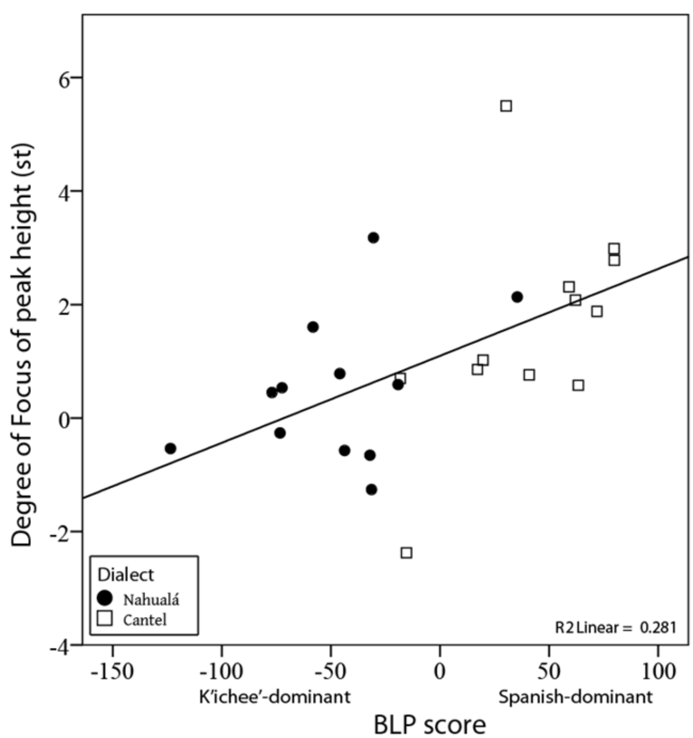


Figure 5.32 Paroxytones: mean peak height in *in situ* contrastive focus (st) minus mean peak height in broad focus (st) as a function of the speakers' BLP score.

## 5.4 DISCUSSION

The goal of this chapter was to analyze the prosodic features of contrastive focus marking in two stress patterns in Spanish according to factors such as age, gender, dialect, and bilingual language dominance. While the results demonstrate some differences across these factors, the speakers in this study primarily used similar strategies to acoustically mark contrastive focus in Spanish. The research questions posed at the beginning of this chapter and the corresponding results are summarized below.

The first research question addressed in this chapter was how the bilinguals in this study gave prosodic prominence to a contrastive focus constituent in Spanish, whether this prominence differed according to stress pattern or syntactic structure, and how it compared to prosodic focus marking in other varieties of Spanish. Like the results for K'ichee' in Chapter 4, the results from the sociolinguistic interviews and the production task presented in this chapter follow the proposal of the Effort Code (Gussenhoven, 2004) by providing evidence that a contrastive focus constituent is prosodically marked in the Spanish of these bilinguals when compared to the same constituent in a broad focus context. The group analyses demonstrate that, with a few exceptions, all of the acoustic features of prosodic focus marking were significantly more marked in a contrastive focus condition than in broad focus.[56] The individual speaker analyses demonstrate that every speaker used some combination of the acoustic features to mark contrastive focus in both stress patterns.

Overall, the results of prosodic contrastive focus marking in Spanish reported in this chapter are comparable to the results of prosodic contrastive focus marking in

[56] These exceptions were the following: Oxytone Rise and Slope, Paroxytone Slope.

K'ichee' reported in Chapter 4. The group results and the individual speaker results for both stress patterns show that the most consistently used feature of prosodic contrastive focus marking is an earlier alignment of the pitch peak; the second most consistent feature is an earlier alignment of the valley. The use of a higher pitch peak, a lower valley, a greater overall rise, and a steeper slope to mark contrastive focus demonstrate a greater amount of variation among the groups and individual speakers in both stress patterns. As with K'ichee', the acoustic measure of Rise was correlated with Peak and Valley Height and the acoustic measure of Slope was correlated with Duration and Rise, though to lesser degrees than in K'ichee'. The use of duration differed according to speaker group and stress pattern and is discussed below. These results demonstrate that, similar to K'ichee', prosodic contrastive focus marking in Spanish is predominately realized via earlier occurrences of the intonational events in the contour associated with the constituent being marked for focus. Again, within the Autosegmental-Metrical framework, these changes in the location of the intonational event help convey pragmatic meanings (Estebas & Prieto, 2008; Face, 2001, 2002a; Frota, 2000; Pierrehumbert, 1980, Pierrehumbert & Steele, 1989; Silverman & Pierrehumbert, 1990) and, overall, the group and individual speaker results suggest that an earlier location of the high and low tones may be more common for marking focus in Spanish oxytones and paroxytones than the actual height of the high and low the tones.

It should be recognized that, for the group results, the comparisons involving the clefted contrastive focus condition only included data from six of the speakers, only one of which was female. Consequently, the clearer results for comparisons involving focus marking on clefted contrastive focus constituents are seen in the individual speaker analyses. Among these speakers that produced more than one syntactic structure to mark contrastive focus, there was an overall tendency to give the most prosodic emphasis to the constituent in the *in situ* contrastive focus structure. While the prominence given to the constituent in the clefted contrastive focus structured varied, for some acoustic features it was even less prominent than in the broad focus condition, the *in situ* contrastive focus condition was always significantly more marked than the broad focus condition. In several of the group analyses and among several speakers, there was a 'focus prominence hierarchy' similar to the one reported in K'ichee'; *in situ* contrastive focus was significantly more prominent than clefted contrastive focus which, in turn, was significantly more prominent than broad focus. Again, these results follow the proposals set forth in Relevance Theory (Sperber & Wilson, 1986/1995); more prosodic emphasis is needed in an in situ structure because the word order is the same as the broad focus structure and the prosodic prominence is the only feature differentiating between the two. Meanwhile, a contrastive focus constituent marked syntactically, by a change in word order, would already present a difference between the contrastive and broad focus constituent and any additional prosodic prominence could be considered a secondary cue.

As previously stated, research on prosodic focus in Spanish has primarily examined paroxytone target words because they provide more 'phonetic space' in which to analyze the intonational contour, i.e., there is a tonic and a post-tonic syllable where the suprasegmental events can occur, as opposed to oxytone target words, where the suprasegmental events are 'crammed' into a single tonic syllable. The prosodic focus marking reported in this chapter was similar for both stress patterns. While there were differences between the alignment of the peaks and valleys across stress patterns, they were aligned later in paroxytones than in oxytones, peaks and valleys in both stress patterns were consistently earlier in contrastive focus conditions than in broad focus conditions. The only overall difference between oxytones and paroxytones was seen in Rise: there was a main effect of Pragmatic Condition in paroxytones but not in oxytones, suggesting that more phonetic space, i.e., more segmental material, allows for a greater rise to mark contrastive focus among these bilinguals. However, the individual speaker analyses do demonstrate that multiple speakers did reach significance between the pragmatic conditions for rise in both stress patterns.

These pitch excursions that are used to mark contrastive focus have received a substantial amount of attention in the literature on Spanish intonation. The main findings have been a longer duration of the tonic syllable (de la Mota Gorriz, 1997; Face, 2002b; Kim & Avelino, 2003), a higher pitch peak (Barjam, 2004; Cabrera Abreu & García Lecumberri, 2003; de la Mota Gorriz, 1997; Domínguez, 2004; Face, 2001; García Lecumberri, 1995), and an earlier peak alignment (Barjam, 2004; de la Mota Gorriz, 1997; Face, 2001). As previously mentioned, the majority of these studies have used paroxytone target words. The results from the paroxytone target words in this study demonstrate that contrastive focus is marked with a longer duration by 22 of 24 speakers, a higher pitch peak by 11 of 24 speakers and an earlier peak alignment by 22 of 24 speakers. However, most studies on other varieties of Spanish have reported that while the pitch peak generally occurs within a post-tonic syllable in broad or neutral focus, the peak often occurs within the tonic syllable in contrastive focus contexts. Perhaps an unfortunate consequence of the Autosegmental-Metrical framework of intonation and the corresponding ToBI system of analysis in Spanish is that peak alignment is often thought of as categorical, e.g., either early peaks within the tonic syllable, L+H*, or late peaks in a post-tonic syllable, L+>H*. However, research has shown that the actual alignment of the pitch peak is continuous throughout the tonic and post-tonic syllables and that a change from L+H* to L+>H* does not necessarily mark contrastive focus in several varieties of Spanish. For example, Barjam's (2004) work on Buenos Aires Spanish demonstrates that, while both broad focus and contrastive focus peaks occurred within the tonic syllable, contrastive focus peaks were still significantly earlier. The results of the current study demonstrate that, even though peaks were significantly earlier in contrastive focus conditions, only Nahualá males, as a group, had a mean relative peak alignment score within the tonic syllable in the *in situ* contrastive focus condition. Furthermore, while 22 of 24 bilinguals produced significantly earlier peaks in contrastive focus, only 8 of 24 speakers, 4 of the 8 being Nahualá males, actually produced a peak within the tonic syllable in the contrastive focus condition, though one of these speakers, NM5, also produced broad focus peaks within the tonic syllable. This means that while 14 bilinguals produced significantly earlier peaks in contrastive focus, these earlier peaks were still aligned within the post-tonic syllable, suggesting that there are different phonetic implementations of the same L+>H* phonological category. As the actual alignment of the peaks varied according to speaker, it is proposed that, following Barjam (2004), peak alignment in broad and contrastive focus among these Spanish-K'ichee' bilinguals is relative, rather than absolute.

The second question addressed in this chapter was whether there were any gender differences between these bilinguals. Significant main effects of Gender were found in the oxytone stress pattern in Peak Height, Valley Height, and Valley Alignment whereas significant main effects of Gender in the paroxytone stress pattern included Duration, Peak Height, Valley Height, Valley Alignment, and Rise. Overall, the findings were similar to those reported on K'ichee' in Chapter 4. Females produced higher overall peaks and valleys than males in both stress patterns and a longer duration in the paroxytone stress pattern across all pragmatic conditions whereas males had overall earlier valleys and a greater overall rise. The between-gender differences in peak and valley height are expected and, as mentioned in Chapter 4, speech rate was not controlled in this study which may be a factor in the duration differences. As in K'ichee', males tended to have earlier overall valleys than females, particularly the Nahualá males; however, in contrast to the K'ichee' results, males had a higher overall rise than females in the paroxytone stress pattern.

The significant Pragmatic Condition*Gender interactions reported in this chapter for both oxytones and paroxytones included Peak Height, Peak Alignment, Valley Height, and Valley Alignment; the interaction for Rise was also significant in the paroxytone stress pattern. Females tended to mark oxytone *in situ* contrastive focus with a higher peak and a lower valley, when compared to the respective heights in the broad focus condition in semitones, than males whereas in paroxytones, males tended to mark clefted contrastive focus with a higher peak, a lower valley, and a greater overall rise than females. The results of the higher peaks and lower valleys for females in *in situ* contrastive focus follow the proposal set forth in Chapter 4, that females, with generally higher pitch-registers, would need to create a larger pitch-span difference to mark contrastive focus than males, with generally lower pitch-registers, in order to successfully draw the listener's attention to that focus constituent (Gussenhoven & Rietveld, 1998; among others). However, the results from the paroxytone stress pattern indicate that it was the males that used a greater overall pitch span to mark focus. Nonetheless, it should be noted that these significant interactions were only found with the clefted contrastive focus condition and, of the 12 female speakers, only one produced more than one token of that structure, speaker CF2, whereas 5 male speakers produced more than one token.

Finally, similar to the results in K'ichee', while both genders produced earlier peaks in contrastive focus conditions than in the broad focus condition, males tended to produced earlier peaks in the contrastive focus condition than females. The same was true for valley alignment, with the exception of the clefted contrastive focus condition in paroxytones, where the one female speaker had earlier valleys than the six male speakers. These findings are similar to those reported in Chapter 4: although there were no between-gender differences in the BLP language dominance scores in each dialect, the differences in gender roles could be a factor in these differences, as males tend to have more contact with other varieties of Spanish and with other languages which may have earlier peaks and valleys, as with the male speakers of Yucatecan Spanish reported in Michnowicz & Barnes (2013) and further research is needed to explore these claims.

As with the K'ichee' results, there was never a main effect of Age on any acoustic measurement and the Pragmatic Condition*Age interaction was only significant when there was also a significant interaction between Pragmatic Condition and Gender, though it was not always significant in these cases. As the majority of the older speakers were male, these findings are likely due to the demographics of the speakers studied in this analysis.

Dialectal differences in contrastive focus marking were explored in the third research question in this chapter. The results from Chapter 4 demonstrate that the phonological restrictions on duration in Nahualá K'ichee' reported in Baird (in press) are also present in prosodic contrastive focus marking as there was a significant main effect of Dialect and a significant Pragmatic Condition*Dialect interaction in the oxytone stress pattern: Cantel speakers had a longer duration of the token syllable across pragmatic conditions and tended to mark contrastive focus on oxytones with a greater duration than

Nahualá speakers. The individual speaker results reveal that 7 of the 12 bilinguals from Nahualá did not significantly lengthen the focus constituent in the oxytone stress pattern while all Cantel speakers did. However, the two male speakers that did not significantly lengthen, NM3 and NM6, only produced tokens of clefted contrastive focus and not *in situ* contrastive focus. Consequently, it cannot be presumed that these speakers would not mark *in situ* contrastive focus with a longer duration simply because they did not mark clefted contrastive focus with a significantly longer duration than broad focus; several speakers that produced more than one syntactic structure, including two from Cantel, did not mark clefted contrastive focus with a longer duration than broad focus but did mark *in situ* contrastive focus with a longer duration than broad focus. Nonetheless, 5 of the 6 Nahualá females in this study did not mark *in situ* contrastive focus with a longer duration than broad focus. Since there are no phonological restrictions on duration in Spanish, these results suggest that these female bilinguals have transferred the phonological lengthening restriction of Nahualá K'ichee' into their Spanish. However, in the paroxytone stress pattern for Duration, there was no significant main effect of Dialect nor was there a significant Pragmatic Condition*Dialect interaction. Only one Nahualá female bilingual did not significantly lengthen the tonic syllable in the *in situ* contrastive focus condition, speaker NF5. This difference in duration between stress patterns in Spanish suggests that the influence of the phonological restriction on duration from Nahualá K'ichee' to Nahualá Spanish is less likely in a stress pattern that is infrequent in K'ichee'.

Apart from Oxytone Duration, there were no significant main effects of Dialect. There were, however, significant Pragmatic Condition*Dialect interactions for Valley Height and Valley Alignment in the oxytone stress pattern and for Peak Height, Peak

Alignment, Valley Height, Valley Alignment, and Rise in the paroxytone stress pattern. Similar to the findings in K'ichee', Cantel bilinguals tended to mark contrastive focus with higher peaks and lower valleys than Nahualá bilinguals in both stress patterns. These results, as discussed below, as also correlated with language dominance. Though the interaction showed that Nahualá speakers tended to have a greater rise in paroxytones, this finding was again only present in the clefted contrastive focus condition.

Although most bilinguals tended to mark contrastive focus with an earlier peak and valley than in broad focus, Cantel bilinguals marked contrastive focus with an earlier valley, when compared to the alignment of broad focus, than Nahualá bilinguals. In contrast, Nahualá bilinguals tended to mark contrastive focus with earlier peaks than Cantel bilinguals, at least in the paroxytone stress pattern. Parallel to the findings in K'ichee', these results are best viewed in light of the peak and valley alignment of the Nahualá males. As mentioned above, 4 of the 8 speakers that produced an early L+H* alignment in contrastive focus in the paroxytone stress pattern were Nahualá males and Nahualá males also had the earliest valleys in broad focus. Thus, whereas Nahualá males, as a whole, marked contrastive focus with the earliest peaks, they could not mark it with the earliest valleys because of the already early alignment of their valleys in broad focus, which did not allow for as much phonetic space to have an earlier valley in contrastive focus as the other speakers: like the K'ichee' data, no speaker produced a valley that was aligned before the onset of the tonic syllable in either stress pattern (refer to Figures 5.19 and 5.20).

The final research question of this chapter addressed the correlation between contrastive focus marking and bilingual language dominance, which, as shown in Section 3.5, is highly correlated with Dialect. The results of the analyses of the degree of focus scores and the BLP score only revealed significant correlations with peak height, valley height, and rise in Spanish oxytones and only peak height in Spanish paroxytones. However, unlike the results from K'ichee', a significant correlation between the BLP language dominance score and the degree of focus score was not always found with the same measurements where there was a significant interaction between Pragmatic Condition and Dialect, although in both stress patterns Spanish-dominant bilinguals were more likely to mark contrastive focus to a greater degree, either with a higher peak height, a lower valley height, a greater pitch rise, or any combination thereof, than K'ichee'-dominant bilinguals. These results are similar to the findings in K'ichee' presented in Chapter 4; an earlier alignment of the high and low tones was consistently used to prosodically mark a contrastive focus constituent while the actual height of these tones varied among speakers. Thus, analogous to the proposal for K'ichee' in Chapter 4, it is suggested that while an earlier location of the tones, i.e., the peaks and valleys, may be a consistent acoustic strategy used to mark contrastive focus, the actual height of the tones varies and may be correlated with the individual speaker's level of bilingual language dominance and dialect.

### 5.5 CONCLUSIONS

The sociolinguistic interview and the production task outlined in this chapter have investigated contrastive focus marking in two stress patterns in Spanish and how it varies according to age, gender, dialect, and bilingual language dominance. The principal questions of this study were what type of prosodic prominence is given to a focus constituent in Spanish, how does it compare to other varieties of Spanish, are there any dialectal differences in contrastive focus marking, and is there any correlation between focus marking and bilingual language dominance? Overall, the results parallel those reported in Chapter 4 for K'ichee'. The results from the production task in this chapter indicate that contrastive focus constituents are prosodically marked in Spanish when compared to broad focus constituents and that this prosodic focus marking is most consistently realized through earlier peaks and valleys. However, unlike several other varieties of Spanish, the earlier peaks in contrastive focus condition do not necessarily occur within the tonic syllable of paroxytones. The differences between gender and dialect demonstrate that Nahualá males and Cantel males and females tend to mark contrastive focus to a greater degree than Nahualá females, who appear to have transferred the phonological lengthening restrictions of Nahualá K'ichee' into their Spanish, but only in an oxytone stress pattern. As mentioned in Chapters 2 and 3, studies have shown that Nahualá females tend to be given less access to Spanish than Nahualá males whereas the same is not necessarily true in Cantel (Hanamaikai & Thompson, 2005; Semus, 2005; Van Sistine & Levi, 2008) and these differences in gender roles could be one reason for the between-dialect and between-gender differences reported in this chapter. Finally, the results reported in this chapter reveal a significant correlation between the BLP bilingual language dominance score and peak height, valley height, and pitch rise; Spanish-dominant Cantel bilinguals generally marked focus to a greater degree than K'ichee'-dominant Nahualá bilinguals in these three acoustic aspects.

# 6. A comparison of Spanish and K'ichee' bilingual intonation

The syntactic and prosodic features of contrastive focus marking in K'ichee' and Spanish were analyzed in Chapters 4 and 5, respectively. The current chapter presents a cross-language analysis of the intonational contours associated with broad and contrastive focus produced by the 24 bilinguals analyzed in the previous chapters. The goals of this chapter are to compare both the broad focus contours and the contrastive focus contours across Spanish and K'ichee' and analyze possible cases of convergence or transfer between the languages of the 24 Spanish-K'ichee' bilinguals under study.

As seen in the previous two chapters, these 24 bilinguals mark contrastive focus in both languages in similar ways; an earlier peak and valley alignment were the most consistent acoustic strategies in both languages, while the use of a higher peak, a lower valley, and a greater overall rise varied among the speakers and the degree of focus of these measurements sometimes correlated with the BLP language dominance score. The main differences in contrastive focus marking between the two languages were found in duration and slope; the differences in duration reflected the phonological dissimilarities in vowel systems and acoustic correlates of stress between the two dialects, and a steeper slope, which was often correlated with duration, was used more consistently in K'ichee' than in Spanish. Furthermore, the results of these two analyses have already demonstrated possible cases of transfer, or influence; the data from Chapter 4 demonstrated that Cantel bilinguals, who were significantly more Spanish-dominant as a group than Nahualá bilinguals, produced *in situ* syntactic focus structures in K'ichee' at a significantly higher rate than the Nahualá bilinguals, and the data presented in Chapter 5 showed that the phonological restrictions of duration in Nahualá K'ichee' may have been transferred into the Spanish of several female bilinguals, at least in Spanish oxytones, which have the same stress pattern as K'ichee'. As research on different varieties of contact Spanish has demonstrated convergence or transfer of suprasegmental features, it is anticipated that the same will occur in various features of the intonational contours of Spanish and K'ichee' produced by these bilinguals.

The literature on contact Spanish intonation has mainly focused on the convergence or transfer of the location of intonational events, such as the valley or the peak. Most studies have noted that the peak tends to occur earlier in contact situations (Barnes & Michnowicz, 2013; Colantoni & Gurlekian, 2004; Elordieta, 2003; Michnowicz & Barnes, 2013; O'Rourke, 2004, 2005), though this is not always the case (Alvord, 2010; Colantoni, 2011) and can vary among speakers in the same contact situation (Baird, submitted). Studies that have examined both of the languages in contact, and not just Spanish, have noted convergence of some features, such as peaks (O'Rourke, 2005; Simonet, 2008), while other features did not converge, such as valleys (Simonet, 2008) and boundary tones (O'Rourke, 2005).

The analyses presented in this chapter investigate the acoustic features of broad focus contours and of contrastive focus contours in both Spanish and K'ichee'. For these comparisons, only the data from the production tasks for oxytones were used, since they were explicitly designed to have comparable structures. The research questions addressed in this chapter are the following:

(1) Are there possible cases of convergence between the broad focus constituent in Spanish and K'ichee'? Are any of the acoustic features realized in the same way in both languages?

(2) Are there possible cases of convergence between the contrastive focus constituents in Spanish and K'ichee'? Are the acoustic features of prosodic focus

marking used in similar ways to mark contrastive focus in both languages? Is this convergence more likely when the syntactic structures used to mark contrastive focus are similar?

(3) Is the level of bilingual language dominance correlated with possible cases of convergence? Are Spanish-dominant, K'ichee'-dominant, or near-balanced bilinguals more likely to demonstrate convergence

The remaining sections in this chapter address these questions. Section 6.1 presents the cross-language comparison of the acoustic features of broad focus constituents and Section 6.2 does the same for contrastive focus constituents. The correlation analyses of convergence and BLP language dominance scores are presented in 6.3 and the overall findings are discussed in Section 6.4 and concluded in Section 6.5.

### 6.1 Broad Focus Constituents

The acoustic data of the different features of broad focus constituenta are analyzed via a series of Linear Mixed Models with Language, Gender, and Dialect as factors (with Spanish, Male, and Nahualá as the respective reference levels), Age as a continuous covariate, the measurement of the particular acoustic feature being analyzed as the dependent variable, and Speaker and Token as random effects.[57,58] The individual speakers are analyzed via a series of one-way ANOVAs with language as the independent variable and the particular acoustic measurement being analyzed as the dependent variable.

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[57] Language Dominance was not included as a factor in order to avoid multicollinearality with Dialect, with which it was highly correlated.

[58] The final Hessian matrix was not positive for Token although all convergence criteria were satisfied for Peak Height, Valley Height, Valley Alignment, and Slope.

Whereas the statistical analyses of prosodic focus marking in Chapters 4 and 5 investigated whether a constituent was significantly more marked in a contrastive focus condition than in the broad focus condition, the analyses in this chapter seek to find differences that are *not* significant between the two languages. These non-significant differences are examined as possible cases of convergence between that particular acoustic feature of a broad focus constituent in both languages. Nonetheless, it is noted that, due to the lack of monolingual Spanish or K'ichee' data from either dialect, it is difficult to offer a concrete interpretation of these non-significant differences as convergence of intonational contours and it is recognized that these features may simply be the same in both languages.

Figures 6.1-6.4 demonstrate the time-normalized average pitch contours of the tonic syllable of the target word in the broad focus condition in both languages for each speaker.[59] These time-normalized contours take into account all of the acoustic features of intonation analyzed in this chapter, with the exception of duration. As seen in these figures, there are multiple similarities between the contours of both languages and the following subsections are dedicated to the individual analyses of each of the acoustic features outlined in Section 3.4.5 in order to better define these similarities. The mean and standard deviations of the group analyses were already presented in Chapters 4 and 5, but are repeated here for convenience. The mean and standard deviations of the individual speakers are found in Appendix D.

[59] As duration demonstrated language and dialectal differences (see Sections 6.1.1 and 6.2.1), it was removed as a variable from the average pitch contour figures in this chapter and the contours were time-normalized.

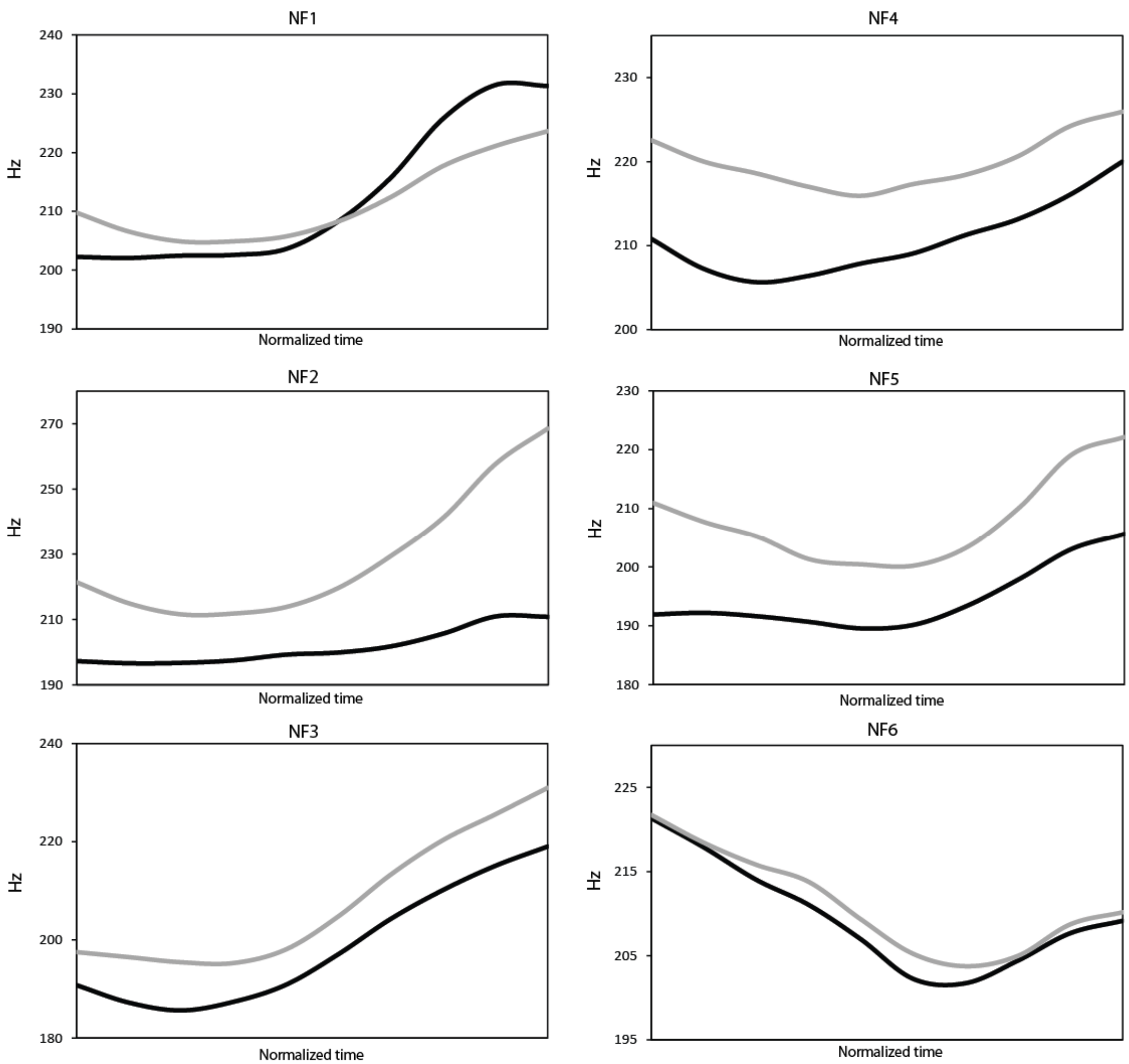


Figure 6.1: Nahualá female speakers: time-normalized average pitch contours of the tonic syllable in broad focus in Spanish (black line) and K'ichee' (gray line).

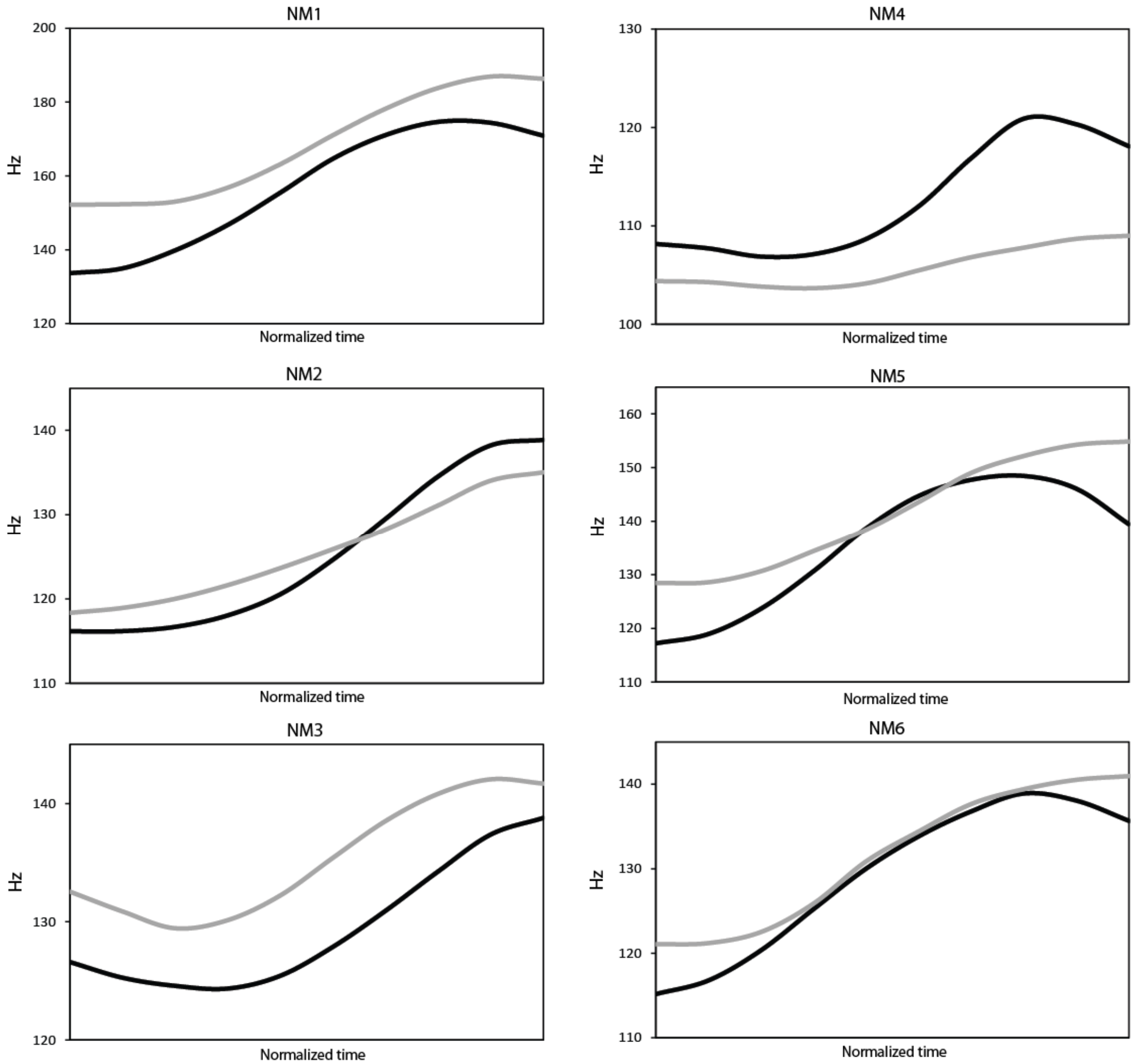


Figure 6.2: Nahualá male speakers: time-normalized average pitch contours of the tonic syllable in broad focus in Spanish (black line) and K'ichee' (gray line).

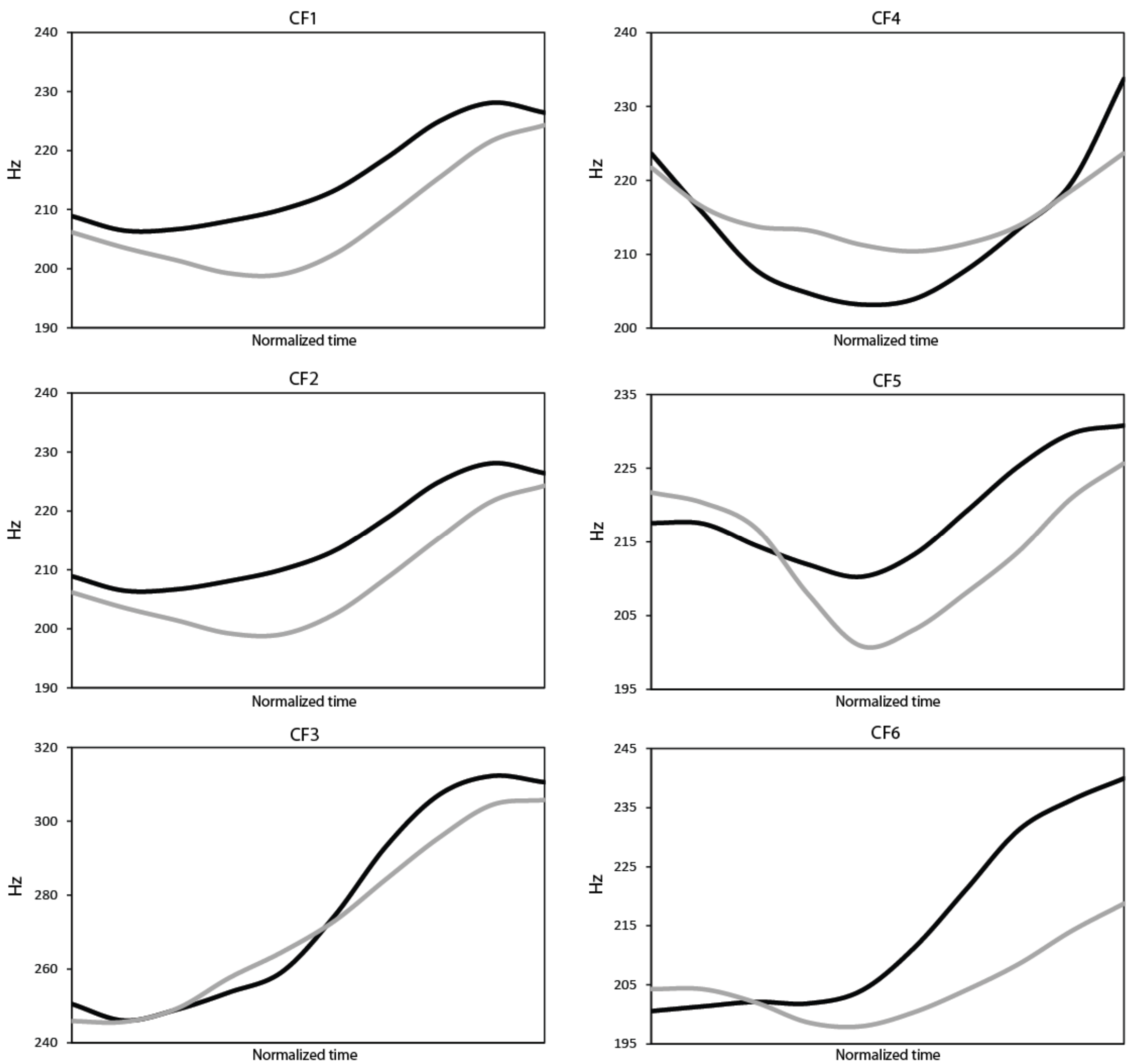


Figure 6.3: Cantel female speakers: time-normalized average pitch contours of the tonic syllable in broad focus in Spanish (black line) and K'ichee' (gray line).

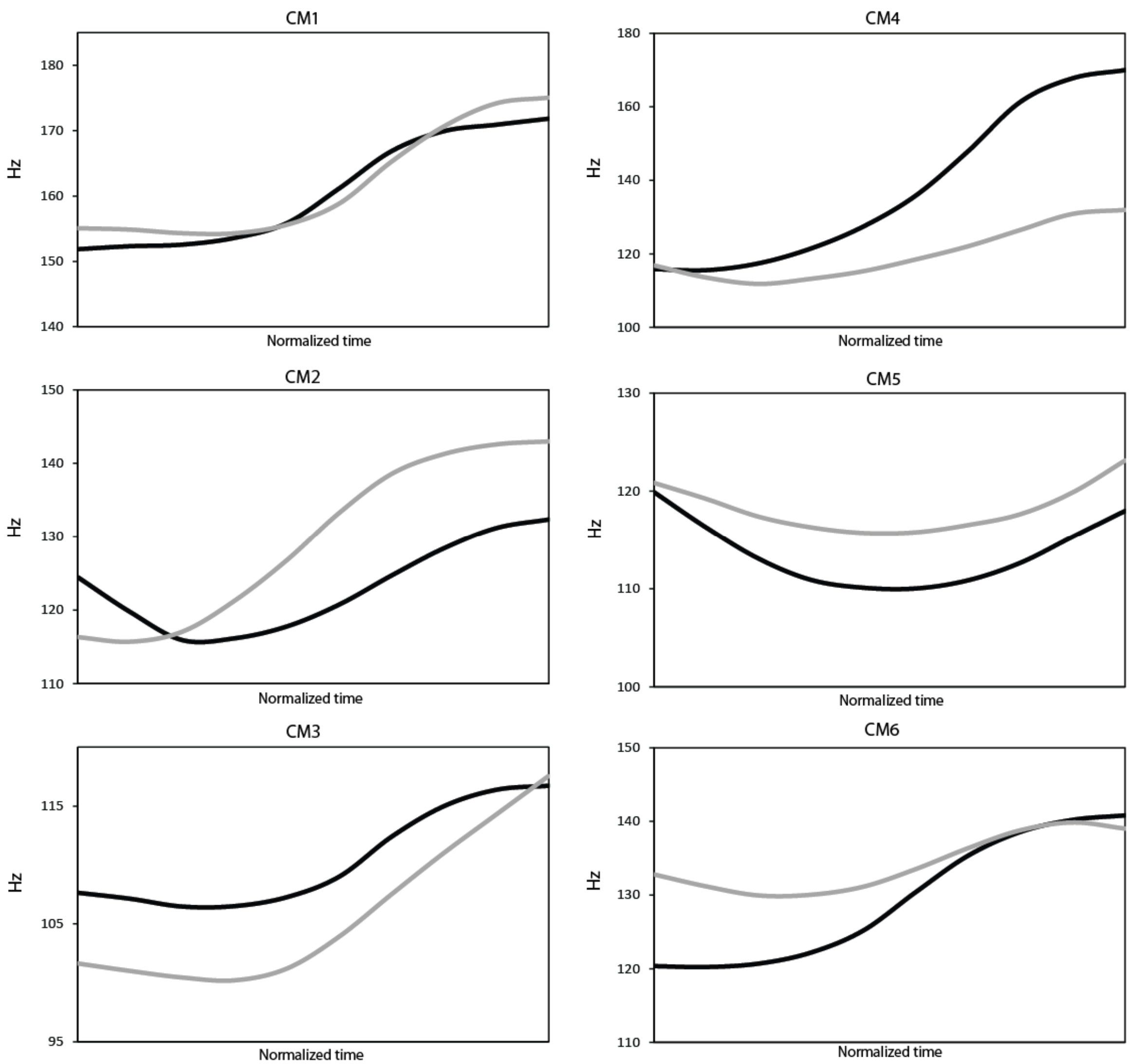


Figure 6.4: Cantel male speakers: time-normalized average pitch contours of the tonic syllable in broad focus in Spanish (black line) and K'ichee' (gray line).

### 6.1.1 Duration

The overall results for Duration are presented in Table 6.1 and 6.2 and illustrated in Figure 6.5. The Linear Mixed Model demonstrates a main effect of Language and Gender: K'ichee' tokens were longer than Spanish and, as seen in Chapters 4 and 5, females tended to produce longer tokens than males regardless of language. The significant Language*Gender interaction reveals that the female speakers had even longer constituents in K'ichee' than male speakers whereas the significant Language*Dialect interaction shows that, while there were no differences in the duration of the K'ichee' broad focus constituent between dialects, Cantel speakers had significantly longer constituents in Spanish. Overall, these results are likely due to the fact that the Nahualá K'ichee' tokens consisted of long vowels whereas the other tokens did not.

| Means (SD) Broad Focus Duration (ms) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Language | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 329 (51) | 305 (53) | 312 (45) | 321 (58) |
| K'ichee' | 328 (45) | 343 (78) | 314 (79) | 328 (76) | 328 (76) |
| Spanish | 304 (59) | 313 (56) | 296 (56) | 292 (55) | 317 (62) |

Table 6.1: Mean (SD) of Broad Focus Duration (ms) in both languages.

| Linear Mixed Model- Broad Focus Duration | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **276.1 (15.9)** | **$F_{(1, 19.936)} = 589.142$, $p < .001$** | **243.2** | **309.1** |
| **Language** | **40.7 (7.9)** | **$F_{(1, 1753.949)} = 26.709$, $p < .001$** | **25.1** | **56.1** |
| **Gender** | **16.7 (9.2)** | **$F_{(1, 19.961)} = 6.816$, $p < .05$** | **2.2** | **35.7** |
| Dialect | 24.0 (8.7) | $F_{(1, 19.981)} = 1.893$, $p = .184$, n.s. | -5.9 | 41.9 |
| Age | .19 (.31) | $F_{(1, 19.918)} = .037$, $p = .85$, n.s. | -.45 | .85 |
| **Language * Gender** | **12.8 (4.6)** | **$F_{(1, 1753.735)} = 7.614$, $p < .01$** | **3.7** | **21.8** |
| **Language * Dialect** | **-24.8 (4.4)** | **$F_{(1, 1753.743)} = 31.728$, $p < .001$** | **-33.5** | **-16.2** |
| Language * Age | -.28 (.16) | $F_{(1, 1754.117)} = 3.152$, $p = .076$, n.s. | -.28 | .16 |
| Random Effects | | | | |
| Residual | 2159.2 (72.93) | - | | - |
| Speaker | 394.18 (133.9) | - | | - |
| Token | .3576 (5.871) | - | | - |
| Model Information Criteria (BIC) = 18874.11 | | | | |

Table 6.2: Results of Linear Mixed Model of Broad Focus Duration: significant results are in bold.

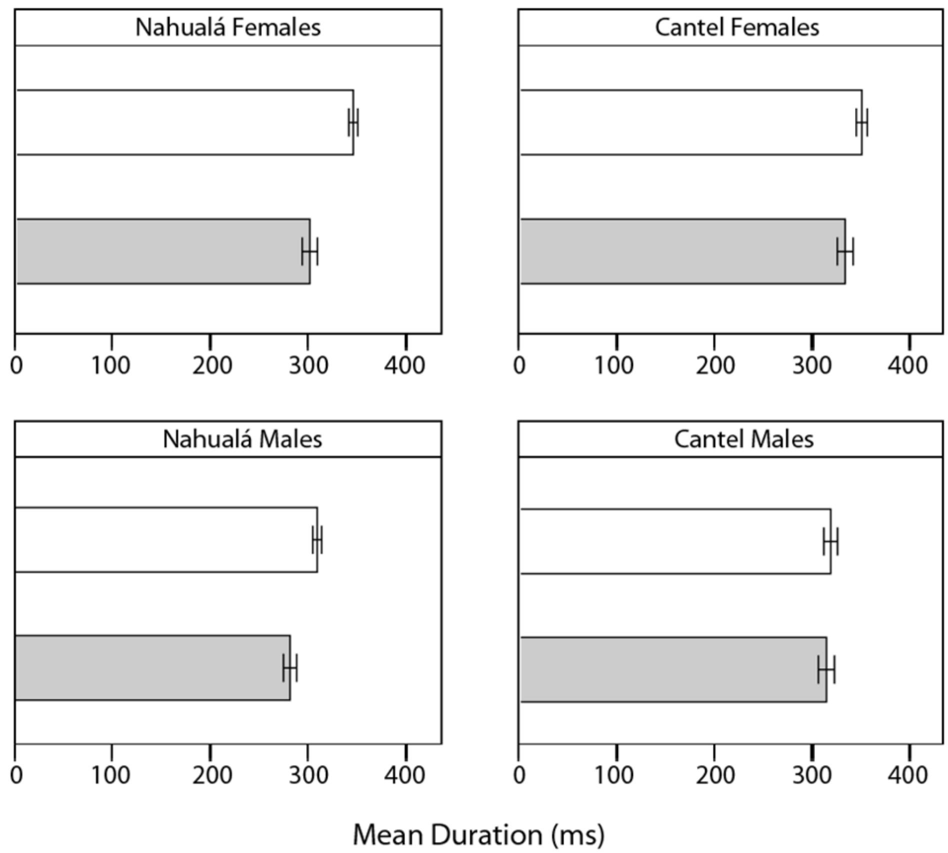


Figure 6.5: Bar graphs of mean duration (ms) of the tonic syllable in broad focus for all speaker groups: K'ichee' (white) Spanish (gray). 95% confidence interval bars included.

The individual speaker results, presented in Table 6.3, indicate that 8 Nahualá speakers produced a difference in duration: all had a significantly longer tonic syllable in K'ichee' than in Spanish. Again, the results most likely reflect the tokens used in this study, as the K'ichee' target words consisted of words that have long vowels in Nahualá, but not in Cantel, where there are no differences in duration between Spanish and K'ichee' broad focus tokens.

| Individual Speaker ANOVAs- Broad Focus Duration | | | | | |
|---|---|---|---|---|---|
| **NF1** | **NF2** | NF3 | **NF4** | **NF5** | **NF6** |
| **$F_{(1, 76)}$ = 19.294, $p$ < .001** | **$F_{(1,73)}$ = 22.67, $p$ < .001** | $F_{(1, 72)}$ = .023, $p$ = .881, n.s. | **$F_{(1, 72)}$ = 48.437, $p$ < .001** | **$F_{(1, 75)}$ = 25.027, $p$ < .001** | **$F_{(1, 70)}$ = .25.263, $p$ < .001** |
| NM1 | **NM2** | NM3 | **NM4** | **NM5** | NM6 |
| $F_{(1, 78)}$ = 2.462, $p$ = .121, n.s. | **$F_{(1, 78)}$ = 16.299, $p$ < .001** | $F_{(1, 73)}$ = .586, $p$ = .447, n.s. | **$F_{(1, 73)}$ = 36.451, $p$ < .001** | **$F_{(1, 71)}$ = 36.085, $p$ < .001** | $F_{(1, 72)}$ = .182, $p$ = .671, n.s. |
| CF1 | CF2 | CF3 | CF4 | CF5 | CF6 |
| $F_{(1, 70)}$ = .249, $p$ = .619, n.s. | $F_{(1, 78)}$ = .75, $p$ = .389, n.s. | $F_{(1, 69)}$ = .007, $p$ = .932, n.s. | $F_{(1, 73)}$ = .624, $p$ = .404, n.s. | $F_{(1, 71)}$ = 2.795, $p$ = .103, n.s. | $F_{(1, 71)}$ = 2.411, $p$ = .118, n.s. |
| CM1 | CM2 | CM3 | CM4 | CM5 | CM6 |
| $F_{(1, 70)}$ = .663, $p$ = .418, n.s. | $F_{(1, 68)}$ = .048, $p$ = .827, n.s. | $F_{(1, 71)}$ = 1.052, $p$ = .308, n.s. | $F_{(1, 72)}$ = .865, $p$ = .386, n.s. | $F_{(1, 70)}$ = 2.187, $p$ = .144, n.s. | $F_{(1, 76)}$ = 2.615, $p$ = .11, n.s. |

Table 6.3: Results from the ANOVAs of broad focus duration for all 24 speakers; significant results are in bold and indicate that the speaker produced a significantly longer tonic syllable in K'ichee' than in Spanish.

### 6.1.2 Peak Height

The overall results for peak height are presented in Tables 6.4 and 6.5 and illustrated in Figure 6.6. The Linear Mixed Model reveals that there is only a main effect of Gender: as seen in Chapters 4 and 5, females have higher pitch peaks than males in both languages.

| Means (SD) Broad Focus Peak Height (st) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Language | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 95.4 (2.6) | 86.1 (3.4) | 90.7 (5.1) | 90.6 (5.5) |
| K'ichee' | 90.6 (5.2) | 95.5 (6.1) | 85.9 (7.4) | 91.2 (5.2) | 90.8 (5.4) |
| Spanish | 90.9 (5.3) | 94.3 (8.2) | 86.1 (4.4) | 90.4 (4.2) | 90.5 (4.1) |

Table 6.4: Mean (SD) of Broad Focus Peak Height (st) in both languages.

| Linear Mixed Model- Broad Focus Peak Height | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **85.5 (1.2)** | **$F_{(1, 19.959)}$ = 8618.336, *p* < .001** | **83.1** | **87.9** |
| Language | .04 (.46) | $F_{(1, 1762.191)}$ = .332, *p* = .564, n.s. | -.85 | .93 |
| **Gender** | **9.1 (.68)** | **$F_{(1, 19.987)}$ = 183.329, *p* < .001** | **7.6** | **10.5** |
| Dialect | -.02 (.64) | $F_{(1, 19.989)}$ = .098, *p* = .757, n.s. | -1.4 | 1.3 |
| Age | .03 (.02) | $F_{(1, 19.952)}$ = 1.507, *p* = .234, n.s. | -.02 | .07 |
| Language * Gender | -.17 (.26) | $F_{(1, 1762.239)}$ = .392, *p* = .531, n.s. | -.68 | .35 |
| Language * Dialect | -.36 (.25) | $F_{(1, 1762.362)}$ = 2.013, *p* = .156, n.s. | -.85 | .14 |
| Language * Age | .004 (.009) | $F_{(1, 1762.228)}$ = .246, *p* = .62, n.s. | -.01 | .02 |
| Random Effects | | | | |
| Residual | 7.075 (.2384) | - | | - |
| Speaker | 2.278 (.7508) | - | | - |
| Token | .0000 (.0000) | - | | - |
| Model Information Criteria (BIC) = 8689.8 | | | | |

Table 6.5: Results of Linear Mixed Model of Broad Focus Peak Height: significant results are in bold.

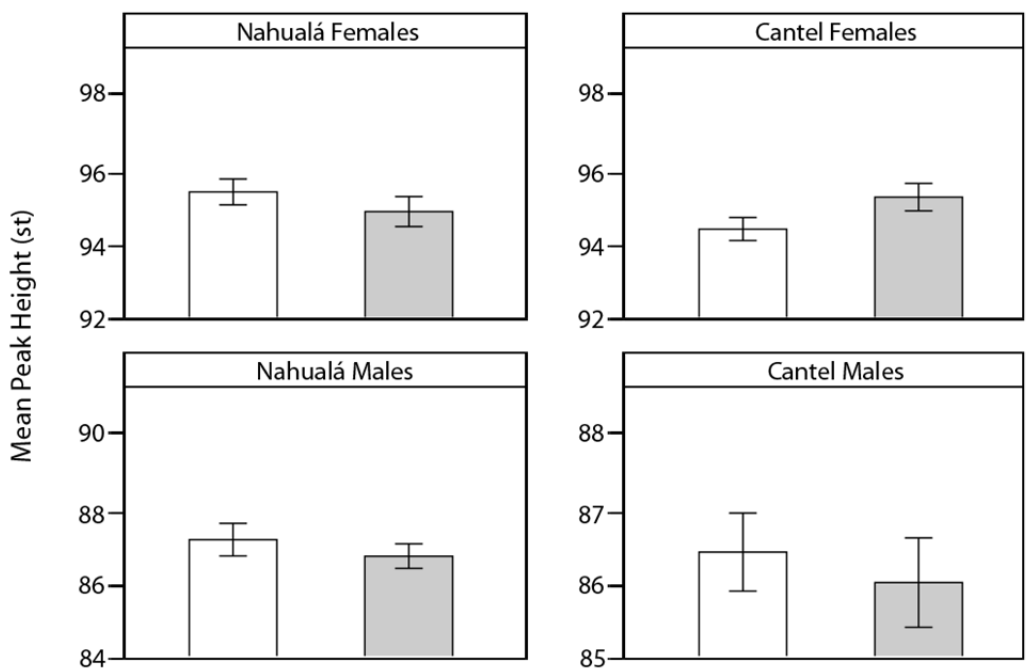


Figure 6.6: Mean peak height (st) in broad focus for all speaker groups: K'ichee' (white) Spanish (gray). 95% confidence interval bars included.

Unlike the group analyses, the individual speaker analyses presented in Table 6.6 reveal that only 8 of 24 bilinguals demonstrate no differences in peak height between Spanish and K'ichee' in broad focus constituents. Of the 16 speakers that did not demonstrate this convergence of peak height, 8 had significantly higher peaks in K'ichee': NF2, NF3, NF4, NF5, NM1, NM3, CM2, CM5; and 8 had significantly higher peaks in Spanish: NF1, NM4, CF1, CF2, CF4, CF5, CF6, CM4. These results demonstrate individual speaker variation as all but one of the Cantel female speakers had a higher peak in Spanish than in K'ichee', whereas Cantel males, Nahualá males, and Nahualá females tended to have higher peaks in K'ichee'.

| Individual Speaker ANOVAs- Broad Focus Peak Height | | | | | |
|---|---|---|---|---|---|
| **NF1** | **NF2** | **NF3** | **NF4** | **NF5** | NF6 |
| **$F_{(1, 76)}$ = 6.419, $p < .05$** | **$F_{(1,73)}$ = 15.5, $p < .001$** | **$F_{(1, 72)}$ = 3.94, $p < .05$** | **$F_{(1, 72)}$ = 30.798, $p < .001$** | **$F_{(1, 75)}$ = 5.04, $p < .05$** | $F_{(1, 70)}$ = .338, $p$ .563, n.s. |
| **NM1** | NM2 | **NM3** | **NM4** | NM5 | NM6 |
| **$F_{(1, 78)}$ = 28.368, $p < .001$** | $F_{(1, 78)}$ = 2.757, $p = .101$, n.s. | **$F_{(1, 73)}$ = 5.26, $p < .05$** | **$F_{(1, 73)}$ = 6.64, $p < .05$** | $F_{(1, 71)}$ = 1.661, $p = .202$, n.s. | $F_{(1, 72)}$ = .571, $p = .453$, n.s. |
| **CF1** | **CF2** | CF3 | **CF4** | **CF5** | **CF6** |
| **$F_{(1, 70)}$ = 17.581, $p < .001$** | **$F_{(1, 78)}$ = 11.211, $p < .01$** | $F_{(1, 69)}$ = 3.758, $p = .056$, n.s. | **$F_{(1, 73)}$ = 4.92, $p < .05$** | **$F_{(1, 71)}$ = 11.947, $p < .01$** | **$F_{(1, 71)}$ = 4.897, $p < .05$** |
| CM1 | **CM2** | CM3 | **CM4** | **CM5** | CM6 |
| $F_{(1, 70)}$ = 2.569, $p = .113$, n.s. | **$F_{(1, 68)}$ = 11.104, $p < .001$** | $F_{(1, 71)}$ = .001, $p = .998$, n.s. | **$F_{(1, 72)}$ = 4.3, $p < .05$** | **$F_{(1, 70)}$ = 4.17, $p < .05$** | $F_{(1, 76)}$ = 2.026, $p = .159$, n.s. |

Table 6.6: Results from the ANOVAs of broad focus peak height for all 24 speakers; significant results are in bold and indicate between-language differences in peak height among the different bilinguals.

### 6.1.3 Peak Alignment

The results of Broad Focus Peak Alignment, displayed in Tables 6.7 and 6.8 and illustrated in Figure 6.7, indicate that there is only a main effect of Dialect: overall, Nahualá bilinguals had earlier peaks in both languages than Cantel bilinguals. These results suggest that the alignment of the pitch peak occurs in the same location in both languages across factors for these bilinguals with the exception of dialectal differences, which is in line with previous findings on the Spanish of these dialects (Baird, submitted).

| Means (SD) Broad Focus Peak Alignment | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Language | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | .86 (.11) | .85 (.14) | .85 (.13) | .87 (.11) |
| K'ichee' | .86 (.11) | .86 (.11) | .86 (.12) | .85 (.12) | .87 (.12) |
| Spanish | .86 (.14) | .86 (.16) | .85 (.15) | .85 (.15) | .86 (.15) |

Table 6.7: Mean (SD) of Broad Focus Peak Alignment in both languages.

| Linear Mixed Model- Broad Focus Peak Alignment | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **.901 (.022)** | **$F_{(1, 20.276)} = 2660.795, p < .001$** | **.855** | **.948** |
| Language | .012 (.013) | $F_{(1, 1754.454)} = 1.285, p = .268$, n.s. | -.013 | .038 |
| Gender | .016 (.013) | $F_{(1, 19.795)} = .755, p = .395$, n.s. | -.010 | .043 |
| **Dialect** | **.073 (.021)** | **$F_{(1, 19.872)} = 4.832, p < .05$** | **-.114** | **-.033** |
| Age | -.001 (.001) | $F_{(1, 19.626)} = 2.06, p = .167$, n.s. | -.002 | .001 |
| Language * Gender | -.013 (.012) | $F_{(1, 1754.564)} = 1.12, p = .29$, n.s. | -.036 | .011 |
| Language * Dialect | .018 (.011) | $F_{(1, 1755.217)} = .11, p = .11$, n.s. | -.004 | .041 |
| Language * Age | .002 (.001) | $F_{(1, 1754.76)} = 1.906, p = .127$, n.s. | -.001 | .003 |
| Random Effects | | | | |
| Residual | .0145 (.0005) | - | | - |
| Speaker | .0005 (.0002) | - | | - |
| Token | .0003 (.0002) | - | | - |
| Model Information Criteria (BIC) = -2369.11 | | | | |

Table 6.8: Results of Linear Mixed Model of Broad Focus Peak Alignment: significant results are in bold.

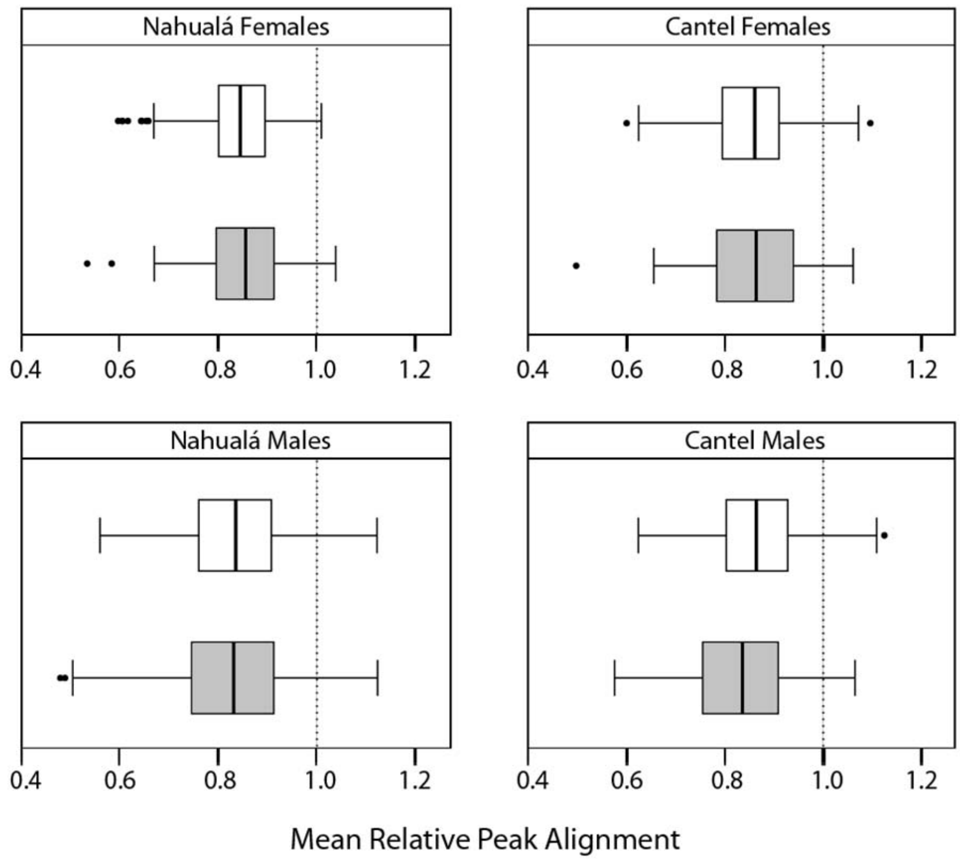


Figure 6.7: Box plots of mean relative peak alignment of the tonic syllable in broad focus for all speaker groups: K'ichee' (white) Spanish (gray). A lower score indicates and earlier peak alignment and the dotted line indicates a score 1.0, i.e., the end of the tonic syllable.

The individual speaker analyses presented in Table 6.9 reveal that 21 of 24 speakers did not have any significant differences in peak alignment between Spanish and K'ichee' in broad focus constituents. All three speakers that did demonstrate a significant difference, NM1, CM1, and CM2, had earlier peaks in Spanish than in K'ichee'. These results suggest that peak alignment is an acoustic characteristic that tends to be similar in Spanish and K'ichee' oxytones in broad focus utterances among these bilingual speakers and that it may be prone to convergence.

| Individual Speaker ANOVAs- Broad Focus Peak Alignment | | | | | |
|---|---|---|---|---|---|
| NF1 | NF2 | NF3 | NF4 | NF5 | NF6 |
| $F_{(1, 76)}$ = 1.166, *p* = .284, n.s. | $F_{(1,73)}$ = 3.93, *p* = .059, n.s. | $F_{(1, 72)}$ = .571, *p* = .453, n.s. | $F_{(1, 72)}$ = 2.44, *p* = .123, n.s. | $F_{(1, 75)}$ = 1.676, *p* = .199, n.s. | $F_{(1, 70)}$ = 2.172, *p* = .145, n.s. |
| **NM1** | NM2 | NM3 | NM4 | NM5 | NM6 |
| **$F_{(1, 78)}$ = 5.464, *p* < .05** | $F_{(1, 78)}$ = 2.891, *p* = .093, n.s. | $F_{(1, 73)}$ = 1.663, *p* = .201, n.s. | $F_{(1, 73)}$ = .245, *p* = .622, n.s. | $F_{(1, 71)}$ = .158, *p* = .692, n.s. | $F_{(1, 72)}$ = 3.001, *p* = .087, n.s. |
| CF1 | CF2 | CF3 | CF4 | CF5 | CF6 |
| $F_{(1, 70)}$ = .96, *p* = .33, n.s. | $F_{(1, 78)}$ = .569, *p* = .453, n.s. | $F_{(1, 69)}$ = .607, *p* = .439, n.s. | $F_{(1, 73)}$ = .691, *p* = .409, n.s. | $F_{(1, 71)}$ = .21, *p* = .648, n.s. | $F_{(1, 71)}$ = 2.237, *p* = .139, n.s. |
| **CM1** | **CM2** | CM3 | CM4 | CM5 | CM6 |
| **$F_{(1, 70)}$ = 6.136, *p* < .05** | **$F_{(1, 68)}$ = 10.592, *p* < .01** | $F_{(1, 71)}$ = .533, *p* = .468, n.s. | $F_{(1, 72)}$ = 2.985, *p* = .088, n.s. | $F_{(1, 70)}$ = .000, *p* = .994, n.s. | $F_{(1, 76)}$ = 2.994, *p* = .088, n.s. |

Table 6.9: Results from the ANOVAs of broad focus peak alignment for all 24 speakers; significant results are in bold and indicate that there are between-language difference in peak alignment for the individual speaker.

### 6.1.4 Valley Height

The overall results of Broad Focus Valley Height in Tables 6.10 and 6.11 and in Figure 6.8 reveal a main effect of Gender and Language: females had higher valleys than males whereas K'ichee' valleys tended to be higher than Spanish valleys for all speakers. According to the significant Language*Gender interaction, when compared to the height of the valley in Spanish, females had higher valleys in K'ichee' than males.

| Means (SD) Broad Focus Valley Height (st) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Language | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 91.7 (1.8) | 82.5 (2.5) | 87.1 (4.7) | 87.0 (5.5) |
| K'ichee' | 87.6 (5.6) | 92.1 (4.4) | 82.9 (4.4) | 87.7 (4.3) | 87.3 (4.2) |
| Spanish | 86.8 (5.2) | 91.4 (3.6) | 82.4 (4.1) | 86.9 (3.5) | 86.7 (3.4) |

Table 6.10: Mean (SD) of Broad Focus Valley Height (st) in both languages.

| Linear Mixed Model- Broad Focus Valley Height | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **80.8 (.91)** | $\mathbf{F_{(1, 19.965)} = 2961.461}$, $\boldsymbol{p} < .001$ | **78.9** | **82.7** |
| **Language** | **1.64 (.31)** | $\mathbf{F_{(1, 1762.14)} = 20.058}$, $\boldsymbol{p} < .001$ | **-1.04** | **2.25** |
| **Gender** | **9.63 (.53)** | $\mathbf{F_{(1, 19.979)} = 328.181}$, $\boldsymbol{p} < .001$ | **8.5** | **10.7** |
| Dialect | .074 (.05) | $F_{(1, 19.988)} = .117$, $p = .736$, n.s. | -.97 | 1.11 |
| Age | .023 (.018) | $F_{(1, 19.96)} = 1.157$, $p = .295$, n.s. | -.015 | .06 |
| **Language * Gender** | **-.47 (.18)** | $\mathbf{F_{(1, 1762.175)} = 6.819}$, $\boldsymbol{p} < .05$ | **-.82** | **-.12** |
| Language * Dialect | -.09 (.07) | $F_{(1, 1762.268)} = .974$, $p = .328$, n.s. | -.82 | .25 |
| Language * Age | -.007 (.006) | $F_{(1, 1762.167)} = 1.253$, $p = .263$, n.s. | -.019 | .005 |
| Random Effects | | | | |
| Residual | 3.247 (.1093) | - | | - |
| Speaker | 1.409 (.4597) | - | | - |
| Token | .0000 (.0000) | - | | - |
| Model Information Criteria (BIC) = 7307.542 | | | | |

Table 6.11: Results of Linear Mixed Model of Broad Focus Valley Height: significant results are in bold.

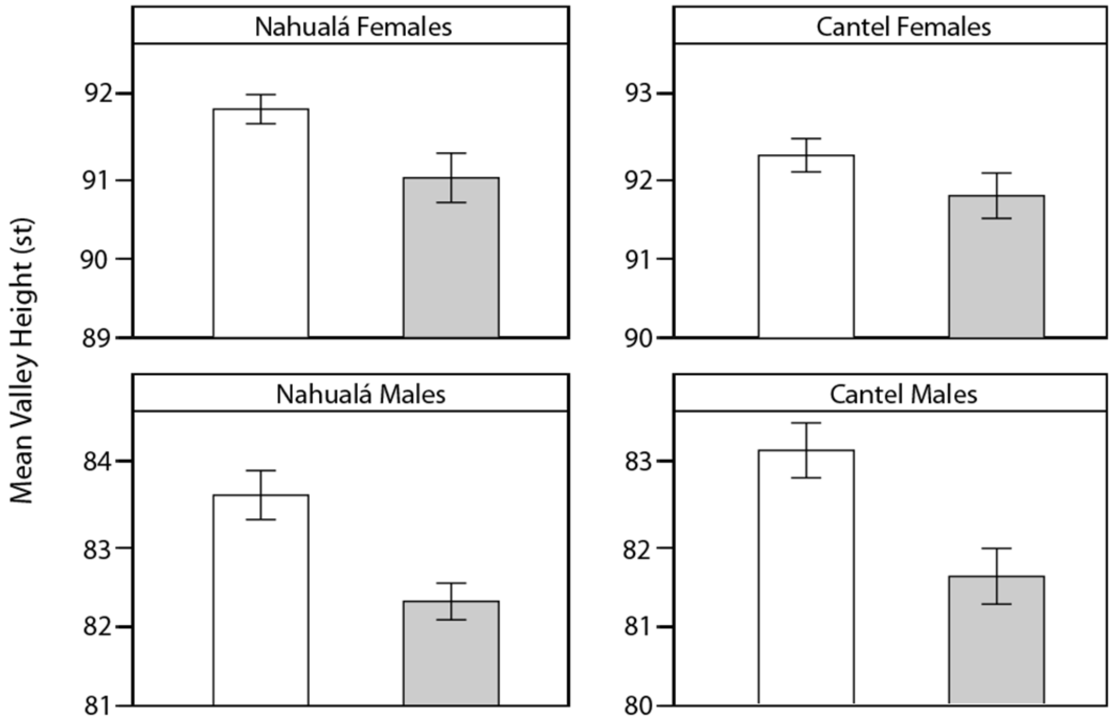


Figure 6.8: Bar graphs of mean valley height (st) of the tonic syllable in broad focus for all speaker groups: K'ichee' (white) Spanish (gray). 95% confidence interval bars included.

According to the individual speaker analyses presented in Table 6.12, 8 of 24 speakers do not demonstrate significant differences between valley heights in Spanish and K'ichee'. Of the 16 speakers that do, 12 have significantly lower valleys in Spanish than in K'ichee' and only speakers NM4, CF1, CF2, and CF5 have lower valleys in K'ichee' than in Spanish. These results are similar to those of peak height as the majority of these bilinguals demonstrated significant between-language differences for Broad Focus Valley Height.

| Individual Speaker ANOVAs- Broad Focus Valley Height | | | | | |
|---|---|---|---|---|---|
| NF1 | **NF2** | **NF3** | **NF4** | **NF5** | NF6 |
| $F_{(1, 76)}$ = .282, *p* = .597, n.s. | **$F_{(1,73)}$ = 46.299, *p* < .001** | **$F_{(1, 72)}$ = 16.373, *p* < .001** | **$F_{(1, 72)}$ = 12.272, *p* < .01** | **$F_{(1, 75)}$ = 42.718, *p* < .001** | $F_{(1, 70)}$ = .512, *p* = .476, n.s. |
| **NM1** | **NM2** | **NM3** | **NM4** | **NM5** | **NM6** |
| **$F_{(1, 78)}$ = 81.761, *p* < .001** | **$F_{(1, 78)}$ = 10.876, *p* < .01** | **$F_{(1, 73)}$ = 14.985, *p* < .001** | **$F_{(1, 73)}$ = 9.133, *p* < .001** | **$F_{(1, 71)}$ = 8.087, *p* < .01** | **$F_{(1, 72)}$ = 54.157, *p* < .001** |
| **CF1** | **CF2** | CF3 | **CF4** | CF5 | CF6 |
| **$F_{(1, 70)}$ = 4.556, *p* < .05** | **$F_{(1, 78)}$ = 36.936, *p* < .001** | $F_{(1, 69)}$ = .903, *p* = .345, n.s. | **$F_{(1, 73)}$ = 13.098, *p* < .01** | $F_{(1, 71)}$ = 3.92, *p* = .052, n.s. | $F_{(1, 71)}$ = .864, *p* = .356, n.s. |
| CM1 | CM2 | **CM3** | CM4 | **CM5** | **CM6** |
| $F_{(1, 70)}$ = 2.621, *p* = .126 | $F_{(1, 68)}$ = 3.177, *p* = .079, n.s. | **$F_{(1, 71)}$ = 9.396, *p* < .01** | $F_{(1, 72)}$ = 2.091, *p* = .152, n.s. | **$F_{(1, 70)}$ = 52.445, *p* < .001** | **$F_{(1, 76)}$ = 66.734, *p* < .001** |

Table 6.12: Results from the ANOVAs of broad focus valley height for all 24 speakers; significant results are in bold and indicate between-language differences in valley height for the individual speaker.

### 6.1.5 Valley Alignment

The overall results of valley alignment in broad focus constituents are presented in Table 6.13 and 6.14. The Linear Mixed Model reveals a significant main effect of both Language and Gender as, overall, valleys were aligned earlier in Spanish than in K'ichee' and earlier among males than females. The significant Language*Gender interaction demonstrates that, when compared to the alignment of the valley in K'ichee', males produce earlier valleys in Spanish than females. The significant Language*Age interaction may again be an effect of the demographics of the bilinguals analyzed in this study: older speakers, who were mostly males, had earlier valleys in Spanish than in

K'ichee' and females. As reported in Chapters 4 and 5 and as seen in Figure 6.9, the Nahualá male speakers tended to have earlier valleys than the rest of the speakers in this study.

| Means (SD) Broad Focus Valley Alignment | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Language | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | .43 (.17) | .27 (.14) | .33 (.20) | .33 (1.5) |
| K'ichee' | .37 (.13) | .44 (.15) | .30 (.17) | .35 (.14) | .38 (.14) |
| Spanish | .30 (.18) | .43 (.26) | .25 (.19) | .33 (.25) | .30 (.23) |

Table 6.13: Mean (SD) of Broad Focus Valley Alignment in both languages.

| Linear Mixed Model- Broad Focus Valley Alignment | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **.336 (.114)** | **$F_{(1, 19.996)}$ = 13.96, *p* < .01** | **.099** | **.573** |
| **Language** | **-.114 (.012)** | **$F_{(1, 1762.014)}$ = 41.442, *p* < .001** | **-.138** | **-.090** |
| **Gender** | **.014 (.065)** | **$F_{(1, 19.998)}$ = 5.274, *p* < .05** | **.004** | **.141** |
| Dialect | .004 (.062) | $F_{(1, 19.999)}$ = .008, *p* = .931, n.s. | -.126 | .133 |
| Age | -.002 (.002) | $F_{(1, 19.996)}$ = .126, *p* = .726, n.s. | -.007 | .003 |
| **Language * Gender** | **.091 (.007)** | **$F_{(1, 1762.017)}$ = 164.327, *p* < .001** | **.077** | **.105** |
| Language * Dialect | .003 (.008) | $F_{(1, 1762.027)}$ = .26, *p* = .61, n.s. | -.010 | .017 |
| **Language * Age** | **.003 (.001)** | **$F_{(1, 1762.167)}$ = 110.571, *p* < .001** | **.002** | **.003** |
| Random Effects | | | | |
| Residual | .0051 (.0002) | - | | - |
| Speaker | .0230 (.0073) | - | | - |
| Token | .0000 (.0000) | - | | - |
| Model Information Criteria (BIC) = -4152.918 | | | | |

Table 6.14: Results of Linear Mixed Model of Broad Focus Valley Alignment: significant results are in bold.

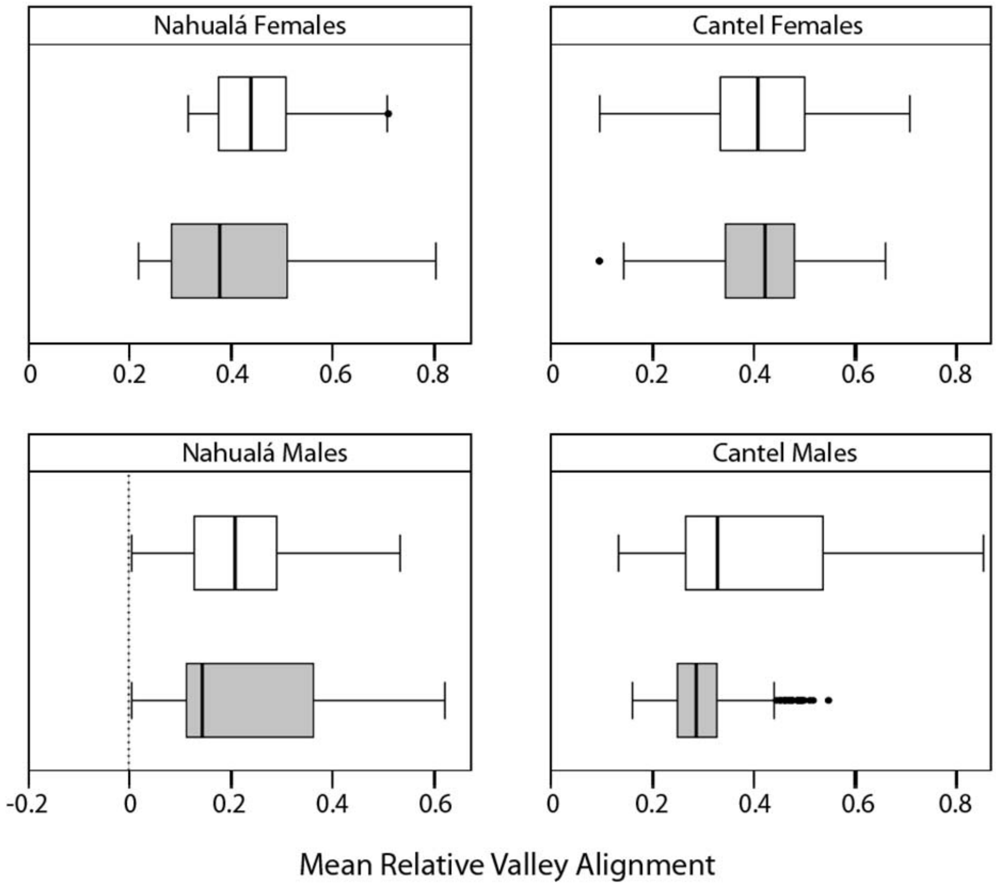


Figure 6.9: Box plots of mean relative peak alignment of the tonic syllable in broad focus for all speaker groups: K'ichee' (white) Spanish (gray). A lower score indicates an earlier valley alignment and the dotted line in Nahualá males indicates a score 0, i.e., the beginning of the tonic syllable.

The individual speaker analyses, shown in Table 6.15, reveal that 14 of 24 speakers do not demonstrate any significant differences between Spanish and K'ichee' valley alignments, though speaker CF4 approaches significance. All 10 speakers that differentiate in the alignment of the valley had a significantly earlier valley alignment in Spanish than in K'ichee'. These results suggest that for some bilinguals Spanish broad focus constituents have an earlier valley alignment, i.e., and earlier beginning to the rise, than in K'ichee', but that this acoustic feature, like peak alignment, is often similar in the two languages of these bilinguals and may be prone to convergence.

| Individual Speaker ANOVAs- Broad Focus Valley Alignment | | | | | |
|---|---|---|---|---|---|
| NF1 | NF2 | **NF3** | **NF4** | **NF5** | NF6 |
| $F_{(1, 76)}$ = .14, $p$ = .709, n.s. | $F_{(1,73)}$ = .204, $p$ = .653, n.s. | **$F_{(1, 72)}$ = 26.647, $p$ < .001** | **$F_{(1, 72)}$ = 165.218, $p$ < .001** | **$F_{(1, 75)}$ = 9.831, $p$ < .01** | $F_{(1, 70)}$ = .263, $p$ = .61, n.s. |
| **NM1** | **NM2** | NM3 | NM4 | NM5 | NM6 |
| **$F_{(1, 78)}$ = 35.186, $p$ < .001** | **$F_{(1, 78)}$ = 28.81, $p$ < .001** | $F_{(1, 73)}$ = .592, $p$ = .556, n.s. | $F_{(1, 73)}$ = .112, $p$ = .739, n.s. | $F_{(1, 71)}$ = .323, $p$ = .725, n.s. | $F_{(1, 72)}$ = .366, $p$ =.547, n.s. |
| **CF1** | **CF2** | CF3 | CF4 | CF5 | CF6 |
| **$F_{(1, 70)}$ = 56.864, $p$ < .001** | **$F_{(1, 78)}$ = 83.559, $p$ < .001** | $F_{(1, 69)}$ = .53, $p$ = .469, n.s. | $F_{(1, 73)}$ = 3.665, $p$ = .059, n.s. | $F_{(1, 71)}$ = .008, $p$ = .928, n.s. | $F_{(1, 71)}$ = .632, $p$ = .429, n.s. |
| **CM1** | CM2 | CM3 | **CM4** | CM5 | **CM6** |
| **$F_{(1, 70)}$ = 75.701, $p$ < .001** | $F_{(1, 68)}$ = 1.726, $p$ = .193, n.s. | $F_{(1, 71)}$ = 1.653, $p$ = .202, n.s. | **$F_{(1, 72)}$ = 71.643, $p$ < .001** | $F_{(1, 70)}$ = .909, $p$ = .344, n.s. | **$F_{(1, 76)}$ = 68.972, $p$ < .001** |

Table 6.15: Results from the ANOVAs of broad focus valley alignment for all 24 speakers; significant results are in bold and indicate that the speaker had an earlier valley alignment in Spanish than in K'ichee'.

### 6.1.6 Rise

The findings of rise in broad focus constituents, presented in Tables 6.16 and 6.17 and illustrated in and Figure 6.10, only reveal a significant main effect of Language. Spanish broad focus constituents had an overall greater rise than K'ichee' broad focus constituents. These results reflect the previous broad focus group findings for Peak and Valley Height, which, as seen in the previous chapters, are correlated with Rise. Though there were no cross-language differences in Peak Height, Spanish valleys were lower than K'ichee' valleys. Accordingly, the overall rise in Spanish was greater than the overall rise in K'ichee'.

| Means (SD) Broad Focus Rise (st) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Language | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 3.7 (2.7) | 4.2 (2.6) | 4.0 (1.8) | 3.9 (2.5) |
| K'ichee' | 3.5 (2.5) | 3.5 (3.6) | 3.6 (3.7) | 3.6 (3.6) | 3.5 (3.6) |
| Spanish | 4.4 (2.8) | 3.9 (3.2) | 4.6 (4.3) | 4.6 (5.8) | 4.4 (5.0) |

Table 6.16: Mean (SD) of Broad Focus Rise (st) in both languages.

| Linear Mixed Model- Broad Focus Rise | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **4.38 (.81)** | **$F_{(1, 19.927)} = 27.858$, $p < .001$** | **2.69** | **6.06** |
| **Language** | **-1.36 (.42)** | **$F_{(1, 1753.821)} = 10.787$, $p < .01$** | **-2.19** | **-.54** |
| Gender | -.58 (.47) | $F_{(1, 19.938)} = .677$, $p = .421$, n.s. | -1.55 | .39 |
| Dialect | -.05 (.45) | $F_{(1, 19.959)} = .014$, $p = .907$, n.s. | -.97 | .87 |
| Age | .008 (.016) | $F_{(1, 19.892)} = .611$, $p = .444$, n.s. | -.03 | .04 |
| Language * Gender | .41 (.21) | $F_{(1, 1753.626)} = 2.884$, $p = .09$, n.s. | -.06 | .89 |
| Language * Dialect | -.004 (.232) | $F_{(1, 1753.657)} = .00$, $p = .985$, n.s. | -.46 | .45 |
| Language * Age | .008 (.008) | $F_{(1, 1753.987)} = 1.044$, $p = .307$, n.s. | -.008 | .025 |
| Random Effects | | | | |
| Residual | 5.976 (.2018) | - | | - |
| Speaker | .1021 (.3487) | - | | - |
| Token | .0030 (.0172) | - | | - |
| Model Information Criteria (BIC) = 8377.681 | | | | |

Table 6.17: Results of Linear Mixed Model of Broad Focus Rise: significant results are in bold.

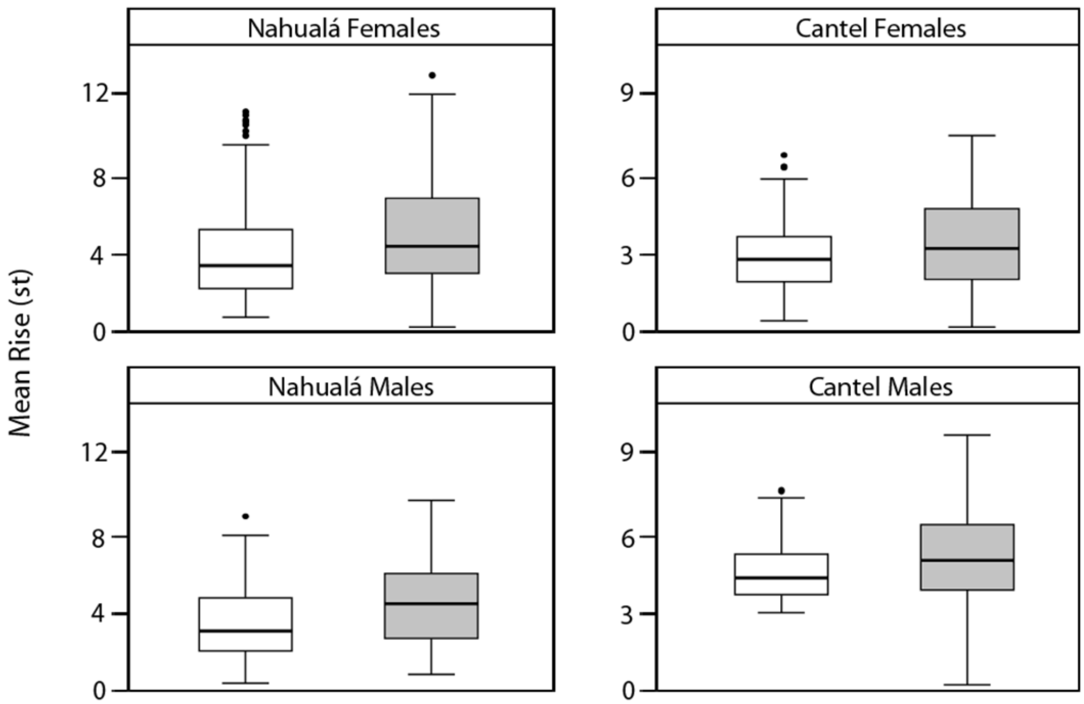


Figure 6.10: Box plots of mean rise (st) of the tonic syllable in broad focus for all speaker groups: K'ichee' (white) Spanish (gray).

The results from the individual speaker analyses in Table 6.18 indicate that, in contrast to the group findings, only 11 of 24 speakers demonstrate significant cross-language differences in terms of the rise of the intonational contour in the broad focus constituent; though, speakers CF2, CF5, and CM2 approached significance. All 11 of these speakers produced a greater rise in Spanish than in K'ichee', and, in the 3 speakers that approached significance, the mean rise was higher in Spanish than K'ichee'. Again, these results are related to the results of Valley Height, where most speakers had a lower valley in Spanish than in K'ichee', which is correlated with the overall rise of the intonational contour in the tonic syllable in both languages.

| Individual Speaker ANOVAs- Broad Focus Rise | | | | | |
|---|---|---|---|---|---|
| NF1 | NF2 | NF3 | **NF4** | **NF5** | NF6 |
| $F_{(1, 76)}$ = 3.394, $p$ = .069, n.s. | $F_{(1,73)}$ = .376, $p$ = .542, n.s. | $F_{(1, 72)}$ = 1.34, $p$ = .251, n.s. | **$F_{(1, 72)}$ = 10.233, $p < .01$** | **$F_{(1, 75)}$ = 12.493, $p < .01$** | $F_{(1, 70)}$ = 1.311, $p$ = .256, n.s. |
| **NM1** | NM2 | NM3 | **NM4** | **NM5** | NM6 |
| **$F_{(1, 78)}$ = 9.977, $p < .01$** | $F_{(1, 78)}$ = .474, $p$ = .493, n.s. | $F_{(1, 73)}$ = 1.772, $p$ = .187, n.s. | **$F_{(1, 73)}$ = 45.471, $p < .001$** | **$F_{(1, 71)}$ = 16.157, $p < .001$** | $F_{(1, 72)}$ = .118, $p$ =.732, n.s. |
| **CF1** | CF2 | **CF3** | CF4 | CF5 | **CF6** |
| **$F_{(1, 70)}$ = 11.431, $p < .01$** | $F_{(1, 78)}$ = 3.551, $p$ = .063, n.s. | **$F_{(1, 69)}$ = 11.126, $p < .01$** | $F_{(1, 73)}$ = 1.034, $p$ = .313, n.s. | $F_{(1, 71)}$ = 3.945, $p$ = .051, n.s. | **$F_{(1, 71)}$ = 8.404, $p < .01$** |
| CM1 | CM2 | **CM3** | CM4 | **CM5** | **CM6** |
| $F_{(1, 70)}$ = 1.103, $p$ = .297, n.s. | $F_{(1, 68)}$ = 3.849, $p$ = .054, n.s. | **$F_{(1, 71)}$ = 5.962, $p < .05$** | $F_{(1, 72)}$ = 2.202, $p$ = .142, n.s. | **$F_{(1, 70)}$ = 31.483, $p < .001$** | **$F_{(1, 76)}$ = 60.775, $p < .001$** |

Table 6.18: Results from the ANOVAs of broad focus rise for all 24 speakers; significant results are in bold and indicate that the individual speaker had a significantly greater rise in Spanish than in K'ichee'.

### 6.1.7 Slope

The results for Broad Focus Slope are presented in Tables 6.19 and 6.20. Overall results of the Linear Mixed Model indicate a significant main effect of Language, Gender, and Dialect as Spanish slopes were steeper than K'ichee' slopes, females produced steeper slopes than males, and Nahualá bilinguals produced steeper slopes than Cantel bilinguals. The significant Language*Gender and Language*Dialect interactions demonstrate that, when compared to the slope in K'ichee', females had steeper slopes in Spanish than males and Nahualá bilinguals had steeper slopes in Spanish than Cantel bilinguals. As seen in Figure 6.11, it is the Nahualá females that have the greatest cross-language difference in slope. As a shorter duration is correlated with a steeper slope, and as the results in Section 6.1.1 demonstrate that the Nahualá females had the shortest overall duration in Spanish broad focus constituents, the Nahualá females subsequently have the steepest slopes in Spanish broad focus constituents.

| Means (SD) Broad Focus Slope | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Language | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | .45 (.49) | .20 (.15) | .46 (.44) | .20 (.15) |
| K'ichee' | .20 (.15) | .23 (.24) | .17 (.24) | .16 (.24) | .24 (.24) |
| Spanish | .47 (.54) | .49 (.82) | .48 (.23) | .46 (.75) | .45 (.29) |

Table 6.19: Mean (SD) of Broad Focus Slope in both languages.

| Linear Mixed Model- Broad Focus Slope | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **.41 (.23)** | **$F_{(1, 20.194)}$ = 17.876, $p$ < .001** | **.08** | **.76** |
| **Language** | **-.37 (.29)** | **$F_{(1, 1766.614)}$ = 10.383, $p$ < .01** | **-.76** | **-.12** |
| **Gender** | **.51 (.13)** | **$F_{(1, 20.593)}$ = 8.986, $p$ < .01** | **.25** | **.78** |
| **Dialect** | **-.39 (.13)** | **$F_{(1, 20.838)}$ = 8.601, $p$ < .01** | **-.63** | **-.13** |
| Age | .005 (.005) | $F_{(1, 20.061)}$ = 1.108, $p$ = .305, n.s. | -.004 | .014 |
| **Language * Gender** | **-.45 (.12)** | **$F_{(1, 1767.337)}$ = 6.708, $p$ < .05** | **-.78** | **-.12** |
| **Language * Dialect** | **.45 (.17)** | **$F_{(1, 1769.251)}$ = 7.542, $p$ < .01** | **.11** | **.79** |
| Language * Age | -.003 (.006) | $F_{(1, 1767.235)}$ = .188, $p$ = .665, n.s. | -.014 | .009 |
| Random Effects | | | | |
| Residual | .3041 (.1024) | - | | - |
| Speaker | .0101 (.0158) | - | | - |
| Token | .0000 (.0000) | - | | - |
| Model Information Criteria (BIC) = 7125.12 | | | | |

Table 6.20: Results of Linear Mixed Model of Broad Focus Slope: significant results are in bold.

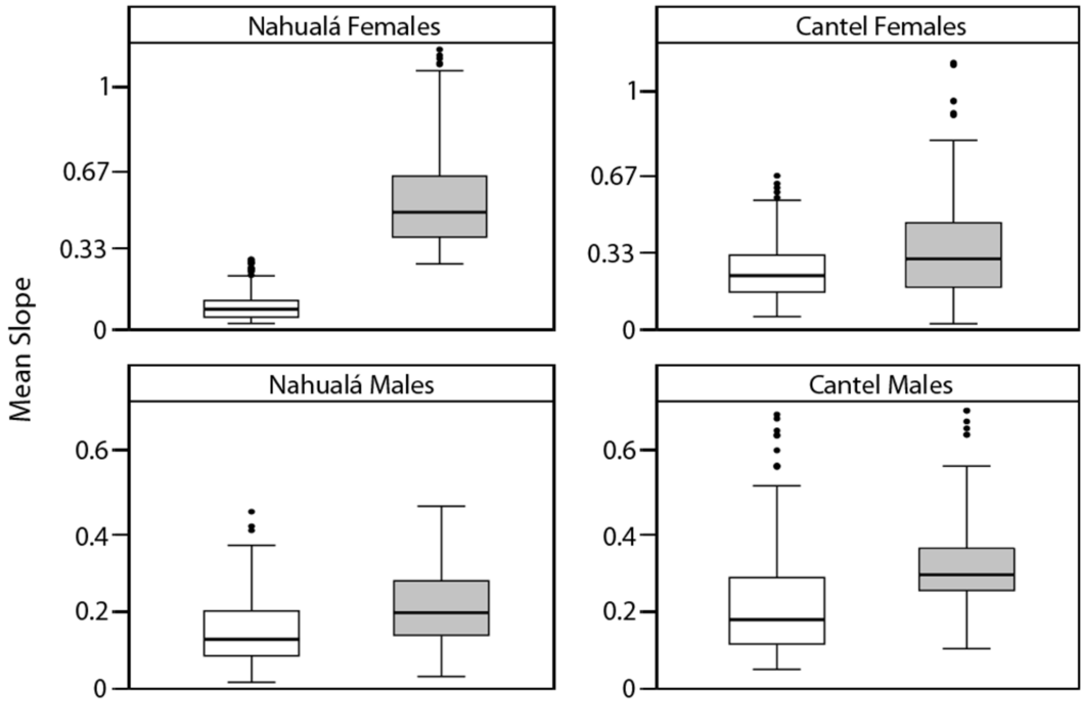


Figure 6.11: Box plots of mean slope of the tonic syllable in broad focus for all speaker groups: K'ichee' (white) Spanish (gray). A higher number indicates a steeper slope.

The results of the individual speaker analyses are presented in Table 6.21. Of the 24 bilinguals analyzed in this study, 13 demonstrated significantly different slopes between Spanish and K'ichee' and, similar to the group results, in each case the slope was steeper in Spanish than in K'ichee'; speaker NM2 approached significance and had a higher mean slope in Spanish as well.

| Individual Speaker ANOVAs- Broad Focus Slope | | | | | |
|---|---|---|---|---|---|
| NF1 | **NF2** | **NF3** | **NF4** | NF5 | **NF6** |
| $F_{(1, 76)}$ = 1.744, *p* = .191, n.s. | **$F_{(1,73)}$ = 16.334, *p* < .001** | **$F_{(1, 72)}$ = 6.644, *p* < .05** | **$F_{(1, 72)}$ = 31.419, *p* < .001** | $F_{(1, 75)}$ = 2.645, *p* = .108, n.s. | **$F_{(1, 70)}$ = 25.051, *p* < .001** |
| NM1 | NM2 | **NM3** | **NM4** | **NM5** | NM6 |
| $F_{(1, 78)}$ = 1.488, *p* = .226, n.s. | $F_{(1, 78)}$ = 3.646, *p* = .06, n.s. | **$F_{(1, 73)}$ = 5.45, *p* < .05** | **$F_{(1, 73)}$ = 29.84, *p* < .001** | **$F_{(1, 71)}$ = 36.705, *p* < .001** | $F_{(1, 72)}$ = .033, *p* =.856, n.s. |
| CF1 | **CF2** | **CF3** | CF4 | CF5 | **CF6** |
| $F_{(1, 70)}$ = 1.012, *p* = .318, n.s. | **$F_{(1, 78)}$ = 7.343, *p* < .01** | **$F_{(1, 69)}$ = 11.19, *p* < .01** | $F_{(1, 73)}$ = 1.399, *p* = .241, n.s. | $F_{(1, 71)}$ = 1.058, *p* = .307, n.s. | **$F_{(1, 71)}$ = 18.182, *p* < .001** |
| CM1 | CM2 | **CM3** | **CM4** | CM5 | **CM6** |
| $F_{(1, 70)}$ = 1.926, *p* = .17, n.s. | $F_{(1, 68)}$ = .001, *p* = .979, n.s. | **$F_{(1, 71)}$ = .469, *p* = .496, n.s.** | **$F_{(1, 72)}$ = 27.922, *p* < .001** | $F_{(1, 70)}$ = .139, *p* = .711, n.s. | **$F_{(1, 76)}$ = 81.313, *p* < .001** |

Table 6.21: Results from the ANOVAs of broad focus slope for all 24 speakers; significant results are in bold and indicate that the speaker had a significantly steeper slope in Spanish than in K'ichee'.

### 6.2 CONTRASTIVE FOCUS CONSTITUENTS

The group analysis of the contrastive focus constituents was also done via a Linear Mixed Model with Language. However, as reported in Chapters 4 and 5, the bilingual speakers in this study produced several different syntactic structures when marking contrastive focus. Consequently, the levels of the Language factor in the Linear Mixed Model were assigned by language and syntactic structure of contrastive focus, e.g., K'ichee' *are + fronted subject,* K'ichee' *in situ*, Spanish *in situ*, etc. As in the previous analyses, the factors were Language, Gender, and Dialect (the respective reference levels were Spanish *in situ*, Male, and Nahualá), Age was a continuous covariate, the particular acoustic measure being analyzed was the dependent variable, and

Speaker and Token were random effects.[60,61] The different levels of Language were further analyzed via Bonferroni pairwise comparisons. The individual speaker data was analyzed via a series of one-way ANOVAs and, where necessary, were further analyzed via Bonferroni pairwise comparisons. Following the same threshold set forth in Chapters 4 and 5, a speaker needed to produce at least 5 tokens of a particular syntactic structure of contrastive focus in order for that structure to be included in the analysis.

As with the analysis of broad focus constituents, Spanish and K'ichee' contrastive focus constituents that are *not* significantly different from each other in a particular acoustic measure are examined as possible cases of convergence. Again, it is noted these possible cases of convergence may merely be cases where the particular acoustic measure is the same in both languages.

It should be noted that some of these comparisons of the contrastive focus constituents are across two variables: language and syntactic structure. This is explicitly seen among the Nahualá females, who only produced enough tokens of K'ichee' *are + fronted subject* and of Spanish *in situ* for the analysis. While the data presented in Chapters 4 and 5 demonstrated that *in situ* constituents were prosodically more marked than syntactically marked constituents in both languages, these comparisons are still valuable for assessing similarities and possible cases of convergence, especially among these speakers that did not produce similar syntactic structures of contrastive focus in both languages. However, they do not offer as strong of a comparison as other cross-language comparisons with similar syntactic structures, e.g., K'ichee' *in situ* vs Spanish

[60] Again, Language Dominance was not included as a factor in order to avoid multicollinearality with Dialect, with which it was highly correlated.
[61] The final Hessian matrix was not positive for Token although all convergence criteria were satisfied for Duration, Peak Height, Valley Height, Valley Alignment, and Rise.

*in situ* or K'ichee' *are + fronted subject* vs Spanish clefted; the latter comparison is considered similar in this study because in both syntactic structures the constituent is moved to the front of the utterance and introduced by a word that was not present in the broad focus structure, *are* and *fue* respectively.[62] Finally, as the results of the pairwise comparisons of the different syntactic structures of contrastive focus in the same language, e.g., Spanish *in situ* vs Spanish clefted, were already reported in the previous chapters, only the results of the cross-language pairwise comparisons are reported here. The individual speaker means and standard deviations can be found in Appendix D.

Time-normalized pitch contours of the tonic syllable of the target word in each contrastive focus condition produced by each speaker can be seen in Figures 6.12-6.15. As in the time-normalized pitch contours in broad focus constituents, similarities in the pitch contours can be seen and these similarities are further analyzed via the same acoustic measurements in the following subsections.

[62] Though it should be noted that *fue* is a verb whereas *are* is not.

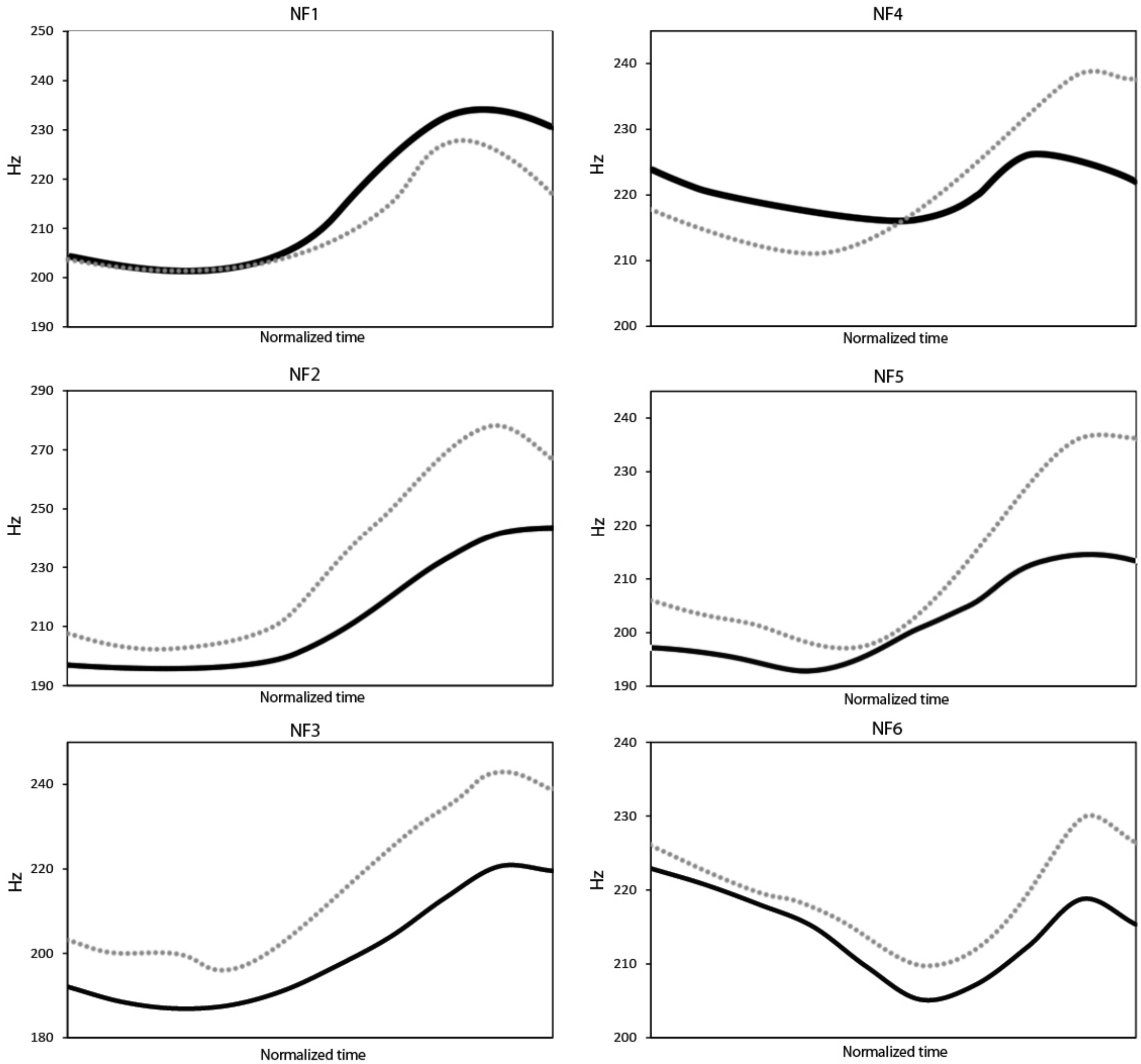


Figure 6.12: Nahualá female speakers: time-normalized average pitch contours of the tonic syllable in contrastive focus in Spanish *in situ* (solid black line) and K'ichee' *are + fronted subject* (dotted gray line).

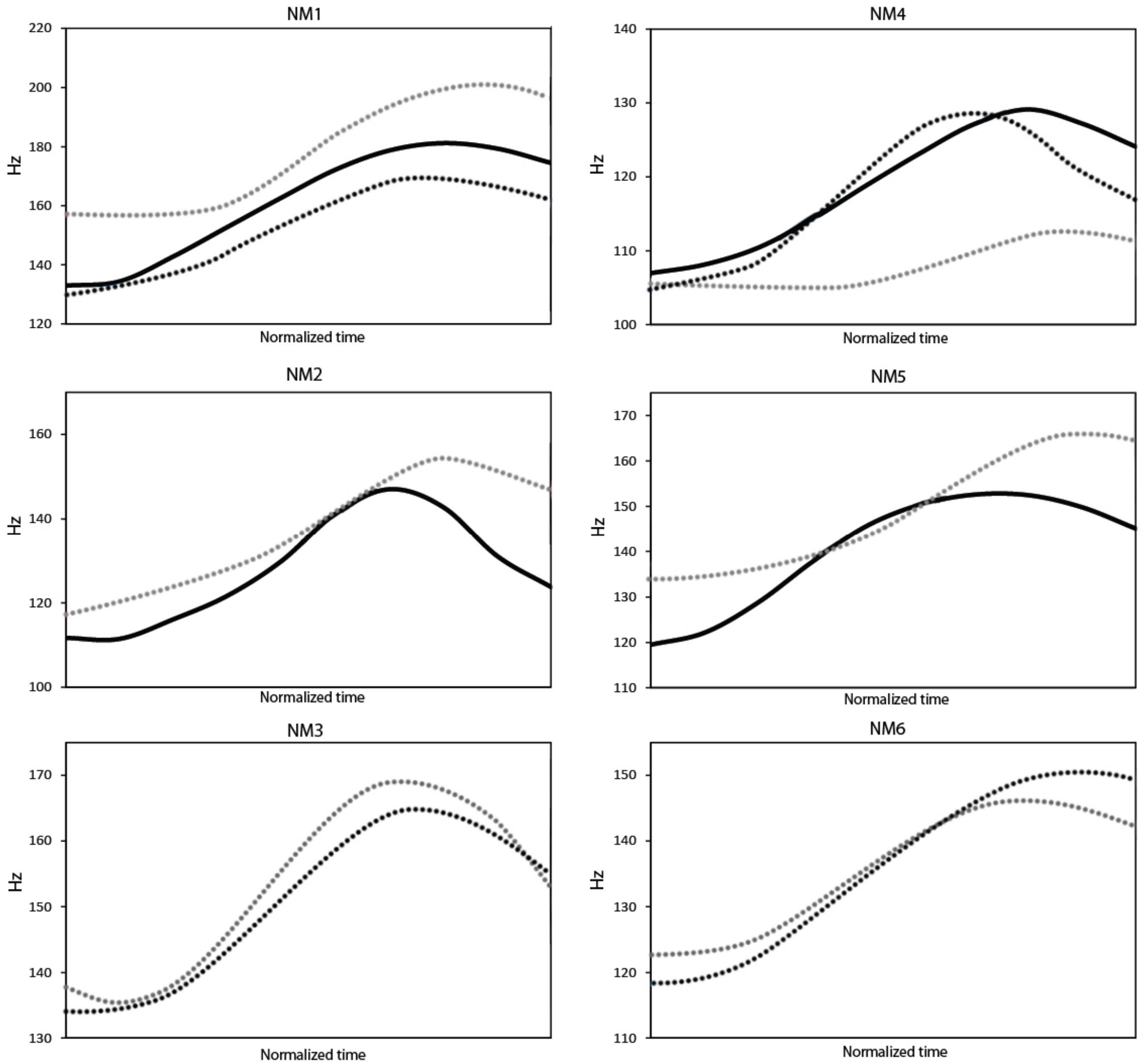


Figure 6.13: Nahualá male speakers: time-normalized average pitch contours of the tonic syllable in contrastive focus in Spanish *in situ* (solid black line), Spanish clefted (dotted black line), and K'ichee' *are + fronted subject* (dotted gray line).

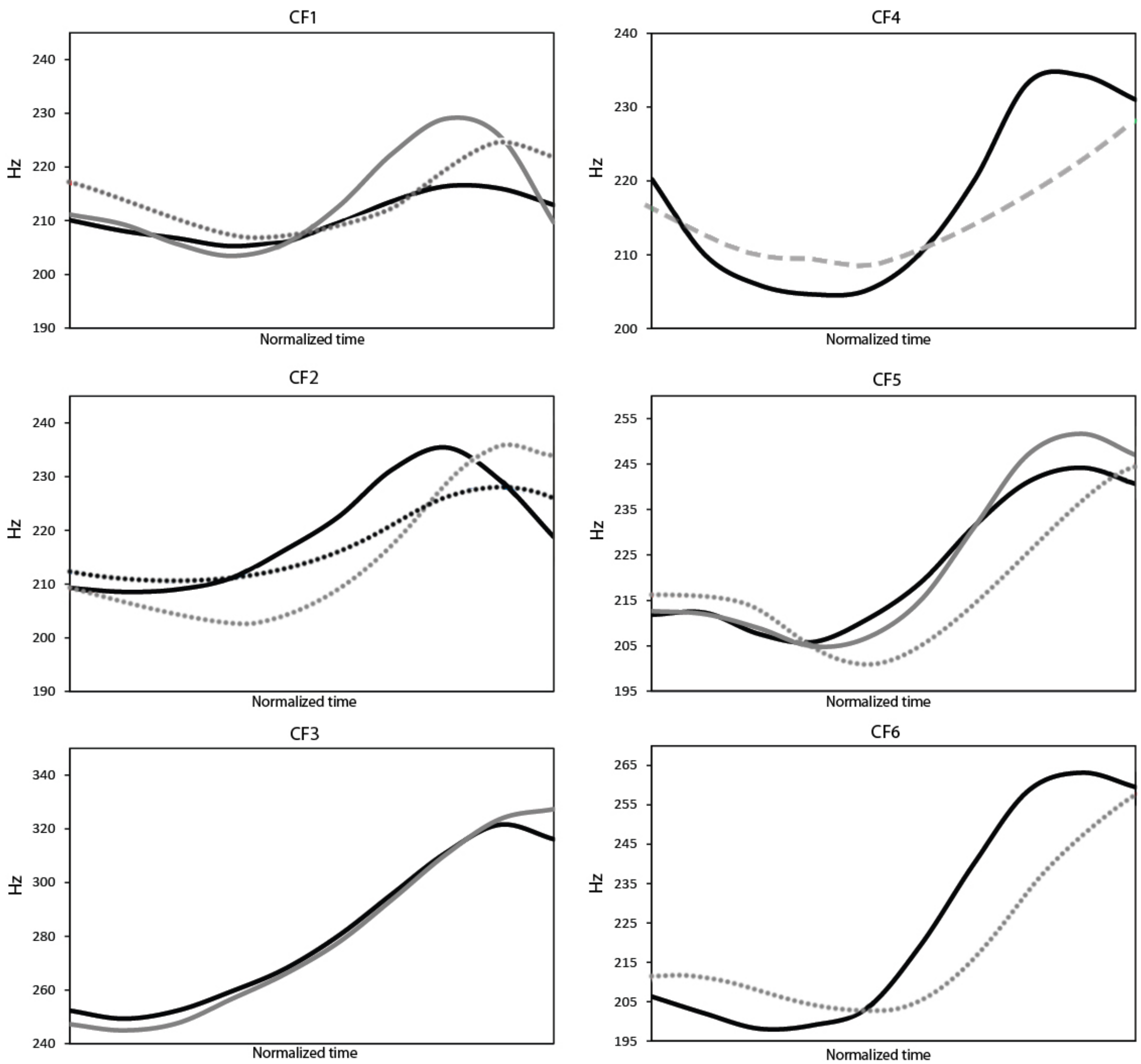


Figure 6.14: Cantel female speakers: time-normalized average pitch contours of the tonic syllable in contrastive focus in Spanish *in situ* (solid black line), Spanish clefted (dotted black line, only speaker CF2), K'ichee' *in situ* (solid gray line), K'ichee' *are + fronted subject* (dotted gray line), and K'ichee' *are + in situ* (dashed gray line, only speaker CF4).

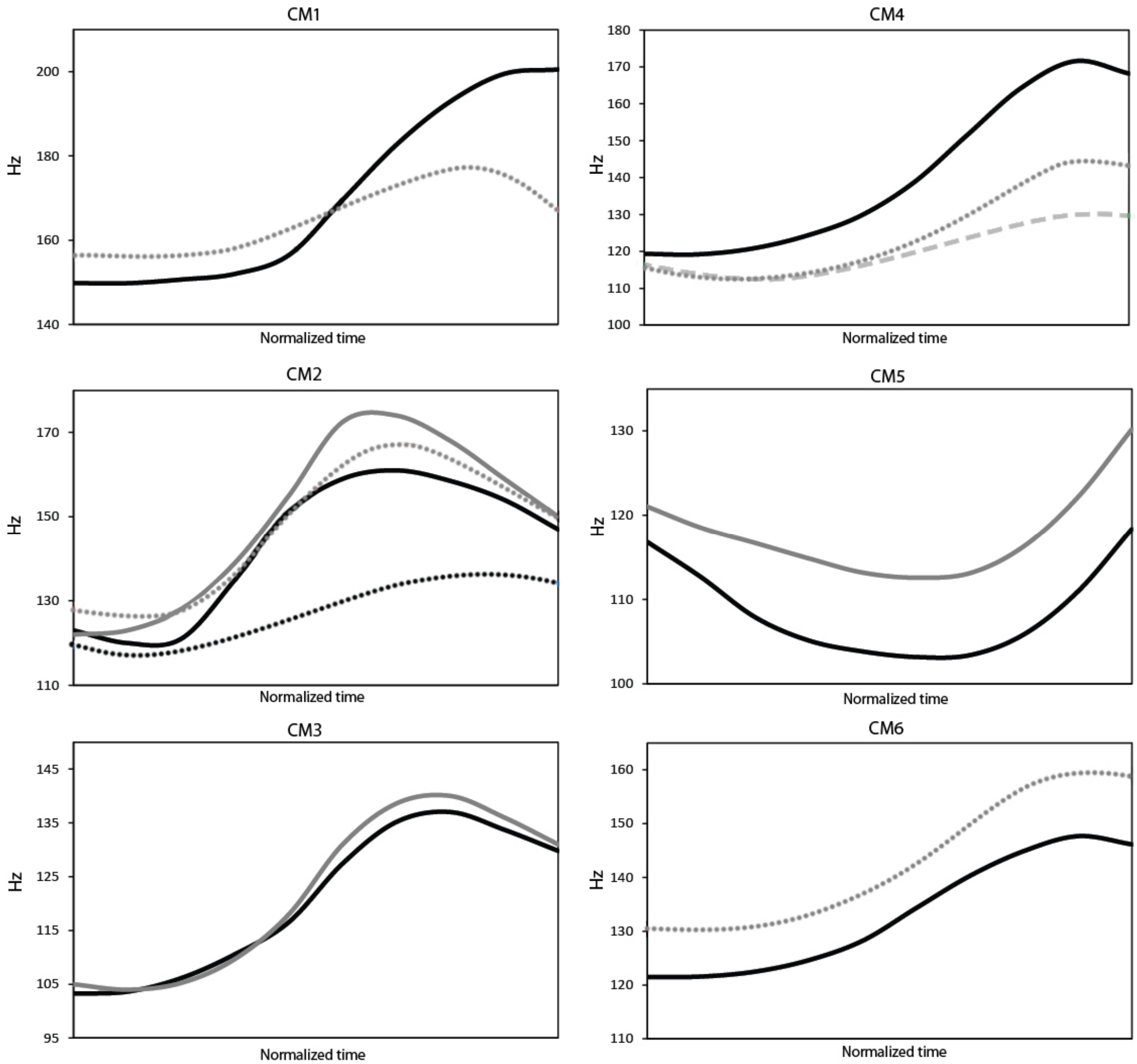


Figure 6.15: Cantel male speakers: time-normalized average pitch contours of the tonic syllable in contrastive focus in Spanish *in situ* (solid black line), Spanish clefted (dotted black line, only speaker CM2), K'ichee' *in situ* (solid gray line), K'ichee' *are + fronted subject* (dotted gray line), and K'ichee' *are + in situ* (dashed gray line, only speaker CM4).

### 6.2.1 Duration

The results of Contrastive Focus Duration are presented in Tables 6.22-6.24 and illustrated, separated by gender and dialect, in Figure 6.16. The Linear Mixed Model revealed a significant main effect of Language and Dialect. Overall, the Cantel speakers produced longer contrastive focus constituents than the Nahualá bilinguals. However, there are three important aspects to consider in this comparison: (i) the Nahualá K'ichee' tokens consisted of long vowels while the others did not, (ii) the Cantel bilinguals produced tokens of K'ichee' *in situ*, which where the longest across all levels, and tokens of K'ichee' *are + in situ* while the Nahualá bilinguals did not, and (iii) the data presented in Chapters 4 and 5 demonstrate the lack of the use of a longer duration to mark contrastive focus in Nahualá K'ichee' and, to a degree, in Nahualá Spanish while it was used in both languages in Cantel. The cross–language pairwise comparisons of Language demonstrate that K'ichee' *in situ* was longer than both types of Spanish contrastive focus and that K'ichee' *are + fronted subject* was longer than Spanish clefted contrastive focus.

All three interactions were significant. The Language*Gender interaction and the Language*Age interaction demonstrate that females and younger speakers produced longer K'ichee' *in situ* constituents than males and older speakers. The Language*Dialect interaction again demonstrates the lack of use of a longer duration to mark contrastive focus in Nahualá as, when compared to the duration of Spanish *in situ*, Nahualá speakers produced a shorter K'ichee' *are + fronted subject* contrastive focus constituent.

| Means (SD) Contrastive Focus Duration (ms) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 349 (62) | 330 (74) | 320 (55) | 350 (75) |
| K'ichee' In Situ | 361 (68) | 388 (80) | 354 (110) | - | 361 (68) |
| K'ichee' Are + Fronted Subject | 344 (65) | 365 (79) | 336 (79) | 327 (76) | 355 (81) |
| K'ichee' Are + In Situ | 349 (52) | 369 (27) | 336 (80) | - | 349 (52) |
| Spanish In Situ | 342 (70) | 341 (62) | 344 (58) | 326 (59) | 359 (60) |
| Spanish Clefted | 282 (56) | 253 (82) | 284 (70) | 252 (67) | 285 (71) |

Table 6.22: Mean (SD) of Contrastive Focus Duration (ms) in both languages.

| Linear Mixed Model- Contrastive Focus Duration | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **301.7 (24.2)** | **$F_{(1, 34.065)}$ = 200.915, *p* < .001** | **251.6** | **351.7** |
| **Language** | **93.5 (65.1)** | **$F_{(4, 1745.762)}$ = 5.888, *p* < .001** | **62.3** | **121.6** |
| Gender | -3.03 (13.9) | $F_{(1, 80.167)}$ = 1.166, *p* = .283, n.s. | -31.8 | 25.7 |
| **Dialect** | **33.8 (13.1)** | **$F_{(1, 25.002)}$ = 7.265, *p* < .05** | **6.7** | **60.9** |
| Age | .57 (.47) | $F_{(1, 41.536)}$ = .382, *p* = .54, n.s. | -.41 | 1.5 |
| **Language * Gender** | **41.2 (7.1)** | **$F_{(4, 1740.85)}$ = 6.708, *p* < .001** | **27.3** | **55.1** |
| **Language * Dialect** | **17.0 (6.9)** | **$F_{(2, 1738.161)}$ = 3.942, *p* < .05** | **3.5** | **30.5** |
| **Language * Age** | **.71 (.023)** | **$F_{(4, 1746.545)}$ = .188, *p* < .05** | **.25** | **1.2** |
| Random Effects | | | | |
| Residual | 3179.9 (108.2) | - | | - |
| Speaker | 907.1 (303.8) | - | | - |
| Token | .0000 (.0000) | - | | - |
| Model Information Criteria (BIC) = 19303.851 | | | | |

Table 6.23: Results of Linear Mixed Model of Contrastive Focus Duration: significant results are in bold.

| Bonferroni Pairwise Comparisons- Duration | |
|---|---|
| Comparison | Significance |
| **K'ichee' *in situ* > Spanish *in situ*** | ***p* < .01** |
| **K'ichee' *in situ* > Spanish clefted** | ***p* < .001** |
| K'ichee' *are + fronted subject* ≈ Spanish *in situ* | *p* = .426 |
| **K'ichee' *are + fronted subject* > Spanish clefted** | ***p* < .001** |
| K'ichee' *are + in situ* ≈ Spanish *in situ* | *p* = .371 |
| K'ichee' *are + in situ* ≈ Spanish clefted | *p* = .559 |

Table 6.24: Results of Bonferroni pairwise cross-language comparisons of Language of Contrastive Focus Duration: significant results are in bold.

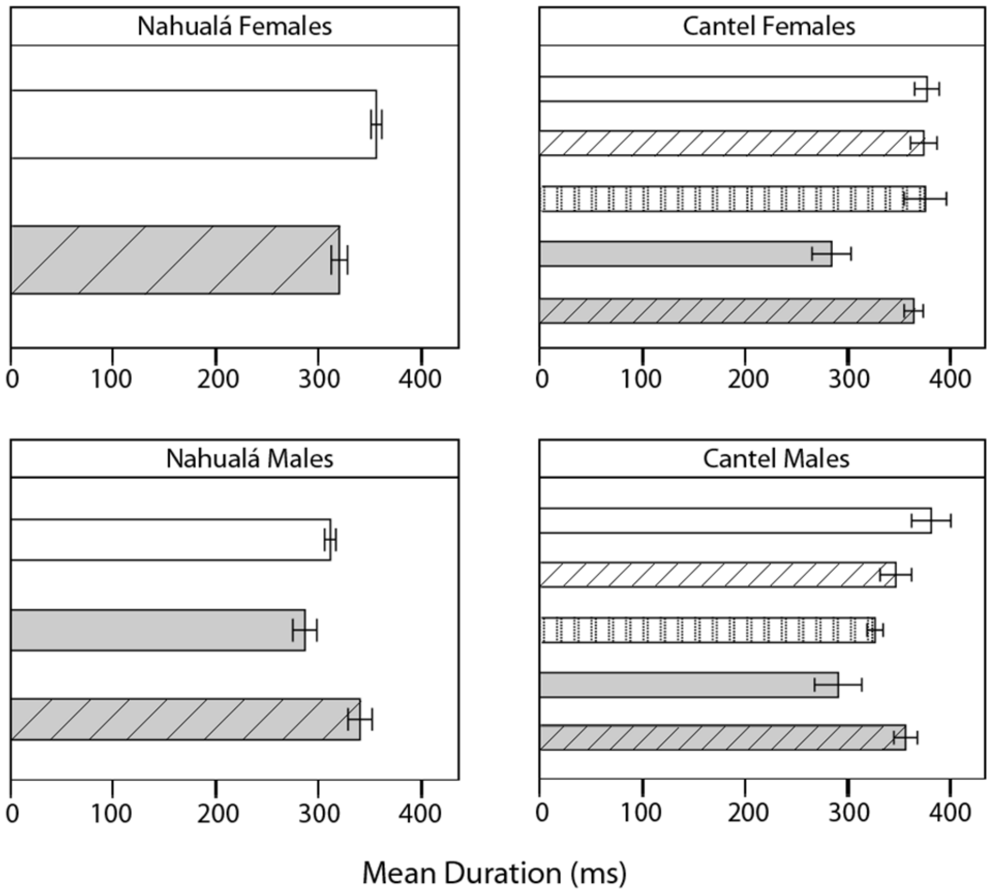


Figure 6.16: Bar graphs of mean duration (ms) of the tonic syllable in contrastive focus for all speaker groups: K'ichee' *are + fronted subject* (white), K'ichee' *in situ* (white with diagonal lines), K'ichee' *are + in situ* (vertical lines) Spanish clefted (gray), Spanish *in situ* (gray with diagonal lines). 95% confidence interval bars included.

The individual speaker analyses presented in Table 6.25 and the corresponding Bonferroni pairwise comparisons in Table 6.26 demonstrate that 16 of 24 speakers do not demonstrate a significant difference in duration between Spanish and K'ichee'; 4 speakers in the pairwise comparison demonstrated no differences in at least one Spanish-K'ichee' comparison and this was usually, but not always, between similar syntactic structures. For the 8 speakers that did demonstrate differences, all but speaker NM1 only

| Individual Speaker ANOVAs- Contrastive Focus Duration | | | | | |
|---|---|---|---|---|---|
| NF1 | **NF2** | **NF3** | **NF4** | **NF5** | **NF6** |
| $F_{(1, 72)}$ = .857, $p$ = .358, n.s. | **$F_{(1, 74)}$ = 8.922, $p$ < .01** | **$F_{(1, 72)}$ = 5.406, $p$ < .05** | **$F_{(1, 72)}$ = 49.066, $p$ < .001** | **$F_{(1, 72)}$ = 26.616, $p$ < .001** | **$F_{(1, 70)}$ = 31.588, $p$ < .001** |
| **NM1*** | **NM2** | NM3 | **NM4*** | NM5 | NM6 |
| **$F_{(2, 77)}$ = 16.616, $p$ < .001** | **$F_{(1, 78)}$ = 31.995, $p$ < .001** | $F_{(1, 73)}$ = 3.426, $p$ = .068, n.s. | **$F_{(2, 72)}$ = 28.999, $p$ < .001** | $F_{(1, 71)}$ = .677, $p$ = .413, n.s. | $F_{(1, 73)}$ = 1.249, $p$ =.267, n.s. |
| CF1* | **CF2*** | CF3 | CF4* | CF5* | **CF6** |
| $F_{(2, 64)}$ = 2.264, $p$ = .112, n.s. | **$F_{(2, 77)}$ = 25.212, $p$ < .001** | $F_{(1, 65)}$ = 3.18, $p$ = .575, n.s. | $F_{(2, 71)}$ = .953, $p$ = .391, n.s. | $F_{(2, 72)}$ = .252, $p$ = .778, n.s. | **$F_{(1, 69)}$ = 41.564, $p$ < .001** |
| CM1 | **CM2*** | CM3 | **CM4*** | CM5 | CM6 |
| $F_{(1, 69)}$ = .199, $p$ = .657, n.s. | **$F_{(3, 73)}$ = 7.883, $p$ < .001** | $F_{(1, 63)}$ = .052, $p$ = .821, n.s. | **$F_{(2, 68)}$ = 33.107, $p$ < .001** | $F_{(1, 71)}$ = 1.146, $p$ = .323, n.s. | $F_{(1, 76)}$ = 2.739, $p$ = .102, n.s. |

Table 6.25: Results from the ANOVAs of contrastive focus duration for all 24 speakers; significant differences are in bold and the asterisk indicates that the speaker produced more than two types of syntactic structure for contrastive focus and, where there is a significant main effect, is further analyzed in Table 6.26.

produced tokens of K'ichee' *are + fronted subject* and Spanish *in situ* contrastive focus; NM1 produced significantly different durations between K'ichee' *are + fronted subject* and both Spanish *in situ* and Spanish clefted contrastive focus. These results reveal that there are fewer cases of cross-language differences of duration in contrastive focus than in broad focus and that these similar durations appears to occur more often in similar syntactic structures, though this was not always the case. This lower number of cases of cross-language differences in duration of the tonic syllable in contrastive focus reflects the findings in Chapters 4 and 5. Nahualá males used an increased duration in Spanish oxytones in contrastive focus but not in K'ichee', suggesting that while broad focus constituents are longer in K'ichee' than in Spanish, due to the long vowel in Nahualá K'ichee', this difference diminishes in contrastive focus where the constituents significantly lengthen in Spanish but do not change in K'ichee'. This is further evidenced among the Nahualá females, who, with the exception of speaker NF1, did not significantly lengthen in contrastive focus in either language. As seen in Table 6.25, every Nahualá female speaker except NF1 had significantly longer tonic syllables in K'ichee' than in Spanish.

| Bonferroni Pairwise Comparisons- Contrastive Focus Duration | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM1 | **Spanish *in situ* > K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | **K'ichee' *are* + *fronted subject* > Spanish clefted** | ***p* < .001** |
| NM4 | **Spanish *in situ* > K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | K'ichee' *are* + *fronted subject* ≈ Spanish clefted | *p* = 1.00 |
| CF1 | -no significant main effect- | |
| CF2 | Spanish *in situ* ≈ K'ichee' *are* + *fronted subject* | *p* = .104 |
| | **K'ichee' *are* + *fronted subject* > Spanish clefted** | ***p* < .001** |
| CF4 | -no significant main effect- | |
| CF5 | -no significant main effect- | |
| CM2 | Spanish *in situ* ≈ K'ichee' *are* + *fronted subject* | *p* = 1.00 |
| | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = 1.00 |
| | **K'ichee' *are* + *fronted subject* > Spanish clefted** | ***p* < .01** |
| | **K'ichee' *in situ* > Spanish clefted** | ***p* < .001** |
| CM4 | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = .754 |
| | **Spanish *in situ* > K'ichee' *are* + *in situ*** | ***p* < .001** |

Table 6.26: Bonferroni cross-language pairwise comparisons of contrastive focus duration for the speakers that produced more than two types of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

### 6.2.2 Peak Height

The overall results of Contrastive Focus Peak Height, presented in Tables 6.27-6.29 and Figure 6.17, demonstrate main effects of Language and Gender. As seen in the previous analyses, females had higher overall pitch peaks than males and the pairwise comparisons reveal that K'ichee' *in situ* peaks were higher than both Spanish contrastive focus conditions. The significant Language*Gender interaction demonstrates that males mark Spanish clefted contrastive focus to a greater degree than females when compared to the peak height of the other conditions. However, as stated in Chapter 5, only one female in this study produced more than one token of Spanish clefted contrastive focus.

| Means (SD) Contrastive Focus Peak Height (st) | | | | | | |
|---|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 349 (62) | 330 (74) | 320 (55) | 350 (75) |
| K'ichee' In Situ | 92.0 (5.2) | 97.6 (7.3) | 86.8 (6.2) | - | 92.0 (7.1) |
| K'ichee' Are + Fronted Subject | 91.1 (5.6) | 96.2 (6.2) | 86.2 (8.3) | 91.7 (6.2) | 91.4 (6.8) |
| K'ichee' Are + In Situ | 90.2 (5.1) | 94.5 (9.1) | 85.2 (6.4) | - | 91.4 (6.8) |
| Spanish In Situ | 91.8 (4.2) | 95.9 (4.2) | 87.1 (5.2) | 92.1 (4.1) | 92.1 (4.0) |
| Spanish Clefted | 89.3 (4.7) | 93.1 (4.3) | 85.8 (4.2) | 88.6 (6.7) | 89.7 (5.8) |

Table 6.27: Mean (SD) of Contrastive Focus Peak Height (st) in both languages.

| Linear Mixed Model- Contrastive Focus Peak Height | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **84.8 (1.1)** | **$F_{(1, 38.658)}$ = 8347.903, $p$ < .001** | **82.6** | **87.0** |
| **Language** | **2.8 (.60)** | **$F_{(4, 1735.598)}$ = 5.936, $p$ < .001** | **1.6** | **3.9** |
| **Gender** | **9.2 (.60)** | **$F_{(1, 104.543)}$ = 104.965, $p$ < .001** | **7.9** | **10.4** |
| Dialect | .14 (.56) | $F_{(1, 26.236)}$ = .295, $p$ = .592, n.s. | -1.0 | 1.3 |
| Age | .02 (.02) | $F_{(1, 49.121)}$ = .118, $p$ = .732, n.s. | -.02 | .07 |
| **Language * Gender** | **3.6 (.57)** | **$F_{(4, 1724.798)}$ = 18.304, $p$ < .001** | **2.5** | **4.7** |
| Language * Dialect | -.12 (.79) | $F_{(2, 1716.07)}$ = 2.072, $p$ = .126, n.s. | -1.7 | 1.4 |
| Language * Age | -.01 (.02) | $F_{(4, 1739.69)}$ = .722, $p$ = .577, n.s. | -.06 | .03 |
| Random Effects | | | | |
| Residual | 7.661 (.2603) | - | | - |
| Speaker | 1.634 (.5611) | - | | - |
| Token | .0000 (.0000) | - | | - |
| Model Information Criteria (BIC) = 8730.409 | | | | |

Table 6.28: Results of Linear Mixed Model of Contrastive Focus Peak Height: significant results are in bold.

| Bonferroni Pairwise Comparisons- Peak Height | |
|---|---|
| Comparison | Significance |
| **K'ichee' *in situ* > Spanish *in situ*** | ***p* < .001** |
| **K'ichee' *in situ* > Spanish clefted** | ***p* < .001** |
| K'ichee' *are + fronted subject* ≈ Spanish *in situ* | *p* = 1.00 |
| K'ichee' *are + fronted subject* ≈ Spanish clefted | *p* = 1.00 |
| K'ichee' *are + in situ* ≈ Spanish *in situ* | *p* = .306 |
| K'ichee' *are + in situ* ≈ Spanish clefted | *p* = .826 |

Table 6.29: Results of Bonferroni pairwise cross-language comparisons of Language of Contrastive Focus Peak Height: significant results are in bold.

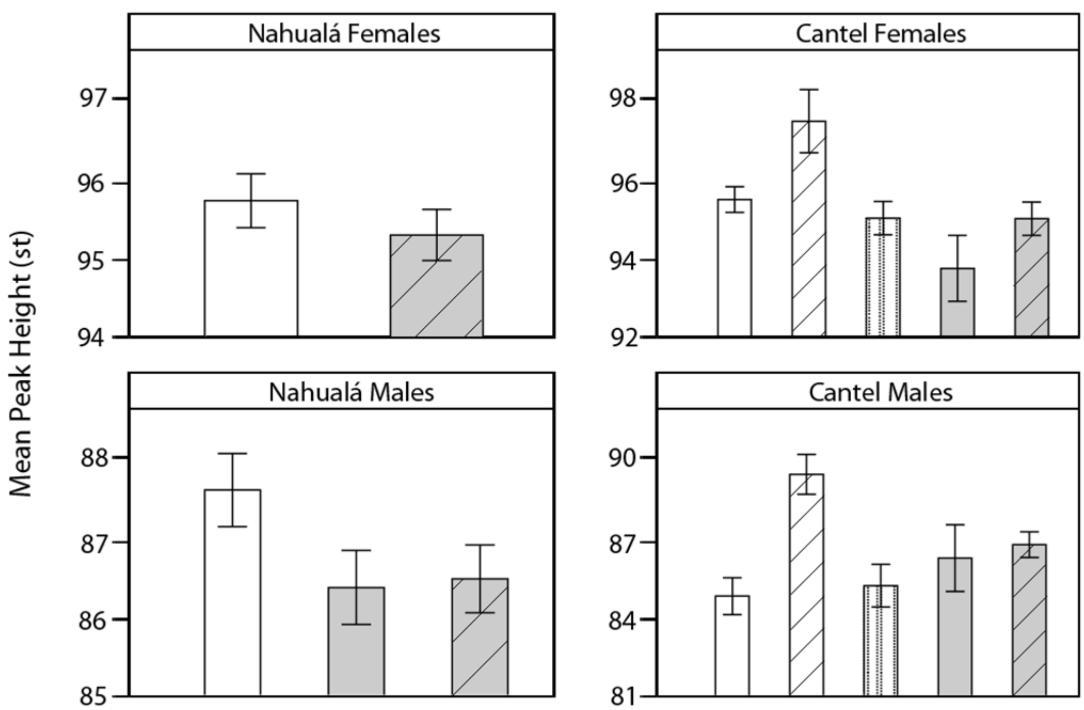


Figure 6.17: Bar graphs of mean peak height (st) of the tonic syllable in contrastive focus for all speaker groups: K'ichee' *are + fronted subject* (white), K'ichee' *in situ* (white with diagonal lines), K'ichee' *are + in situ* (vertical lines) Spanish clefted (gray), Spanish *in situ* (gray with diagonal lines). 95% confidence interval bars included.

| Individual Speaker ANOVAs- Contrastive Focus Peak Height | | | | | |
|---|---|---|---|---|---|
| NF1 | **NF2** | **NF3** | **NF4** | **NF5** | NF6 |
| $F_{(1, 72)}$ = 3.807, *p* = .055, n.s. | **$F_{(1, 74)}$ = 21.416, *p* < .001** | **$F_{(1, 72)}$ = 15.111, *p* < .001** | **$F_{(1, 72)}$ = 4.203, *p* < .05** | **$F_{(1, 72)}$ = 14.705, *p* < .001** | $F_{(1, 70)}$ = .000, *p* = .996, n.s. |
| **NM1*** | **NM2** | NM3 | **NM4*** | **NM5** | **NM6** |
| **$F_{(2, 77)}$ = 50.265, *p* < .001** | **$F_{(1, 78)}$ = 63.318, *p* < .001** | $F_{(1, 73)}$ = 1.128, *p* = .329, n.s. | **$F_{(2, 72)}$ = 19.835, *p* < .001** | **$F_{(1, 71)}$ = 11.445, *p* < .01** | **$F_{(1, 73)}$ = 9.435, *p* < .01** |
| **CF1*** | **CF2*** | **CF3** | **CF4*** | **CF5*** | **CF6** |
| **$F_{(2, 64)}$ = 29.394, *p* < .001** | **$F_{(2, 77)}$ = 71.665, *p* < .001** | **$F_{(1, 65)}$ = 7.042, *p* < .05** | **$F_{(2, 71)}$ = 5.197, *p* < .05** | **$F_{(2, 72)}$ = 19.214, *p* < .001** | **$F_{(1, 69)}$ = 32.996, *p* < .001** |
| **CM1** | **CM2*** | **CM3** | **CM4*** | CM5 | **CM6** |
| **$F_{(1, 69)}$ = 12.672, *p* < .001** | **$F_{(3, 73)}$ = 12.646, *p* < .001** | **$F_{(1, 63)}$ = 18.505, *p* < .001** | **$F_{(2, 68)}$ = 4.62, *p* < .05** | $F_{(1, 71)}$ = .872, *p* = .353, n.s. | **$F_{(1, 76)}$ = 40.633, *p* < .001** |

Table 6.30: Results from the ANOVAs of contrastive focus peak height for all 24 speakers; significant differences are in bold and the asterisk indicates that the speaker produced more than two types of syntactic structure for contrastive focus and, where there is a significant main effect, is further analyzed in Table 6.31.

The individual speaker analyses in Table 6.30 and 6.31 indicate that only 4 of 24 speakers do not demonstrate any differences in peak height between Spanish and K'ichee'. Of the 20 speakers that do demonstrate a significant difference, all but 6, NM4, NM6, CF4, CF6, CM1, and CM4, had significantly higher peaks in K'ichee' than in Spanish. Overall, both the group and individual speaker results present a tendency for the most prosodically marked structure of K'ichee' contrastive focus to have a higher peak than the most prosodically marked structure of Spanish contrastive focus: the peaks in K'ichee' *in situ* tokens tended to be higher than in Spanish *in situ* contrastive focus while the peaks in K'ichee' *are + fronted subject* did not. However, among individual speakers who only produced tokens of K'ichee' *are + fronted subject* contrastive focus, these tokens tended to have higher peaks than the Spanish *in situ* tokens that they produced, with the exception of speakers NM4, CF2, and CM4.

| Bonferroni Pairwise Comparisons- Contrastive Focus Peak Height | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM1 | **Spanish *in situ* < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | **Spanish clefted < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| NM4 | **Spanish *in situ* > K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | **Spanish clefted > K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| CF1 | Spanish *in situ* ≈ K'ichee' *are* + *fronted subject* | *p* = .647 |
| | **Spanish *in situ* < K'ichee' *in situ*** | ***p* < .001** |
| CF2 | **Spanish *in situ* > K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | **Spanish clefted < K'ichee' *are* + *fronted subject*** | ***p* < .01** |
| CF4 | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = .18 |
| | **Spanish *in situ* > K'ichee' *are* + *in situ*** | ***p* < .05** |
| CF5 | Spanish *in situ* ≈ K'ichee' *are* + *fronted subject* | *p* = 1.00 |
| | **Spanish *in situ* < K'ichee' *in situ*** | ***p* < .001** |
| CM2 | Spanish *in situ* ≈ K'ichee' *are* + *fronted subject* | *p* = .945 |
| | **Spanish *in situ* < K'ichee' *in situ*** | ***p* < .01** |
| | Spanish clefted ≈ K'ichee' *are* + *fronted subject* | *p* = .965 |
| | **Spanish clefted < K'ichee' *in situ*** | ***p* < .001** |
| CM4 | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = .18 |
| | **Spanish *in situ* > K'ichee' *are* + *in situ*** | ***p* < .05** |

Table 6.31: Bonferroni cross-language pairwise comparisons of contrastive focus peak height for the speakers that produced more than two types of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

### 6.2.3 Peak Alignment

The group means and results of the Linear Mixed Model and Bonferroni pairwise comparisons are presented Tables 6.32-6.34 and are illustrated, grouped by dialect and gender, in the boxplots in Figure 6.18.

| Means (SD) Contrastive Focus Peak Alignment | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | .78 (.12) | .70 (.15) | .73 (.14) | .75 (.14) |
| K'ichee' In Situ | .75 (.12) | .76 (.12) | .71 (.12) | - | .75 (.12) |
| K'ichee' Are + Fronted Subject | .77 (.13) | .82 (.12) | .72 (.12) | .75 (.12) | .78 (.12) |
| K'ichee' Are + In Situ | .79 (.15) | .82 (.16) | .76 (.16) | - | .79 (.15) |
| Spanish In Situ | .71 (.12) | .73 (.16) | .67 (.16) | .69 (.16) | .71 (.15) |
| Spanish Clefted | .72 (.15) | .76 (.38) | .70 (.22) | .70 (.30) | .74 (.25) |

Table 6.32: Mean (SD) of Contrastive Focus Peak Alignment in both languages.

| Linear Mixed Model- Contrastive Focus Peak Alignment | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **.56 (.06)** | **$F_{(1, 28.059)}$ = 166.689, $p$ < .001** | **.43** | **.68** |
| **Language** | **.15 (.05)** | **$F_{(4, 1743.341)}$ = 8.94, $p$ < .001** | **.06** | **.25** |
| **Gender** | **.13 (.03)** | **$F_{(1, 53.232)}$ = 4.693, $p$ < .05** | **.05** | **.20** |
| **Dialect** | **.04 (.02)** | **$F_{(1, 22.742)}$ = 4.51, $p$ < .05** | **.01** | **.08** |
| Age | .001 (.001) | $F_{(1, 32.277)}$ = .86, $p$ = .361, n.s. | -.001 | .004 |
| **Language * Gender** | **-.05 (.01)** | **$F_{(4, 1742.529)}$ = 4.887, $p$ < .01** | **-.08** | **-.02** |
| Language * Dialect | .02 (.01) | $F_{(2, 1741.895)}$ = 1.837, $p$ = .16, n.s. | -.01 | .04 |
| Language * Age | -.001 (.003) | $F_{(4, 1742.114)}$ = 1.696, $p$ = .148, n.s. | -.007 | .004 |
| Random Effects | | | | |
| Residual | .0128 (.0004) | - | | - |
| Speaker | .0058 (.0019) | - | | - |
| Token | .0001 (.0003) | - | | - |
| Model Information Criteria (BIC) = -2463.494 | | | | |

Table 6.33: Results of Linear Mixed Model of Contrastive Focus Peak Alignment: significant results are in bold.

| Bonferroni Pairwise Comparisons- Peak Alignment | |
|---|---|
| Comparison | Significance |
| K'ichee' *in situ* ≈ Spanish *in situ* | $p$ = .199 |
| K'ichee' *in situ* ≈ Spanish clefted | $p$ = 1.00 |
| **K'ichee' *are* + *fronted subject* > Spanish *in situ*** | **$p$ < .01** |
| K'ichee' *are* + *fronted subject* ≈ Spanish clefted | $p$ = .646 |
| **K'ichee' *are* + *in situ* > Spanish *in situ*** | **$p$ < .001** |
| **K'ichee' *are* + *in situ* > Spanish clefted** | **$p$ < .01** |

Table 6.34: Results of Bonferroni pairwise cross-language comparisons of Language of Contrastive Focus Peak Alignment: significant results are in bold.

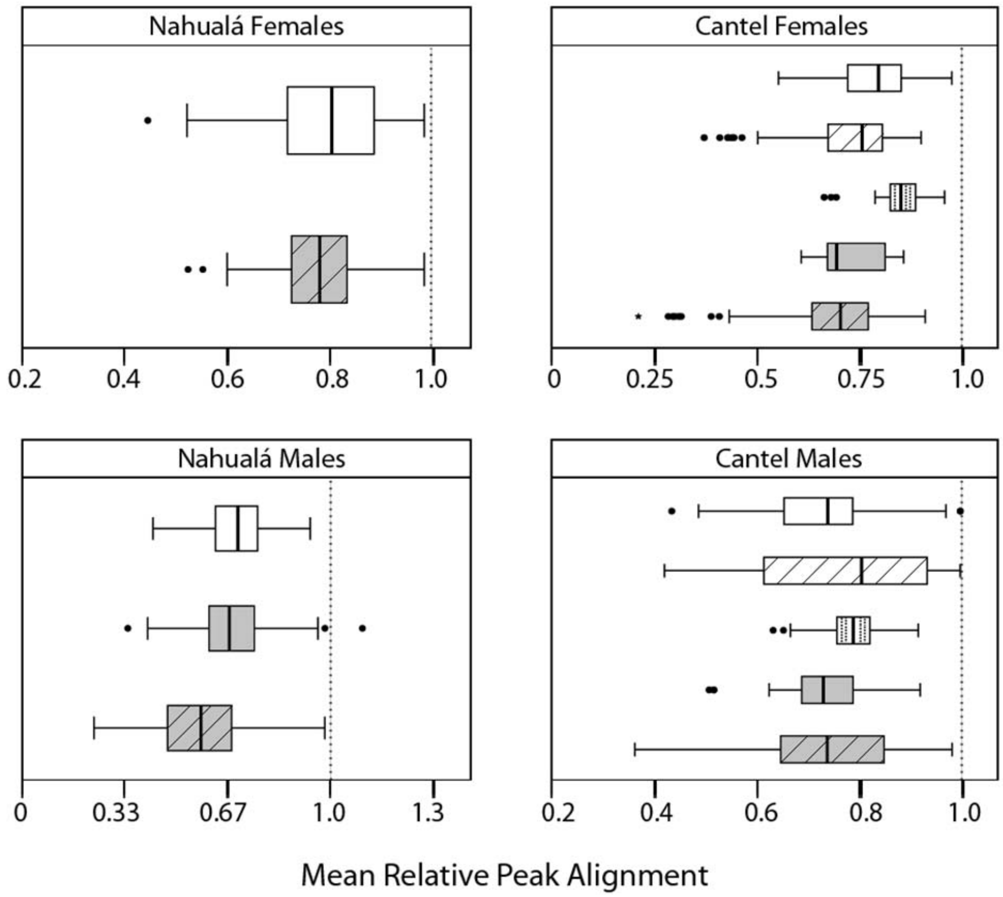


Figure 6.18: Box plots of mean relative peak alignment of the tonic syllable in contrastive focus for all speaker groups: K'ichee' *are + fronted subject* (white), K'ichee' *in situ* (white with diagonal lines), K'ichee' *are + in situ* (vertical lines) Spanish clefted (gray), Spanish *in situ* (gray with diagonal lines). A lower number indicates an earlier peak and the dotted line defines a relative peak alignment score of 1.0, i.e., the end of the tonic syllable.

The results of the Linear Mixed Model reveal a significant main effect of Language, Gender, and Dialect. As seen in the K'ichee' data presented in Chapter 4 and in the Spanish data presented in Chapter 5, males tend to have earlier peaks in both languages than females. The main effect of Dialect, which shows that Nahualá bilinguals tend to have earlier peaks in both languages than Cantel bilinguals, is in line with the findings in broad focus and previous research among this population (Baird, submitted). The pairwise comparisons indicate that there are no significant differences in the alignment of the pitch peak between similar syntactic structures, e.g. K'ichee' *in situ* and Spanish *in situ*, and that the only significant cross-language differences are between conditions that differ in syntactic structure and for the K'ichee' *are + in situ* structure, which had a later peak than the two Spanish structures. The significant Language*Gender interaction indicates that, even though males have overall earlier peaks than females, their peaks in the K'ichee' *are + fronted subject* condition were even earlier than the females' when compared to the peak alignment in the other conditions.

| Individual Speaker ANOVAs- Contrastive Focus Peak Alignment | | | | | |
|---|---|---|---|---|---|
| NF1 | **NF2** | NF3 | **NF4** | NF5 | NF6 |
| $F_{(1, 72)}$ = .449, *p* = .505, n.s. | **$F_{(1, 74)}$ = 12.515, *p* < .01** | $F_{(1, 72)}$ = .11, *p* = .741, .ns. | **$F_{(1, 72)}$ = 32.276, *p* < .001** | $F_{(1, 72)}$ = .744, *p* = .391, n.s. | $F_{(1, 70)}$ = .529, *p* = .474, n.s. |
| **NM1*** | **NM2** | NM3 | NM4* | **NM5** | NM6 |
| **$F_{(2, 77)}$ = 19.002, *p* < .001** | **$F_{(1, 78)}$ = 33.211, *p* < .001** | $F_{(1, 73)}$ = .365, *p* = .548, n.s. | $F_{(2, 72)}$ = 2.179, *p* = .144, n.s. | **$F_{(1, 71)}$ = 41.398, *p* < .001** | $F_{(1, 73)}$ = 1.263, *p* = .254, n.s. |
| **CF1*** | CF2* | CF3 | **CF4*** | **CF5*** | **CF6** |
| **$F_{(2, 64)}$ = 12.703, *p* < .001** | $F_{(2, 77)}$ = 1.282, *p* = .283, n.s. | $F_{(1, 65)}$ = 3.511, *p* = .072, n.s. | **$F_{(2, 71)}$ = 7.163, *p* < .01** | **$F_{(2, 72)}$ = 4.883, *p* < .01** | **$F_{(1, 69)}$ = 54.726, *p* < .001** |
| CM1 | **CM2*** | CM3 | CM4* | CM5 | CM6 |
| $F_{(1, 69)}$ = .938, *p* = .336, n.s. | **$F_{(3, 73)}$ = 6.183, *p* < .01** | $F_{(1, 63)}$ = .313, *p* = .578, n.s. | $F_{(2, 68)}$ = 2.508, *p* = .089, n.s. | $F_{(1, 71)}$ = .109, *p* = .743, n.s. | $F_{(1, 76)}$ = .086, *p* = .77, n.s. |

Table 6.35: Results from the ANOVAs of contrastive focus peak alignment for all 24 speakers; significant differences are in bold and the asterisk indicates that the speaker produced more than two types of syntactic structure for contrastive focus and, where there is a significant main effect, is further analyzed in Table 6.36.

The results of the individual speaker analyses presented in Table 6.35 parallel the results of the group analyses. Although 10 of the 24 bilinguals produced significantly different peak alignments in Spanish and K'ichee', the pairwise comparisons in Table 6.36 demonstrate that 5 of these speakers only produced these significant cross-language differences when the syntactic structures of contrastive focus were different. Furthermore, the other 5 speakers did not produce the same syntactic structure in both languages; in all 5 cases, the comparison was between tokens of K'ichee' *are + fronted subject* and Spanish *in situ* contrastive focus. Overall, these results are comparable to those of broad focus in Section 6.1.3; peak alignment demonstrates very few cross-language differences when compared to the other acoustic measures analyzed in this study and it may be quite susceptible to possible cases of convergence between Spanish and K'ichee', especially among similar syntactic structures of contrastive focus.

| Bonferroni Pairwise Comparisons- Contrastive Focus Peak Alignment | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM1 | **Spanish *in situ* < K'ichee' *are + fronted subject*** | **$p < .05$** |
| | Spanish clefted ≈ K'ichee' *are + fronted subject* | $p = 1.00$ |
| NM4 | -no significant main effect- | |
| CF1 | **Spanish *in situ* < K'ichee' *are + fronted subject*** | **$p < .01$** |
| | Spanish *in situ* ≈ K'ichee' *in situ* | $p = .107$ |
| CF2 | -no significant main effect- | |
| CF4 | Spanish *in situ* ≈ K'ichee' *in situ* | $p = 1.00$ |
| | **Spanish *in situ* < K'ichee' *are + in situ*** | **$p < .01$** |
| CF5 | **Spanish *in situ* < K'ichee' *are + fronted subject*** | **$p < .001$** |
| | Spanish *in situ* ≈ K'ichee' *in situ* | $p = 1.00$ |
| CM2 | Spanish *in situ* ≈ K'ichee' *are + fronted subject* | $p = 1.00$ |
| | Spanish *in situ* ≈ K'ichee' *in situ* | $p = .799$ |
| | Spanish clefted ≈ K'ichee' *are + fronted subject* | $p = .089$ |
| | **Spanish clefted > K'ichee' *in situ*** | **$p < .01$** |
| CM4 | -no significant main effect- | |

Table 6.36: Bonferroni cross-language pairwise comparisons of contrastive focus peak alignment for speakers that produced more than two types of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

### 6.2.4 Valley Height

The results of Contrastive Focus Valley Alignment, presented in Tables 6.37-6.39 and illustrated in Figure 6.19, indicate a significant main effect of Language and Gender. Again, females had higher overall valleys than males. The pairwise comparisons of Language demonstrate that Spanish *in situ* tokens had the lowest valley and that Spanish clefted tokens had a lower valley than K'ichee' *are + fronted subject* tokens.

| Means (SD) Contrastive Focus Valley Height (st) | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 91.3 (2.0) | 82.1 (2.6) | 86.8 (4.8) | 86.6 (5.5) |
| K'ichee' In Situ | 86.0 (4.9) | 90.6 (6.1) | 81.6 (5.7) | - | 86.0 (4.9) |
| K'ichee' Are + Fronted Subject | 87.4 (4.5) | 91.7 (4.4) | 81.7 (2.8) | 87.4 (4.2) | 87.4 (4.4) |
| K'ichee' Are + In Situ | 86.9 (7.2) | 91.1 (8.1) | 82.9 (4.4) | - | 86.9 (7.2) |
| Spanish In Situ | 83.9 (3.8) | 87.7 (3.6) | 81.2 (3.6) | 86.1 (3.5) | 83.8 (5.0) |
| Spanish Clefted | 86.5 (5.2) | 91.2 (6.0) | 81.8 (3.5) | 86.3 (3.5) | 86.4 (4.5) |

Table 6.37: Mean (SD) of Contrastive Focus Valley Height (st) in both languages.

| Linear Mixed Model- Contrastive Focus Valley Height | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **80.8 (.88)** | **$F_{(1, 32.144)} = 1611.705$, $p < .001$** | **78.9** | **82.6** |
| **Language** | **2.1 (.42)** | **$F_{(4, 1748.026)} = 4.073$, $p < .01$** | **1.3** | **2.9** |
| **Gender** | **9.9 (.50)** | **$F_{(1, 70.625)} = 188.439$, $p < .001$** | **8.9** | **11.0** |
| Dialect | -.1 (.48) | $F_{(1, 24.417)} = 2.544$, $p = .124$, n.s. | -1.1 | .88 |
| Age | .01 (.02) | $F_{(1, 38.451)} = .000$, $p = .991$, n.s. | -.02 | .05 |
| **Language * Gender** | **1.9 (.39)** | **$F_{(4, 1744.95)} = 28.968$, $p < .001$** | **1.2** | **2.7** |
| **Language * Dialect** | **2.2 (.55)** | **$F_{(2, 1744.082)} = 8.283$, $p < .001$** | **1.1** | **3.3** |
| Language * Age | -.02 (.02) | $F_{(4, 1747.852)} = 1.232$, $p = .295$, n.s. | -.05 | .02 |
| Random Effects | | | | |
| Residual | 3.684 (.1252) | - | | - |
| Speaker | 1.215 (.4036) | - | | - |
| Token | .0000 (.0000) | - | | - |
| Model Information Criteria (BIC) = 7455.338 | | | | |

Table 6.38: Results of Linear Mixed Model of Contrastive Focus Valley Height: significant results are in bold.

| Bonferroni Pairwise Comparisons- Valley Height | |
|---|---|
| Comparison | Significance |
| **K'ichee' *in situ* ≈ Spanish *in situ*** | ***p* < .05** |
| K'ichee' *in situ* ≈ Spanish clefted | *p* = 1.00 |
| **K'ichee' *are* + *fronted subject* > Spanish *in situ*** | ***p* < .001** |
| **K'ichee' *are* + *fronted subject* > Spanish clefted** | ***p* < .001** |
| **K'ichee' *are* + *in situ* > Spanish *in situ*** | ***p* < .01** |
| K'ichee' *are* + *in situ* ≈ Spanish clefted | *p* = 1.00 |

Table 6.39: Results of Bonferroni pairwise cross-language comparisons of Language of Contrastive Focus Valley Height: significant results are in bold.

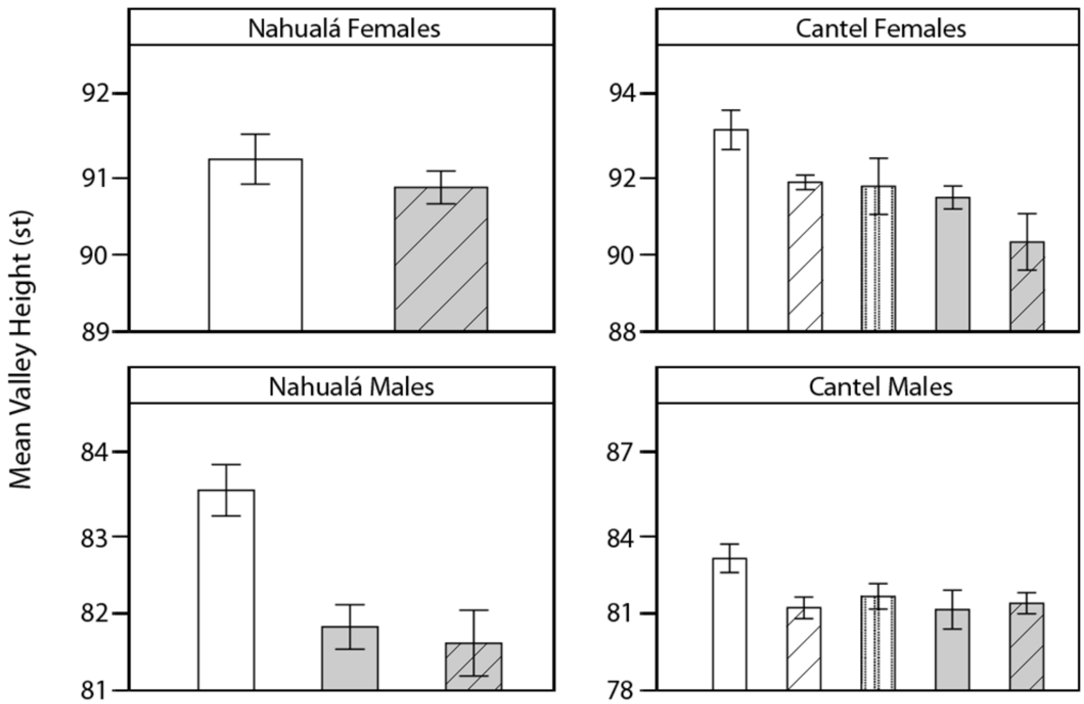


Figure 6.19: Bar graphs of mean valley height (st) of the tonic syllable in contrastive focus for all speaker groups: K'ichee' *are + fronted subject* (white), K'ichee' *in situ* (white with diagonal lines), K'ichee' *are + in situ* (vertical lines) Spanish clefted (gray), Spanish *in situ* (gray with diagonal lines). 95% confidence interval bars included.

The significant Language*Dialect interaction demonstrates that, when compared to the height of the valley in K'ichee' *are + fronted subject* tokens, Cantel bilinguals mark Spanish *in situ* tokens with a lower valley. The significant Language*Gender interaction only involves within-language interactions that were already reported in Chapters 4 and 5 and are not pertinent to the discussion of cross-language differences.

The individual speaker analyses in Tables 6.40 and 6.41 demonstrate that 15 of 24 bilinguals have significantly different valley heights in Spanish and K'ichee'. Of these 15, 14 have higher valleys in K'ichee' than in Spanish, the exception being speaker CF2. These results are similar to the group results and the results of valley height in broad focus; overall, though some speakers do not demonstrate any cross-language differences, there is a tendency for speakers to have higher valleys in K'ichee' than in Spanish.

| Individual Speaker ANOVAs- Contrastive Focus Valley Height | | | | | |
|---|---|---|---|---|---|
| NF1 | NF2 | NF3 | **NF4** | **NF5** | NF6 |
| $F_{(1, 72)}$ = 2.225, $p$ = .140, n.s. | $F_{(1, 74)}$ = 2.461, $p$ = .121, n.s. | $F_{(1, 72)}$ = .592, $p$ = .444, n.s. | **$F_{(1, 72)}$ = 32.276, $p < .001$** | **$F_{(1, 72)}$ = 27.742, $p < .001$** | $F_{(1, 70)}$ = .878, $p$ = .352, n.s. |
| **NM1*** | **NM2** | NM3 | NM4* | NM5 | **NM6** |
| **$F_{(2, 77)}$ = 151.394, $p < .001$** | **$F_{(1, 78)}$ = 47.509, $p < .001$** | $F_{(1, 73)}$ = 1.135, $p$ = .29, n.s. | $F_{(2, 72)}$ = 2.087, $p$ = .131, n.s. | $F_{(1, 71)}$ = 3.345, $p$ = .072, n.s. | **$F_{(1, 73)}$ = 50.827, $p < .001$** |
| **CF1*** | **CF2*** | CF3 | CF4* | **CF5*** | **CF6** |
| **$F_{(2, 64)}$ = 22.245, $p < .001$** | **$F_{(2, 77)}$ = 24.871, $p < .001$** | $F_{(1, 65)}$ = 3.052, $p$ = .086, n.s. | $F_{(2, 71)}$ = .929, $p$ = .4, n.s. | **$F_{(2, 72)}$ = 11.607, $p < .001$** | **$F_{(1, 69)}$ = 46.188, $p < .001$** |
| **CM1** | **CM2*** | **CM3** | **CM4*** | **CM5** | **CM6** |
| **$F_{(1, 69)}$ = 17.024, $p < .001$** | **$F_{(3, 73)}$ = 19.228, $p < .001$** | **$F_{(1, 63)}$ = 7.138, $p < .01$** | **$F_{(2, 68)}$ = 6.194, $p < .01$** | **$F_{(1, 71)}$ = 31.114, $p < .001$** | **$F_{(1, 76)}$ = 36.439, $p < .001$** |

Table 6.40: Results from the ANOVAs of contrastive focus valley height for all 24 speakers; significant differences are in bold and the asterisk indicates that the speaker produced more than two types of syntactic structure for contrastive focus and, where there is a significant main effect, is further analyzed in Table 6.41.

| Bonferroni Pairwise Comparisons- Contrastive Focus Valley Height | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM1 | **Spanish *in situ* < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | **Spanish clefted < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| NM4 | -no significant main effect- | |
| CF1 | **Spanish *in situ* < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = .132 |
| CF2 | **Spanish *in situ* > K'ichee' *are* + *fronted subject*** | ***p* < .01** |
| | **Spanish *in situ* > K'ichee' *in situ*** | ***p* < .001** |
| CF4 | -no significant main effect- | |
| CF5 | **Spanish *in situ* < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = .769 |
| CM2 | **Spanish *in situ* < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = .598 |
| | **Spanish clefted < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | Spanish clefted ≈ K'ichee' *in situ* | *p* = .81 |
| CM4 | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = .42 |
| | **Spanish *in situ* > K'ichee' *are* + *in situ*** | ***p* < .05** |

Table 6.41: Bonferroni cross-language pairwise comparisons of contrastive focus valley height for the speakers that produced more than two types of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

### 6.2.5 Valley Alignment

Tables 6.42-6.44 reveal a main effect of Language and Gender. As reported in the previous two chapters, males tend to have earlier valleys than females in both languages. The pairwise comparison of Language only reveals one significant cross-language comparison: Spanish *in situ* tokens had earlier valleys than K'ichee' *are + in situ* tokens. All three interactions were significant but only reveal findings that were already discussed in Chapters 4 and 5: females, younger speakers, and Cantel bilinguals tended to mark *in situ* tokens with earlier valleys, when compared to the valley alignment in other conditions, than males, older speakers, and Nahualá bilinguals. Again, Nahualá males tended to align contrastive focus valleys in both languages near the onset of the tonic syllable, as seen in Figure 6.20.

| Means (SD) Contrastive Focus Valley Alignment | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | .38 (.15) | .21 (.20) | .30 (.20) | .35 (.18) |
| K'ichee' In Situ | .32 (.14) | .37 (.16) | .23 (.14) | - | .32 (.14) |
| K'ichee' Are + Fronted Subject | .32 (.16) | .44 (.14) | .24 (.14) | .26 (.14) | .35 (.14) |
| K'ichee' Are + In Situ | .33 (.16) | .39 (.14) | .25 (.16) | - | .33 (.16) |
| Spanish In Situ | .25 (.16) | .35 (.21) | .17 (.18) | .31 (.28) | .26 (.19) |
| Spanish Clefted | .29 (.19) | .36 (.21) | .24 (.17) | .35 (.29) | .27 (.22) |

Table 6.42: Mean (SD) of Contrastive Focus Valley Alignment in both languages.

| Linear Mixed Model- Contrastive Focus Valley Alignment | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **.23 (.12)** | **$F_{(1, 20.838)} = 7.902$, $p < .05$** | **.02** | **.48** |
| **Language** | **-.19 (.03)** | **$F_{(4, 1736.122)} = 16.021$, $p < .001$** | **-.26** | **-.13** |
| **Gender** | **.15 (.07)** | **$F_{(1, 22.896)} = 5.046$, $p < .05$** | **.01** | **.29** |
| Dialect | .07 (.07) | $F_{(1, 20.325)} = 3.324$, $p = .083$, n.s. | -.07 | .21 |
| Age | -.001 (.002) | $F_{(1, 21.222)} = .040$, $p = .844$, n.s. | -.006 | .004 |
| **Language * Gender** | **.05 (.02)** | **$F_{(4, 1736.48)} = 2.765$, $p < .05$** | **.02** | **.08** |
| **Language * Dialect** | **.06 (.01)** | **$F_{(2, 1737.173)} = 24.043$, $p < .001$** | **.04** | **.08** |
| **Language * Age** | **.005 (.001)** | **$F_{(4, 1735.668)} = 7.483$, $p < .05$** | **.004** | **.006** |
| Random Effects | | | | |
| Residual | .0059 (.0002) | - | | - |
| Speaker | .0261 (.0082) | - | | - |
| Token | .0000 (.0000) | - | | - |
| Model Information Criteria (BIC) = -3767.636 | | | | |

Table 6.43: Results of Linear Mixed Model of Contrastive Focus Valley Alignment: significant results are in bold.

| Bonferroni Pairwise Comparisons- Valley Alignment | |
|---|---|
| Comparison | Significance |
| K'ichee' *in situ* ≈ Spanish *in situ* | $p = .868$ |
| K'ichee' *in situ* ≈ Spanish clefted | $p = 1.00$ |
| K'ichee' *are + fronted subject* ≈ Spanish *in situ* | $p = .665$ |
| K'ichee' *are + fronted subject* ≈ Spanish clefted | $p = .801$ |
| **K'ichee' *are + in situ* > Spanish *in situ*** | **$p < .05$** |
| K'ichee' *are + in situ* ≈ Spanish clefted | $p = .565$ |

Table 6.44: Results of Bonferroni pairwise cross-language comparisons of Language of Contrastive Focus Valley Alignment: significant results are in bold.

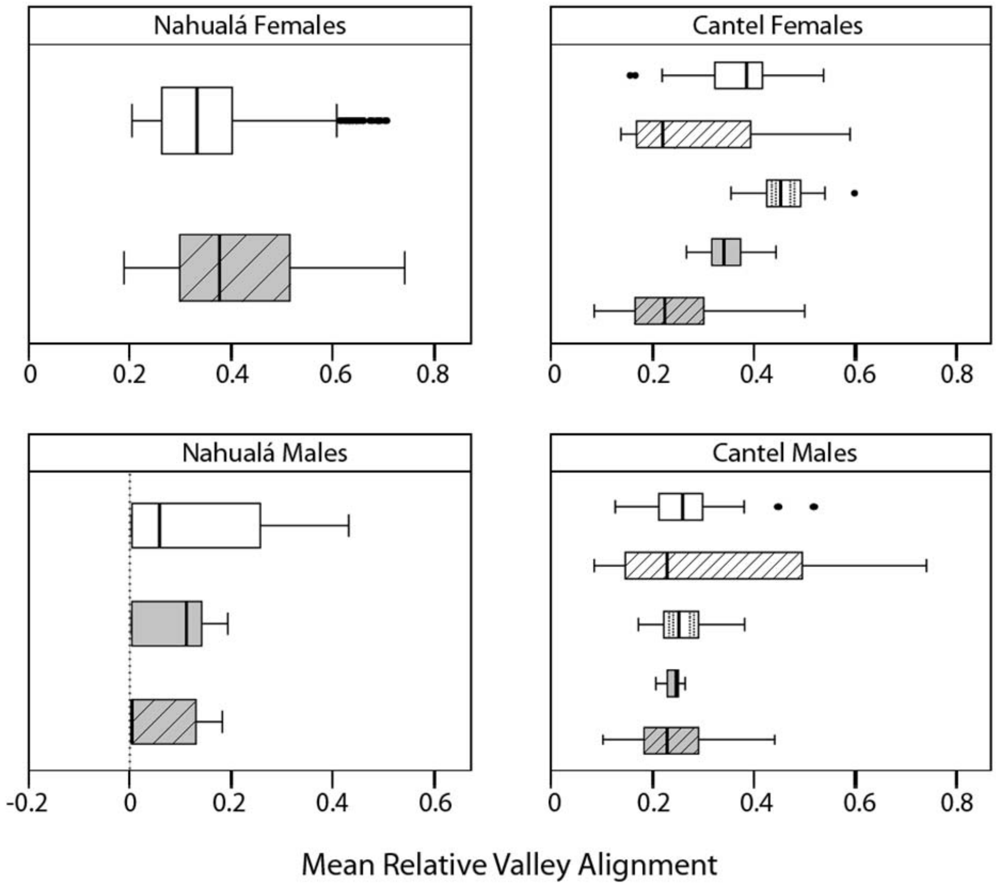


Figure 6.20: Box plots of mean relative valley alignment of the tonic syllable in contrastive focus for all speaker groups: K'ichee' *are + fronted subject* (white), K'ichee' *in situ* (white with diagonal lines), K'ichee' *are + in situ* (vertical lines) Spanish clefted (gray), Spanish *in situ* (gray with diagonal lines). A lower number indicates an earlier valley and the dotted line in Nahualá males designates a relative peak alignment score of 0, i.e., the beginning of the tonic syllable.

The results of the individual speaker analyses are presented in Table 6.45 and the corresponding pairwise comparisons in Table 6.46. These results demonstrate that 13 of 24 bilinguals produced significantly different valley alignments in Spanish and K'ichee'. However, of these 13 speakers, only 2 produced significantly different valley alignments in similar syntactic structures: speakers NM1 and NM4. With the exception of these two speakers, the bilinguals analyzed in the pairwise comparisons only demonstrated differences in valley alignment across different syntactic structures of contrastive focus (see Table 6.46). These individual speaker and group results are similar to those of peak alignment, suggesting that the alignment of the valley in the Spanish and K'ichee' of these bilinguals is similar across pragmatic conditions even though there may be some between-group differences, such as the early alignment of the valley near the onset of the tonic syllable by the Nahualá males in both languages.

| Individual Speaker ANOVAs- Contrastive Focus Valley Alignment | | | | | |
|---|---|---|---|---|---|
| NF1 | NF2 | **NF3** | **NF4** | **NF5** | NF6 |
| $F_{(1, 72)}$<br>= .047,<br>*p* = .828, n.s. | $F_{(1, 74)}$<br>= .532,<br>*p* = .468, n.s. | **$F_{(1, 72)}$<br>= .44.163,<br>*p* < .001** | **$F_{(1, 72)}$<br>= 72.65,<br>*p* < .001** | **$F_{(1, 72)}$<br>= 17.674,<br>*p* < .001** | $F_{(1, 70)}$<br>= .000,<br>*p* = .989, n.s. |
| **NM1*** | **NM2** | NM3 | **NM4*** | **NM5** | NM6 |
| **$F_{(2, 77)}$<br>= 45.683,<br>*p* < .001** | **$F_{(1, 78)}$<br>= 69.911,<br>*p* < .001** | $F_{(1, 73)}$<br>= .423,<br>*p* = .518, n.s. | **$F_{(2, 72)}$<br>= 94.181,<br>*p* < .001** | **$F_{(1, 71)}$<br>= 17.022,<br>*p* < .001** | $F_{(1, 73)}$<br>= 1.259,<br>*p* = .266, n.s. |
| **CF1*** | **CF2*** | CF3 | CF4* | **CF5*** | **CF6** |
| **$F_{(2, 64)}$<br>= 43.875,<br>*p* < .001** | **$F_{(2, 77)}$<br>= 75.921,<br>*p* < .001** | $F_{(1, 65)}$<br>= .405,<br>*p* = .527, n.s. | $F_{(2, 71)}$<br>= 2.071,<br>*p* = .148, n.s. | **$F_{(2, 72)}$<br>= 21.015,<br>*p* < .001** | **$F_{(1, 69)}$<br>= 194.51,<br>*p* < .001** |
| **CM1** | **CM2*** | CM3 | CM4* | CM5 | CM6 |
| **$F_{(1, 69)}$<br>= 46.074,<br>*p* < .001** | **$F_{(3, 73)}$<br>= 132.864,<br>*p* < .001** | $F_{(1, 63)}$<br>= .023,<br>*p* = .88, n.s. | $F_{(2, 68)}$<br>= 2.678,<br>*p* = .106, n.s. | $F_{(1, 71)}$<br>= .255,<br>*p* = .615, n.s. | $F_{(1, 76)}$<br>= .844,<br>*p* , .35, n.s. |

Table 6.45: Results from the ANOVAs of contrastive focus valley alignment for all 24 speakers; significant differences are in bold and the asterisk indicates that the speaker produced more than two types of syntactic structure for contrastive focus and, where there is a significant main effect, is further analyzed in Table 6.46.

| Bonferroni Pairwise Comparisons- Contrastive Focus Peak Height | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM1 | **Spanish *in situ* < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | **Spanish clefted < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| NM4 | **Spanish *in situ* < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | **Spanish clefted < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| CF1 | **Spanish *in situ* < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = .677 |
| CF2 | **Spanish *in situ* < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | Spanish clefted ≈ K'ichee' *are* + *fronted subject* | *p* = .677 |
| CF4 | -no significant main effect- | |
| CF5 | **Spanish *in situ* < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = 1.00 |
| CM2 | **Spanish *in situ* < K'ichee' *are* + *fronted subject*** | ***p* < .001** |
| | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = 1.00 |
| | Spanish clefted ≈ K'ichee' *are* + *fronted subject* | *p* = 1.00 |
| | **Spanish clefted > K'ichee' *in situ*** | ***p* < .001** |
| CM4 | -no significant main effect- | |

Table 6.46: Bonferroni cross-language pairwise comparisons of contrastive focus valley alignment for the speakers that produced more than two types of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

### 6.2.6 Rise

The overall results of rise of the tonic syllable in contrastive focus are presented in Tables 6.47 and 6.48 and shown in Figure 6.21. According to the Linear Mixed Model, there are no significant main effects. There are, however, two significant interactions. The Language*Gender interaction shows that females had a smaller overall rise in Spanish clefted tokens, when compared to the rise in the other conditions, than males: again, it should be noted that there was only one female speaker, CF2, who produced more than one token of Spanish clefted contrastive focus. The Language*Dialect interaction reveals that, when compared to the other conditions, Cantel bilinguals had a greater overall rise in Spanish *in situ* tokens than bilinguals from Nahualá.

| Means (SD) Contrastive Focus Rise (st) | | | | | | |
|---|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | 4.1 (2.6) | 4.4 (2.6) | 4.3 (2.6) | 4.4 (2.6) |
| K'ichee' In Situ | 4.5 (2.8) | 4.7 (5.2) | 4.8 (3.8) | - | 4.5 (2.8) |
| K'ichee' Are + Fronted Subject | 4.4 (2.8) | 4.4 (3.6) | 4.4 (5.3) | 4.3 (3.6) | 4.3 (4.0) |
| K'ichee' Are + In Situ | 3.7 (2.6) | 3.7 (3.8) | 3.7 (5.8) | - | 3.7 (2.6) |
| Spanish In Situ | 4.5 (2.5) | 4.1 (3.3) | 4.8 (3.4) | 4.2 (3.3) | 4.7 (3.2) |
| Spanish Clefted | 4.6 (2.2) | 3.7 (7.2) | 4.6 (4.3) | 4.6 (5.8) | 4.4 (5.0) |

Table 6.47: Mean (SD) of Contrastive Focus Rise (st) in both languages.

| Linear Mixed Model- Contrastive Focus Rise | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **4.5 (.87)** | **$F_{(1, 41.184)} = 6.983$, $p < .01$** | **2.7** | **6.3** |
| Language | .17 (.53) | $F_{(4, 1727.504)} = .568$, $p = .686$, n.s. | -.86 | 1.2 |
| Gender | -.78 (.98) | $F_{(1, 118.418)} = .247$, $p = .62$, n.s. | -1.5 | -.23 |
| Dialect | .37 (.47) | $F_{(1, 26.872)} = .668$, $p = .421$, n.s. | -.60 | 1.3 |
| Age | .01 (.02) | $F_{(1, 53.361)} = .044$, $p = .834$, n.s. | -.03 | .04 |
| **Language * Gender** | **1.7 (.49)** | **$F_{(4, 1712.775)} = 3.592$, $p < .01$** | **.02** | **.08** |
| **Language * Dialect** | **-2.3 (.69)** | **$F_{(2, 1699.973)} = 5.701$, $p < .01$** | **-3.6** | **-.91** |
| Language * Age | .003 (.02) | $F_{(4, 1733.909)} = .500$, $p = .736$, n.s. | -.04 | .04 |
| Random Effects | | | | |
| Residual | 5.856 (.1989) | - | | - |
| Speaker | 1.097 (.3817) | - | | - |
| Token | .0000 (.0000) | - | | - |
| Model Information Criteria (BIC) = 8257.217 | | | | |

Table 6.48: Results of Linear Mixed Model of Contrastive Focus Rise: significant results are in bold.

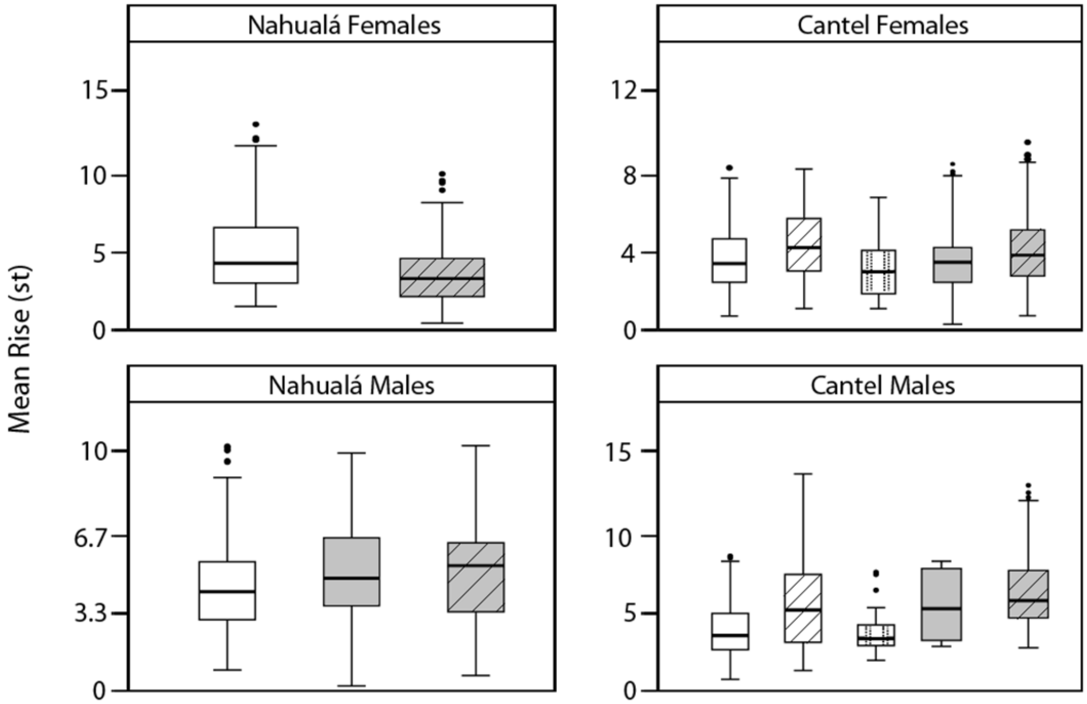


Figure 6.21: Box plots of mean rise (st) of the tonic syllable in contrastive focus: K'ichee' *are + fronted subject* (white), K'ichee' *in situ* (white with diagonal lines), K'ichee' *are + in situ* (vertical lines) Spanish clefted (gray), Spanish *in situ* (gray with diagonal lines).

The individual speaker results presented in Table 6.49 reveal between-speaker variation in Rise. As shown, 13 of 24 bilinguals demonstrated significant differences in Rise between Spanish and K'ichee'. The pairwise comparisons presented in Table 6.50 demonstrate that 4 of these speakers have significantly different rises only across different syntactic structures of contrastive focus. Of the remaining 9 speakers that demonstrated a significant difference, 3 had significantly greater rises in Spanish, speakers NM1, NM5, and NM6, 5 had significantly greater rises in K'ichee', speakers NF2, NM2, CF3, CF6, and CM5, and one speaker, CF1, had a greater rise in K'ichee' *in situ* than in Spanish *in situ*, but a greater rise in Spanish *in situ* than in K'ichee' *are +*

*fronted subject*. Overall, these results suggest that there is significant variation in the amount of rise given to a contrastive focus constituent in both languages of these bilinguals.

| Individual Speaker ANOVAs- Contrastive Focus Rise | | | | | |
|---|---|---|---|---|---|
| NF1 | **NF2** | NF3 | NF4 | NF5 | NF6 |
| $F_{(1, 72)}$ = .421, $p$ = .519, n.s. | **$F_{(1, 74)}$ = 11.154, $p$ < .001** | $F_{(1, 72)}$ = .79, $p$ = .377, n.s. | $F_{(1, 72)}$ = .069, $p$ = .793, n.s. | $F_{(1, 72)}$ = .006, $p$ = .941, n.s. | $F_{(1, 70)}$ = .567, $p$ = .454, n.s. |
| **NM1*** | **NM2** | NM3 | **NM4*** | **NM5** | **NM6** |
| **$F_{(2, 77)}$ = 9.729, $p$ < .001** | **$F_{(1, 78)}$ = 10.719, $p$ < .001** | $F_{(1, 73)}$ = 1.95, $p$ = .167, n.s. | **$F_{(2, 72)}$ = 14.123, $p$ < .001** | **$F_{(1, 71)}$ = 10.288, $p$ < .01** | **$F_{(1, 73)}$ = 8.111, $p$ < .01** |
| **CF1*** | **CF2*** | **CF3** | CF4* | **CF5*** | **CF6** |
| **$F_{(2, 64)}$ = 19.848, $p$ < .001** | **$F_{(2, 77)}$ = 12.063, $p$ < .001** | **$F_{(1, 65)}$ = 5.552, $p$ < .05** | $F_{(2, 71)}$ = .608, $p$ = .547, n.s. | **$F_{(2, 72)}$ = 5.694, $p$ < .01** | **$F_{(1, 69)}$ = 6.006, $p$ < .05** |
| CM1 | **CM2*** | CM3 | CM4* | **CM5** | CM6 |
| $F_{(1, 69)}$ = .669, $p$ = .416, n.s. | **$F_{(3, 73)}$ = 5.226, $p$ < .01** | $F_{(1, 63)}$ = .089, $p$ = .915, n.s. | $F_{(2, 68)}$ = 1.108, $p$ = .336, n.s. | **$F_{(1, 71)}$ = 10.286, $p$ < .01** | $F_{(1, 76)}$ = .475, $p$ , .493, n.s. |

Table 6.49: Results from the ANOVAs of contrastive focus rise for all 24 speakers; significant differences are in bold and the asterisk indicates that the speaker produced more than two types of syntactic structure for contrastive focus and, where there is a significant main effect, is further analyzed in Table 6.50.

| Bonferroni Pairwise Comparisons- Contrastive Focus Rise | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM1 | **Spanish *in situ* > K'ichee' *are + fronted subject*** | ***p* < .001** |
| | **Spanish clefted > K'ichee' *are + fronted subject*** | ***p* < .05** |
| NM4 | **Spanish *in situ* > K'ichee' *are + fronted subject*** | ***p* < .001** |
| | Spanish clefted ≈ K'ichee' *are + fronted subject* | *p* = 1.00 |
| CF1 | **Spanish *in situ* > K'ichee' *are + fronted subject*** | ***p* < .001** |
| | **Spanish *in situ* < K'ichee' *in situ*** | ***p* < .01** |
| CF2 | **Spanish *in situ* > K'ichee' *are + fronted subject*** | ***p* < .001** |
| | Spanish clefted ≈ K'ichee' *are + fronted subject* | *p* = 1.00 |
| CF4 | -no significant main effect- | |
| CF5 | **Spanish *in situ* > K'ichee' *are + fronted subject*** | ***p* < .05** |
| | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = 1.00 |
| CM2 | **Spanish *in situ* > K'ichee' *are + fronted subject*** | ***p* < .05** |
| | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = .129 |
| | Spanish clefted ≈ K'ichee' *are + fronted subject* | *p* = 1.00 |
| | **Spanish clefted < K'ichee' *in situ*** | ***p* < .01** |
| CM4 | -no significant main effect- | |

Table 6.50: Bonferroni cross-language pairwise comparisons of contrastive focus rise for the speakers that produced more than two types of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

### 6.2.7 Slope

The means and results of Contrastive Focus Slope are presented in Tables 6.51-6.53 and Figure 6.22. There is only a main effect of Language: pairwise comparisons further demonstrate that this cross-language difference is only found between Spanish *in situ* tokens and K'ichee' *are + in situ* tokens, the former had a significantly steeper slope.

| Means (SD) Contrastive Focus Slope | | | | | |
|---|---|---|---|---|---|
| | | Gender | | Dialect | |
| Pragmatic Condition | Overall | Female | Male | Nahualá | Cantel |
| Overall | - | .43 (.35) | .38 (.34) | .40 (.38) | .38 (.34) |
| K'ichee' In Situ | .39 (.47) | .49 (.34) | .38 (.27) | - | .39 (.47) |
| K'ichee' Are + Fronted Subject | .39 (.66) | .48 (.27) | .33 (.44) | .35 (.34) | .40 (.45) |
| K'ichee' Are + In Situ | .31 (.47) | .33 (.44) | .32 (.37) | - | .31 (.47) |
| Spanish In Situ | .49 (.43) | .53 (.88) | .46 (.38) | .52 (.78) | .45 (.19) |
| Spanish Clefted | .36 (.27) | .38 (.81) | .35 (.43) | .34 (.29) | .37 (.22) |

Table 6.51: Mean (SD) of Contrastive Focus Slope in both languages.

| Linear Mixed Model- Contrastive Focus Slope | | | | |
|---|---|---|---|---|
| | | | 95% CI | |
| Source | Estimate (SE) | Significance | Lower | Upper |
| **Intercept** | **.54 (.27)** | **$F_{(1, 57.855)} = 3.878, p < .05$** | **.006** | **1.08** |
| **Language** | **-.41 (.19)** | **$F_{(4, 1647.167)} = 3.336, p < .01$** | **-.79** | **-.02** |
| Gender | .26 (.15) | $F_{(1, 208.81)} = .969, p = .326$, n.s. | -.05 | .57 |
| Dialect | .14 (.14) | $F_{(1, 30.895)} = .218, p = .644$, n.s. | -.15 | .43 |
| Age | -.004 (.005) | $F_{(1, 81.38)} = .031, p = .86$, n.s. | -.014 | .006 |
| Language * Gender | .27 (.31) | $F_{(4, 1603.579)} = .946, p = .437$, n.s. | -.34 | .88 |
| Language * Dialect | -.17 (.11) | $F_{(2, 1560.277)} = 2.255, p = .105$, n.s. | -.39 | .05 |
| Language * Age | .007 (.007) | $F_{(4, 1671.639)} = 1.426, p = .223$, n.s. | -.008 | .021 |
| Random Effects | | | | |
| Residual | .8288 (.0282) | - | | - |
| Speaker | .0891 (.0331) | - | | - |
| Token | .0015 (.0029) | - | | - |
| Model Information Criteria (BIC) = 4822.164 | | | | |

Table 6.52: Results of Linear Mixed Model of Contrastive Focus Slope: significant results are in bold.

| Bonferroni Pairwise Comparisons- Slope | |
|---|---|
| Comparison | Significance |
| K'ichee' *in situ* ≈ Spanish *in situ* | $p = 1.00$ |
| K'ichee' *in situ* ≈ Spanish clefted | $p = 1.00$ |
| K'ichee' *are + fronted subject* ≈ Spanish *in situ* | $p = 1.00$ |
| K'ichee' *are + fronted subject* ≈ Spanish clefted | $p = 1.00$ |
| **K'ichee' *are + in situ* < Spanish *in situ*** | **$p < .001$** |
| K'ichee' *are + in situ* ≈ Spanish clefted | $p = 1.00$ |

Table 6.53: Results of Bonferroni pairwise cross-language comparisons of Language of Contrastive Focus Slope: significant results are in bold.

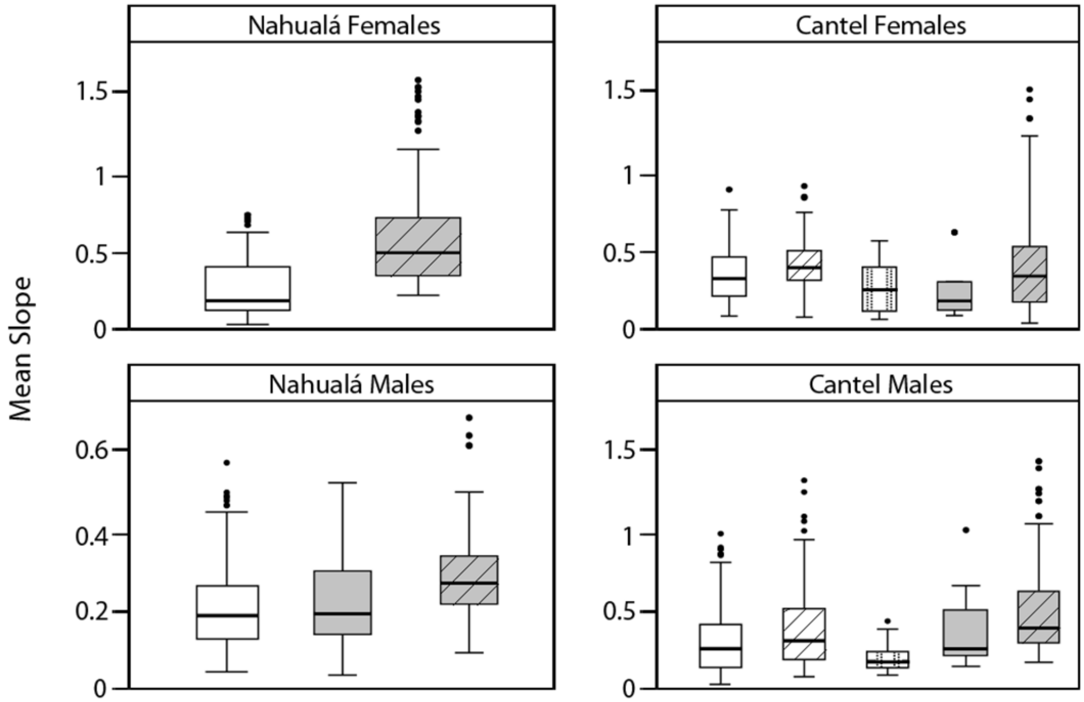


Figure 6.22: Box plots of mean slope of the tonic syllable in contrastive focus for all speaker groups: K'ichee' *are + fronted subject* (white), K'ichee' *in situ* (white with diagonal lines), K'ichee' *are + in situ* (vertical lines) Spanish clefted (gray), Spanish *in situ* (gray with diagonal lines). A higher number indicates a steeper slope.

The individual speaker analyses presented in Table 6.54 reveal that only nine of 24 bilinguals demonstrate a significant cross-language difference. As seen in Table 6.55, 2 speakers, NM4 and CM4, produced significant within-language differences only between different syntactic structures and didn't produce any cross-language differences. These results suggest that 17 of 24 speakers did not produce any significant differences between the slopes of Spanish and K'ichee' contrastive focus constituents. Of the 7 that did have a significant cross-language difference, only speaker CF5 produced this difference between similar syntactic structures. In contrast with the results for broad focus, these results indicate that the slope of the intonational contour associated with contrastive focus constituents tends to be similar in both languages of these bilinguals.

| Individual Speaker ANOVAs- Contrastive Focus Slope | | | | | |
|---|---|---|---|---|---|
| NF1 | **NF2** | NF3 | **NF4** | NF5 | **NF6** |
| $F_{(1, 72)}$ = .085, $p$ = .771, n.s. | **$F_{(1, 74)}$ = 5.933, $p < .05$** | $F_{(1, 72)}$ = .016, $p$ = .899, n.s. | **$F_{(1, 72)}$ = 63.234, $p < .001$** | $F_{(1, 72)}$ = .2.447, $p$ = .122, n.s. | **$F_{(1, 70)}$ = 7.135, $p < .01$** |
| NM1* | **NM2** | NM3 | **NM4*** | **NM5** | NM6 |
| $F_{(2, 77)}$ = .078, $p$ = .925, n.s. | **$F_{(1, 77)}$ = 6.616, $p < .05$** | $F_{(1, 73)}$ = 3.211, $p$ = .077, n.s. | **$F_{(2, 72)}$ = 5.528, $p < .01$** | **$F_{(1, 71)}$ = 74.68, $p < .001$** | $F_{(1, 73)}$ = .000, $p$ = .998, n.s. |
| CF1* | CF2* | CF3 | CF4* | **CF5*** | **CF6** |
| $F_{(2, 64)}$ = .653, $p$ = .524, n.s. | $F_{(2, 77)}$ = 1.146, $p$ = .323, n.s. | $F_{(1, 65)}$ = .866, $p$ = .355, n.s. | $F_{(2, 71)}$ = .654, $p$ = .523, n.s. | **$F_{(2, 72)}$ = 10.348, $p < .001$** | **$F_{(1, 69)}$ = 21.299, $p < .001$** |
| CM1 | **CM2*** | CM3 | **CM4*** | CM5 | CM6 |
| $F_{(1, 69)}$ = .075, $p$ = .785, n.s. | **$F_{(3, 73)}$ = 6.706, $p < .001$** | $F_{(1, 63)}$ = 1.068, $p$ = .305, n.s. | **$F_{(2, 68)}$ = 4.014, $p < .05$** | $F_{(1, 71)}$ = .705, $p$ = .404, n.s. | $F_{(1, 76)}$ = .014, $p$ , .906, n.s. |

Table 6.54: Results from the ANOVAs of contrastive focus slope for all 24 speakers; significant differences are in bold and the asterisk indicates that the speaker produced more than two types of syntactic structure for contrastive focus and, where there is a significant main effect, is further analyzed in Table 6.55.

| Bonferroni Pairwise Comparisons- Contrastive Focus Slope | | |
|---|---|---|
| Speaker | Comparison | Significance |
| NM1 | -no significant main effect- | |
| NM4 | Spanish *in situ* ≈ K'ichee' *are + fronted subject* | *p* = .27 |
| | Spanish clefted ≈ K'ichee' *are + fronted subject* | *p* = .753 |
| CF1 | -no significant main effect- | |
| CF2 | -no significant main effect- | |
| CF4 | -no significant main effect- | |
| CF5 | Spanish *in situ* ≈ K'ichee' *are + fronted subject* | *p* = 1.00 |
| | **Spanish *in situ* < K'ichee' *in situ*** | ***p* < .001** |
| CM2 | Spanish *in situ* ≈ K'ichee' *are + fronted subject* | *p* = 1.00 |
| | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = 1.00 |
| | Spanish clefted ≈ K'ichee' *are + fronted subject* | *p* = .06 |
| | **Spanish clefted < K'ichee' *in situ*** | ***p* < .01** |
| CM4 | Spanish *in situ* ≈ K'ichee' *in situ* | *p* = .084 |
| | Spanish *in situ* ≈ K'ichee' *are + in situ* | *p* = .063 |

Table 6.55: Bonferroni cross-language pairwise comparisons of contrastive focus slope for the speakers that produced more than two types of syntactic structure to mark contrastive focus and had a main effect. Significant results are in bold.

### 6.3 CORRELATIONS WITH BILINGUAL LANGUAGE DOMINANCE

Chapters 4 and 5 analyzed prosodic contrastive focus marking in K'ichee' and Spanish and the correlation between the degree of focus score for each acoustic measurement and the BLP language dominance score. The results revealed different correlations between peak height, valley height, and rise with bilingual language dominance in the different analyses. This section provides correlation analyses between possible degrees of convergence of the different acoustic measurements and the BLP language dominance score.

Similar to the degree of focus score used for the correlation analyses in Chapters 4 and 5, the degree of convergence score is calculated as the mean Spanish acoustic measurement minus the mean K'ichee' acoustic measurement for each particular acoustic feature being analyzed; a score closer to zero indicates that the particular acoustic feature is more similar in the Spanish and K'ichee' of the bilingual. With the exception of duration, these data were submitted to a series or Pearson correlation analyses (two-tailed). Duration was not included because of the dialectal differences between Nahualá and Cantel K'ichee' reported in Sections 6.1.1 and 6.2.1. However, since the data in Section 6.2 demonstrated that convergence between Spanish and K'ichee' is more likely in similar syntactic structures of contrastive focus and since the bilinguals in this study produced a variety of syntactic structures to mark contrastive focus, only the correlation analyses of broad focus utterances are reported in this section.[63]

In order to answer the research questions of whether Spanish-dominant, K'ichee'-dominant, or 'balanced' bilinguals are more likely to demonstrate convergence, two separate analyses were performed: (i) an analysis of the degree of convergence score and the BLP score to analyze correlations with Spanish- and K'ichee- dominance, and (ii) an analysis of the degree of convergence score and the absolute value of the BLP score to analyze correlations with bilinguals who are more balanced and those who are more dominant in either language. In the latter analysis, the direction of language dominance is removed, e.g. a score of K 73 becomes 73, a score of S 40 becomes 40, etc. The BLP scores are continuous, increasing from zero, and a lower score indicates that the bilingual is closer to being balanced, according to the BLP, between Spanish and K'ichee'. These two analyses are presented in the following subsections.

[63] Following the same threshold as Sections 4.3 and 5.3, only 7 speakers produced enough tokens of *in situ* contrastive focus and only 6 speakers produced enough tokens of syntactically marked contrastive focus in both languages to be included in the correlation analyses. Pearson correlation analyses (two-tailed) were run on these speakers for all of the acoustic measurements but they never revealed any significant results, which may in part be due to the low number of data points in the analyses.

### 6.3.1 Correlations with language dominant bilinguals

As seen in Table 6.56, there were no significant correlations between any acoustic measurement of the broad focus utterances and the BLP score. These results indicate that, among the bilinguals in this study, neither Spanish- nor K'ichee'-dominant bilinguals were more likely to demonstrate possible convergence of the intonational contours associated with broad focus utterances.

| Pearson correlation analyses with BLP score (two-tailed) | |
|---|---|
| Peak Height | r = -.034, *p* = .875, n.s. |
| Peak Alignment | r = -.166, *p* = .437, n.s. |
| Valley Height | r = -.007, *p* = .973, n.s. |
| Valley Alignment | r = -.093, *p* = .664, n.s. |
| Rise | r = -.050, *p* = .817, n.s. |
| Slope | r = -.351, *p* = .093, n.s. |

Table 6.56: Pearson correlation analyses between the BLP score and the corresponding acoustic measurement of broad focus utterance. In all analyses, n = 24.

### 6.3.2 Correlations with balanced bilinguals

The results of the Pearson correlation analyses (two-tailed) presented in Table 6.30 demonstrate similar findings. There were no significant correlations between the absolute BLP scores and any acoustic measurement of broad focus utterances, meaning that near-balanced bilinguals were not more likely to demonstrate possible convergence of different acoustic features in broad focus utterances than bilinguals who were more dominant in either language.

| Pearson correlation analyses with absolute BLP score (two-tailed) | |
|---|---|
| Peak Height | r = .101, *p* = .64, n.s. |
| Peak Alignment | r = -.183, *p* = .393, n.s. |
| Valley Height | r = -.053, *p* = .805, n.s. |
| Valley Alignment | r = .082, *p* = .704, n.s. |
| Rise | r = .248, *p* = .242, n.s. |
| Slope | r = -.024, *p* = .913, n.s. |

Table 6.57: Pearson correlation analyses between the absolute BLP score and the corresponding acoustic measurement of broad focus utterances. In all analyses, n = 24.

### 6.4 Discussion

The goal of this chapter was to analyze similarities and possible cases of convergence of the intonational contours associated with broad and contrastive focus in the Spanish and K'ichee' of these bilinguals. The results reported in this chapter demonstrate that, similar to findings in other bilingual situations, some intonational features tend to be similar and possibly converged across the languages of bilinguals while others do not (O'Rourke, 2005; Simonet, 2008). The research questions posed at the beginning of this chapter and the corresponding results are summarized below.

The first two research questions addressed in this chapter were whether or not there were similarities and possible cases of convergence between the intonational contours of Spanish and K'ichee' in broad and contrastive focus constituents and, in contrastive focus constituents, if this convergence was more likely when the syntactic structures were similar. While the variation in contrastive focus word order in K'ichee' reported in Chapter 4 was correlated with the Cantel bilinguals' higher use of Spanish, and the lack of duration to mark contrastive focus in Spanish oxytones among Nahualá females reported in Chapter 5 suggested transfer from K'ichee', it is not possible to determine the directionality of the possible cases of convergence reported in this chapter.

While studies on other varieties of Spanish have described the prosodic features of contrastive focus marking, they remain relatively understudied in K'ichee'. Furthermore, it is quite simply not possible to know what the intonational systems of K'ichee' and these varieties of Guatemalan Spanish were like before they came into contact. Therefore, in this chapter, acoustic features of Spanish and K'ichee' intonational contours that were not significantly different from each other are examined as possible cases of convergence. Nonetheless, it should be noted again that the lack of monolingual data from either dialect in either language impedes any definite conclusion of convergence, as the acoustic features may just be similar between the two languages of these bilinguals.[64]

The results of duration further establish the dialectal differences between Nahualá and Cantel K'ichee'; the Nahualá K'ichee' tokens consisted of long vowels while the other tokens did not. As a result, the tonic syllable of the focus constituent was longer in K'ichee' than in Spanish among the majority of Nahualá speakers in broad focus utterances while no speakers from Cantel had any significant cross-language differences in duration. However, in contrastive focus utterances, there were fewer cases of Spanish being shorter than K'ichee' as the focus constituent was significantly lengthened in this pragmatic condition in Spanish for the majority of the speakers. The main exceptions to this were the Nahualá female speakers, who did not significantly lengthen the tonic syllable of the focus constituent in either language. However, speaker NF1, the only Nahualá female speaker that did significantly lengthen in Spanish oxytones, was also the only Nahualá female that did not demonstrate any significant cross-language differences

[64] There is an overall scarcity of true monolingual speakers, particular K'ichee' monolinguals, in either dialect. Though multiple speakers may be considered 'near monolinguals' in either language (cf. Guion, 2003), they still speak a contact variety of Spanish or K'ichee' and their language would still possibly demonstrate cases of influence from the other language. The majority of these near monolingual K'ichee' speakers in either dialect were older speakers who were unable to participate in this study.

in duration, suggesting that the transfer of the phonological restrictions of an increased duration from Nahualá K'ichee' to Nahualá Spanish may cause these differences in duration in contrastive focus constituents.

The results in both broad and contrastive focus indicate that the acoustic feature that is the most consistently similar cross-linguistically and perhaps the most prone to convergence is the alignment of the pitch peak. Within Accommodation Theory, convergence is said to occur more frequently with features that are more salient than other features (Gallois, et al., 2005; Giles & Powesland, 1975). The results of Chapters 4 and 5 demonstrated that an earlier peak alignment was the most consistently used feature in marking prosodic contrastive focus in both K'ichee' and Spanish, suggesting that peak alignment may be a salient prosodic feature in broad and contrastive focus constituents in both languages. As stated in Chapter 1, the Autosegmental-Metrical (AM) model of intonation (Pierrehumbert, 1980) and the resulting language-specific ToBI systems of analysis are largely based on the location of important intonational events, such as the alignment of peaks and valleys, again indicating that these features of intonational contours may be quite salient corss-lingusitically. In general, the alignment of the pitch peak has been shown to be rather susceptible to convergence and transfer in multiple contact situations; as stated above, the majority of the literature on contact Spanish intonation has focused on variations in pitch peak alignment.

Of all the acoustic features analyzed in this chapter, the alignment of the pitch peak demonstrates the highest likelihood of cross-language influence that may be correlated with language dominance and/or dialect: the results of both broad and contrastive focus constituents demonstrated that while there were no cross-language differences in peak alignment, there was a main effect of dialect which showed that

Nahualá bilinguals tended to have an earlier peak alignment than Cantel bilinguals in both languages and in both pragmatic conditions. This finding is in line with previous research in the Spanish spoken in these communities and in the city of Quetzaltenango, which also showed that Nahualá bilinguals tended to have earlier peaks than Cantel bilinguals and that the later peak alignment of Cantel bilinguals was similar to the late peak alignment of Spanish monolinguals from Quetzaltenango (Baird, submitted). Accordingly, it is proposed that the higher rate of possible convergence in the alignment of the pitch peak in Spanish and K'ichee' than in the other acoustic features may, in part, be due to the overall salience of this acoustic feature within the intonational contours of both languages and to variations in dialect and/or language dominance among these bilinguals.

Similarly, the acoustic feature that demonstrated the second highest amount of possible convergence in this study was the alignment of the valley, which demonstrated more similarities in contrastive focus than in broad focus: while there were between-group differences in overall valley alignment, these variations were the same in both languages in each group, such as the early alignment of the valley near the onset of the tonic syllable in the Spanish and K'ichee' of Nahualá males. These results are again similar to those reported in the previous two chapters as an earlier valley was the second most consistently used acoustic feature to mark prosodic contrastive focus in both languages. Furthermore, these results are similar to those found among Spanish-Catalan bilinguals (Simonet, 2008), who were more likely to converge the alignment of the peak in broad and contrastive focus than the alignment of the valley.

While the results of Chapters 4 and 5 showed that an earlier peak and valley alignment were more consistently used to mark prosodic focus, the use of a higher peak, a lower valley, and an overall greater rise, which were shown to be correlated, revealed variation among these bilingual speakers. The same is true of the cross-language findings presented in this chapter; similarities of peak height, valley height, and, to a lesser degree rise, varied among the speakers. Previous research among bilinguals has demonstrated that they often have language-specific pitch spans. For example, English has been reported as having a greater overall pitch span than Dutch (Chen, et al., 2001; Rietveld, et al., 1999), and, whereas English monolinguals have been shown to have a higher overall pitch span than German monolinguals, English-German bilinguals also speak English with a higher pitch span than German (Scharff–Rethfeldt, et al., 2008). However, these language-specific pitch spans are not always universal; Ordin & Mennen (2009) found that while most, but not all, Welsh-English female bilinguals spoke Welsh at a higher overall pitch than English, Welsh-English male bilinguals did not demonstrate any cross-language differences in pitch span.

Although it was not always the case, the Spanish-K'ichee' bilinguals in this study demonstrated a tendency to speak K'ichee' at a higher overall pitch than Spanish, i.e., both peak and valley heights were higher in K'ichee' than in Spanish. This was particularly true for valley height, as 12 of the 16 speakers who demonstrated cross-language differences in broad focus had higher valleys in K'ichee' and 14 of the 15 speakers who demonstrated cross-language differences in contrastive focus also had higher valleys in K'ichee'. For peak height, 8 of the 16 bilinguals that demonstrated cross-language differences in broad focus had higher peaks in K'ichee' while 14 of 20 bilinguals that demonstrated cross-language differences in contrastive focus also had higher peaks in K'ichee'. The majority of the bilinguals that had higher peaks in Spanish in broad focus constituents were the Cantel females, 5 of 8. However, in contrastive focus, only 2 of 6 speakers that had higher peaks in Spanish were Cantel females. Rise, however, did not demonstrate as many significant cross-language differences among these bilinguals, suggesting that there are several bilinguals who use similar amounts of rise in the tonic syllable of the focus constituent in both languages, but that one language, usually K'ichee', is spoken at a higher overall pitch.

Slope, which was used to mark prosodic focus more consistently in K'ichee' than in Spanish, also revealed differences in convergence between broad and contrastive focus. In broad focus utterances, 13 bilinguals had significantly steeper slopes in Spanish than in K'ichee', while in contrastive focus, only one speaker had significantly different slopes in a comparison of similar syntactic structures, they were also steeper in Spanish. Slope was calculated by the rise in pitch (st) and by the duration (ms) from the valley to the peak, and, as shown in Chapters 4 and 5, this measure is correlated with both of the measures from which it is obtained: a greater overall rise was correlated with a steeper slope and a longer duration of the tonic syllable was correlated with a less steep slope. The differences in slope reflect the differences seen in duration; less significant cross-language differences were seen in contrastive focus than in broad focus in the analyses of both duration and slope. These results indicate that the possible convergence of the slopes is, in part, associated with the possible convergence of duration.

The data presented on contrastive focus demonstrate that possible cases of convergence between Spanish and K'ichee' were more likely when the syntactic structures were similar. These findings correspond to the data in Chapters 4 and 5, which demonstrated that the speakers that produced more than one syntactic structure produced different intonational contours with each structure; *in situ* contours had significantly greater pitch excursions in both languages. However, some speakers demonstrated cross-language similarities and possible cases of convergence between different syntactic structures, e.g., the Nahualá females only produced tokens of K'ichee' *are + fronted subject* and Spanish *in situ* but several still demonstrated possible cases of convergence in various acoustic measurements, including four of six in peak alignment. In such cases, it is hypothesized that if these Nahualá speakers do not use an *in situ* structure to mark contrastive focus then the *are + fronted subject* structure would by default be the most prosodically marked in their K'ichee', and may be similar to the most prosodically marked syntactic structure in their Spanish, which would be *in situ* contrastive focus in this case. This is possibly evidenced in results of peak height, as there was a tendency among each bilingual for the most prosodically marked structure of K'ichee' contrastive focus, either syntactically marked or *in situ*, to have a higher peak than the most prosodically marked structure of Spanish contrastive focus, even if it was *in situ*. Of course, such a hypothesis would require further syntactic and prosodic analyses among these Nahualá speakers.

The final research question addressed in this chapter was whether or not there was a correlation between possible cases of convergence and bilingual language dominance, as interpreted by the BLP. The results show that there were no significant correlations between Spanish-dominant, K'ichee'-dominant, or near-balanced bilinguals and the degree of convergence score of the intonational contours in broad focus utterances. The results indicate that the level of bilingual language dominance among these speakers is not an important factor in which acoustic features are similar, and possibly converged, in the intonational contours they produced, nor is it an important factor in the language-specific pitch spans reported in this chapter as both Spanish- and K'ichee'-dominant bilinguals tended to speak K'ichee' at a higher overall pitch.

### 6.5 CONCLUSIONS

The analyses presented in this chapter investigated cross-language similarities and possible cases of convergence between the intonational contours associated with broad and contrastive focus in Spanish and K'ichee'. The overarching questions of these analyses were whether or not any of the acoustic features on intonation analyzed in this dissertation project demonstrated possible convergence and if any of these cross-language comparisons were correlated with the BLP language dominance scores of the bilinguals studied. Overall, the results presented in this chapter corroborate the results presented in Chapters 4 and 5. The acoustic features that were most consistently used to mark prosodic focus in both languages were also the features that demonstrated the highest amount of possible convergence between Spanish and K'ichee': peak and valley alignment. Furthermore, the features that demonstrated the greatest between-speaker variation in prosodic focus marking in both languages were also the features that demonstrated the most cross-language differences: peak and valley height. However, in contrast to the findings of Chapter 4 and 5, there were no correlations between the BLP language dominance scores and the degree of convergence score of any of these acoustic measurements, thus suggesting that these bilinguals, regardless of language dominance, demonstrate cross-language similarities, and possible convergence, in the same acoustic features.

# 7. Conclusions

## 7.1 Summary of aims and experiments

The overarching goal of this dissertation project was to contribute to the ongoing scholarly investigation of intonation, information structure, and bilingualism. Within this goal, there were three specific aims of this dissertation: (i) to provide a description of contrastive focus in K'ichee' among the population studied and investigate whether it is marked via prosodic means along with the canonical syntactic movement described in the literature; (ii) to describe contrastive focus in Spanish among the population studied and to investigate if it is similar to other documented varieties of Spanish; and (iii), to explore individual speaker factors implicated in broad and contrastive focus patterns to determine if language dominance affects the production of these intonational contours.

These aims were addressed using four different production tasks, two sociolinguistic interviews and two question-answer tasks, one of each in each language, and three separate analyses: contrastive focus marking in K'ichee', contrastive focus marking in Spanish, and a cross-language comparison of Spanish and K'ichee'. While an in-depth acoustic analysis was not possible in the sociolinguistic interviews, analyses of the question-answer tasks were conducted on the tonic syllable of the focus constituent for duration, the height of the pitch peak, the alignment of the pitch peak, the height of the valley before the rise, the alignment of the valley before the rise, the overall rise of the contour, and the rising slope of the contour. The results of the analyses of contrastive focus marking in both languages indicate various main effects of pragmatic condition on these acoustic measurements. In both languages, contrastive focus was significantly more marked than broad focus to varying degrees. The results of the cross-language comparison reveal a higher rate of cross-language similarities, as possible cases of convergence, in the location of intonational events than in the size of the pitch excursion. The results also demonstrate gender and dialectal differences in contrastive focus marking in both languages.

### 7.2 Research questions and theoretical implications

To address the main findings derived from the results above, the original research questions are revisited.

RQ1: *In the K'ichee' of Spanish-K'ichee' bilinguals from Nahualá and Cantel, are contrastive focus constituents prosodically emphasized? Are there effects of different syntactic structures of focus marking on prosodic prominence?*

Data from both the sociolinguistic interview and the question-answer task demonstrate that a greater pitch excursion is used in contrastive focus constituents than in broad focus constituents in both dialects of K'ichee', even if the contrastive focus constituent is already marked syntactically. The data from the question-answer task revealed that the acoustic features most consistently used to mark prosodic focus were earlier occurrences of intonational events, i.e., an earlier alignment of the pitch peak and an earlier alignment of the valley before the rise. Other acoustic features, such as peak height, valley height, and rise, were also used to mark contrastive focus but demonstrated more between-speaker variation. The results also suggest that the use of a longer duration to mark focus was dialectal, as discussed below.

These findings confirm the original hypothesis, based on the proposal of the Effort Code (Gussenhoven, 2004), that all languages should have enough phonetic space to realize a pitch excursion in different pragmatic conditions, such as contrastive focus. However, these results are in contrast to previous findings on Yukateko (Gussenhoven

2006; Gussenhoven & Teeuw, 2008; Kügler et al., 2007) and Yasavul's (2013) work on the Santa María Tzejá dialect of K'ichee'. The differences between the findings in this dissertation project and Yasavul (2013) are in part due to differences in dialect, methodology, and target words; Yasavul's study compared a focused nominal to a topicalized nominal and only used Spanish names with paroxytone stress patterns as target words while this project compared a nominal in contrastive focus to one in broad focus and used target words with the oxytone stress pattern that is more common in K'ichee'.

The results of the question-answer task in K'ichee' also demonstrated that in Cantel an in situ contrastive focus constituent was prosodically more marked than a syntactically marked contrastive focus constituent. Stemming from these results, an interpretation of Relevance Theory (Sperber & Wilson 1986/1995) was proposed. As a change in word order would already mark a contrastive focus constituent, any prosodic emphasis given to the same constituent could be seen as a secondary focus marking strategy, similar to studies on Quechua contrastive focus constituents that are marked morphologically (O'Rourke, 2012b). However, in situ contrastive focus constituents, with no difference in word order from broad focus constituents, would require more prosodic emphasis as this may be the lone strategy available to mark contrastive focus and draw the listener's attention to the constituent.

RQ2: *In the Spanish of Spanish-K'ichee' bilinguals from Nahualá and Cantel, how are contrastive focus constituents prosodically marked and how does it compare to other varieties of contact and non-contact Spanish? Are there effects of different syntactic structures of focus marking on prosodic prominence?*

The findings from the sociolinguistic interviews and the question-answer task in Spanish were comparable to those in K'ichee'. The data demonstrate that a greater pitch excursion is used on a contrastive focus constituent than on a broad focus constituent in both dialects, even if the contrastive focus constituent has already been marked syntactically. As in K'ichee', the data from the question-answer task demonstrated that the most consistent strategy of marking prosodic contrastive focus in Spanish oxytones and paroxytones was an earlier occurrence of the intonational events, i.e., the peak and the valley. Again, the use of a higher peak, a lower valley, and a greater overall rise to mark contrastive focus varied among the bilinguals in this study and the use of duration differed according to both dialect and gender and is discussed below.

Considering the previous findings on prosodic focus marking in other varieties of Spanish, it is not surprising that these results reveal a significantly larger pitch excursion in contrastive focus constituents. However, one of the main findings of these studies has been with paroxytones, where an earlier peak in a contrastive focus context generally means that the peak occurs within the tonic syllable, whereas the peak in a broad focus context generally occurs in a post-tonic syllable (for example, Face 2001). As previous research has shown, this peak alignment may vary in contact situations (Barjam, 2004). In contrast to the original hypothesis, the paroxytone data from this dissertation demonstrate that, while most of the bilinguals produced significantly earlier peaks in contrastive focus than in broad focus, the peaks in both conditions were still aligned in a post-tonic syllable. It was therefore proposed that, while an earlier peak is used to mark contrastive focus in the Spanish of these bilinguals, this peak does not necessary have to be early enough to be aligned within the tonic syllable.

Much like the results in K'ichee', the results of the question-answer task in Spanish demonstrated that in situ contrastive focus constituents were more prosodically emphasized than syntactically marked contrastive focus constituents. Consequently, the same interpretation of Relevance Theory (Sperber & Wilson 1986/1995) described in the K'ichee' data was proposed here.

RQ3: *Are there dialectal differences in the contrastive focus marking in either language of these bilinguals in Nahualá and Cantel?*

The results of the syntactic structure used to mark contrastive focus in the K'ichee' question-answer task demonstrated that Cantel speakers used in situ structures at a significantly higher rate than Nahualá speakers. There was also a correlation between the BLP language dominance score and the syntactic structure used when both dialects were included in the analysis; Spanish-dominant speakers had a greater tendency to use the in situ structures in K'ichee'. However, this correlation was not significant in an analysis of each individual dialect. As the Cantel speakers reported a higher use and interaction with Spanish, it was proposed that they used the in situ syntactic structure that is parallel to the in situ structure in Spanish at a greater rate in K'ichee' as a bilingual optimization strategy (Muysken, 2005, 2013).

The results from both the sociolinguistic interviews and the question-answer tasks demonstrated that duration was not used to mark contrastive focus in Nahualá K'ichee', but it was used in Cantel K'ichee'. Drawing on previous accounts of the dialectal differences of Nahualá K'ichee' and Cantel K'ichee' between vowel systems (Baird, 2010, 2014; England, 1992; López Ixcoy, 1994, 1997; Par Sapón & Can Pixabaj, 2000) and acoustic correlates of stress (Baird, in press), this dissertation proposed that Nahualá

K'ichee' did not use an increased duration as an acoustic strategy to mark contrastive focus because it already uses differences in duration to mark phonemic vowel length, whereas Cantel K'ichee' did use duration to mark contrastive focus because phonemic vowel length has been lost in this dialect. However, in contrast to the original hypothesis, five of the six Nahualá female speakers also did not use a longer duration to mark prosodic focus in Spanish oxytones while only two Nahualá speakers, one male and one female, did not use duration to mark contrastive focus in Spanish paroxytones. Accordingly, it was proposed that, among the Nahualá female speakers, the transfer of the Nahualá K'ichee' phonological restriction on an increased duration was more likely in Spanish words with the similar stress patterns to those in K'ichee', i.e., oxytones.

RQ4: *Are there effects of bilingual language dominance on the production of intonational contours associated with broad and contrastive focus constituents among these bilinguals in Nahualá and Cantel?*

The results of the cross-language comparison of both broad and contrastive focus utterances demonstrated that the suprasegmental features that were most consistently similar in both languages were the same ones that were the most consistently used to mark prosodic focus in both languages; peak and valley alignment. It was proposed that, following the framework of Accommodation Theory (Gallois, et al., 2005; Giles & Powesland, 1975), these suprasegmental features were the most susceptible to possible cases of convergence because they may be the most consistent and salient in both broad and contrastive focus constituents.

Peak height, valley height, and rise demonstrated the most between-speaker variation in prosodic focus marking in both languages. Nonetheless, these suprasegmental features were the only ones that demonstrated a significant correlation with the BLP language dominance score as Spanish-dominant bilinguals tended to mark contrastive focus in K'ichee' with a higher peak and a greater rise, Spanish oxytones with a higher peak, a lower valley, and a greater rise, and Spanish paroxytones with a higher peak. These findings are similar to O'Rourke's (2012b) on Spanish-Quechua bilinguals and confirm the original hypothesis, that Spanish-dominant bilinguals mark focus to a greater degree, at least with these suprasegmental features, than K'ichee'-dominant bilinguals in both languages. Following O'Rourke (2012b), it was proposed that this is because Spanish is a language that often only marks contrastive focus prosodically while K'ichee' tends to use changes in word order, though, as seen in this dissertation, these changes are not always necessary. These suprasegmental features also demonstrated the least convergence. Overall, there was a tendency among these bilinguals to speak K'ichee' at a higher pitch than Spanish. These results are similar to those found among bilinguals of other languages (Ordin & Mennen, 2009; Scharff–Rethfeldt, et al., 2008) and it was proposed that these bilinguals have language-specific pitch spans.

Finally, the cross-language comparison did not reveal any significant correlations between the degree of convergence and the BLP language dominance score. Accordingly, bilingual language dominance was not a factor in which suprasegmental features were possibly converged and which were not. These bilinguals, regardless of language dominance or dialect, demonstrated similar peak and valley alignment in both languages and variation in peak and valley height.

### 7.3 Practical and theoretical limitations

The experiments in this dissertation, like all experimental research, have practical and theoretical limitations. There were inherent restrictions and limitations in examining the naturalistic data obtained via the sociolinguistic interviews and in-depth acoustic analyses were not possible. The naturalistic data in this dissertation could not be used to make comprehensive comparisons with the data from the question-answer tasks and this dissertation only described similarities between the two data sets. However, given the phonological nature of K'ichee', including processes such as word-final devoicing of all consonants except nasals, it would be inherently difficult to obtain enough naturalistic data for an in-depth analysis of contrastive focus marking. Furthermore, as the K'ichee' target words analyzed in the question-answer task needed to conform to these various phonological restrictions in order for their associated intonational contours to be analyzed, the variation of target words is admittedly limited and, subsequently, the Spanish oxytone target words, which needed to have the same structure as K'ichee', were limited as well.

The question-answer tasks allowed for the freedom of choice of syntactic structure to mark contrastive focus. As a result, there was an uneven distribution of *in situ* and syntactically marked contrastive focus tokens in both languages, which resulted in fewer possible analyses, especially in the cross-language comparison of contrastive focus constituents and the BLP language dominance correlations in either language. The nature of the tasks could have also influenced the data. Even though the tasks were administered by the native-speaking research assistants, they could still have been seen as formal contexts for the bilinguals and elicited a higher register.

As mentioned in Chapter 6, the lack of monolingual data in either dialect made it difficult to come to a clear conclusion of convergence when acoustic features were not significantly different. Though it was stated that such cases could possibly be examples of convergence, it should be noted that it is entirely plausible that these features were simply the same in both languages of these bilinguals, even though the dialectal differences in overall peak alignment in both languages were in line with previous research among this population that demonstrates that Cantel bilinguals have later peaks that are similar to those of Spanish monolinguals from Quetzaltenango (Baird, submitted).

Finally, there are deficiencies in all bilingual dominance rating systems, including the BLP. The BLP is a self-reporting questionnaire, and, as Olson (2012) states, the use of self-ratings as the sole measure of bilingual language dominance, while better than objective measures, is far from ideal. While objective measures are inherently problematic as well, a combination of the BLP and some form of objective measure would only serve to enhance the claims made here.

Theoretically, while the analysis of prosodic focus marking is supported by several decades of research and frameworks such as Information Structure, (Lambrecht, 1994), the Autosegmental-Metrical model (Pierrehumbert, 1980), Relevance Theory (Sperber & Wilson, 1986/1995), and the Effort Code (Gussenhoven, 2004), there are still paralinguistic factors at play in a speaker's use of intonation (Gumperz, 1982, 1992). For example, intonation has often been associated with the emotive aspects of language, which led Bolinger to describe it as "a half-tamed savage" and that in order "to understand the tame or linguistically harnessed half, one has to make friends with the wild half" (1978:472). Within prosodic focus marking, it is easy to suppose that different emtions on the part of the speaker could have an effect on the size of the pitch excursion. However, while these emotive aspects of intonation should be acknowledged, they are difficult to quantify. Nevertheless, Gussenhoven (2004) states that while these prosodic aspects of focus marking may at first be emotive in behaviour, speakers gain control over these aspects of speech production and the increased pitch excursions may become grammaticalized, i.e., different pitch excursion sizes begin to signal emphasis and may become divorced from the expenditure of effort. While the account of prosodic focus marking provided here is certainly plausible, it is acknowledged that there may be extra-linguistic factors that have affected the pitch contours of these bilinguals in some way and that this account necessitates further research and support. The same is true for the application of Accommodation Theory (Giles & Powesland, 1975) to the convergence of peak and valley alignment among these bilinguals. Accordingly, the extensions of these theories to the intonational contours of these Spanish-K'ichee' bilinguals is intended to add to the ongoing discussion of Information Structure and bilingual intonational systems.

### 7.4 Future research

The current study serves as a point of departure for future studies on the acoustic documentation of K'ichee' and other Mayan languages and for future studies of the speech patterns of Spanish-K'ichee' bilinguals in Guatemala. First and foremost, the continued analyses of the intonational contours in K'ichee' and Guatemalan Spanish are essential. These studies should include, but are not limited to, other types of focus, such as narrow focus, the focus of objects, and the focus of subjects in antipassive constructions in K'ichee'. Furthermore, this dissertation only analyzed the intonational contours of the focus constituent and disregarded the rest of the utterance. Cross-linguistically, research has shown that different prosodic focus marking strategies are used to make the focus constituent more salient in comparison to the rest of the utterance. These strategies may involve greater pitch excursions on the focus constituent, or, conversely, smaller pitch excursions on the rest of the utterance in a contrastive focus context. For example, Manolescu et al. (2009) found that in Romanian, the focus constituent remains relatively the same across broad and narrow focus but the rest of the utterance is phonetically reduced in narrow focus contexts and Lang-Rigal (2011) collected data in Buenos Aires Spanish that suggests that the portion of an utterance that follows a narrow focus constituent is deaccented.

Furthermore, future studies on the perception of prosodic focus are essential to verify several of the proposals set forth in this dissertation project, e.g., it was proposed that the alignment of the peak and the valley were similar in both languages and were the most prone to convergence because they were the most consistent and perhaps the most salient suprasegmental features of prosodic focus in both languages of these Spanish-K'ichee' bilinguals. Moreover, it was also suggested that females marked contrastive focus in both languages with a more prominent peak height than males, when compared to their respective peak heights in broad focus, because the females' higher overall pitch register might require a more prominent peak height to create a prosodically salient focus constituent. However, the salience of any acoustic feature of a language is more commonly related to perception than production and future analyses will need to verify these claims of salience of these features.

It was also demonstrated that these bilinguals have language-specific pitch spans and that most bilinguals spoke K'ichee' at a higher pitch than Spanish. Future research concerning these language-specific pitch spans needs to further analyze these cross-language differences. For example, within the framework of the Frequency Code (Ohala, 1983, 1984, 1994), high pitch is said to be perceived as vulnerable and submissive, while low pitch sounds protective and dominant. Research has shown that monolinguals and bilinguals tend to perceive higher pitch sounds as friendlier and lower pitch sounds as more confident across languages (Chen, et al., 2001; Rietveld, et al., 1999). However, these perceptions are also correlated with the native languages of the speakers. For instance, as English has been reported to sound higher and have greater pitch movement than German, English speech, particular that of females, is often perceived as ‘over the top’ by German listeners (Eckert & Laver, 1994; as cited in Mennen, 2007). In short, much work on the language-specific pitch ranges of Spanish-K’ichee’ bilinguals is needed to determine if they follow the proposal of the Frequency Code, i.e., if K’ichee’ is indeed perceived as friendlier than Spanish and if Spanish is perceived as more confident than K’ichee’.

Finally, this dissertation presented differences between females and males, particularly in Nahualá where the females demonstrated transfer of phonological restrictions on duration from K’ichee’ to Spanish oxytones while the males did not. While anthropological studies of Nahualá have claimed differences in access to and use of Spanish between males and females (Hanamaikai & Thompson, 2005; Semus, 2005), the results of the BLP indicated that there were no significant differences in the overall BLP language dominance score between the two groups or in any of the four modules: Language History, Language Use, Language Competence, or Language Attitudes. The only difference concerning the two groups was that Nahualá females were significantly more K’ichee’-dominant in Language Attitudes than Cantel females and males, whereas Nahualá males were not significantly different from any group in Language Attitudes. Sociolinguistic work on K’ichee’ by Romero (2009) has shown that men can be more sensitive to different phonological stigmatizations than women due to their more frequent contact with other dialects of K’ichee’, and this could be extended to include their more frequent contact with Spanish. He states that this accommodation is often “the result of a conscious attempt by speakers, especially men, to eliminate from their speech those forms that are stereotyped by more powerful social groups" (2009:296). Accordingly, future work among these speakers needs to analyze if this lack of the use of a greater duration in Spanish oxytones in Nahualá Spanish is stigmatized and should include different sociolinguistic variables than those incorporated in the BLP in order to better understand the gender differences presented in this dissertation.

### 7.5 Concluding remarks

This dissertation has attempted to provide one of the first in-depth acoustic analyses of the intonational contours associated with broad and contrastive focus in both languages of Spanish-K'ichee' bilinguals. Overall, the results indicate that all of the bilinguals in this study prosodically mark a contrastive focus constituent to some degree in both languages, and that this focus marking was most consistently achieved by earlier alignments of intonational events. In reiterating MacMahon (2004), that such studies demonstrate the importance of tracking changes in intonation in situations of language contact, it is proposed here that the most consistent, and perhaps most salient, suprasegmental features of prosodic contrastive focus marking were the same features that were the most prone to possible cases of convergence. While much work remains to be done to fully understand Information Structure in both languages, and how languages in contact and bilingual contexts change, this work represents a contribution to the ongoing scholarly conversation and offers several possibilities for future research.

# Appendix A. Bilingual Language Profile (BLP) questionnaire

## Bilingual Language Profile: Spanish-K'ichee'

*Nos gustaría pedir su ayuda para contestar a las siguientes preguntas sobre su historial lingüístico, uso, actitudes y competencia. Esta encuesta ha sido creada con el apoyo del 'Center for Open Educational Resources and Language Learning' de la Universidad de Texas en Austin para poder tener un mayor conocimiento sobre los perfiles de hablantes bilingües independientemente de sus diversos orígenes y en diferentes contextos. La encuesta contiene 19 preguntas y le llevará menos de 10 minutos para completar. Esto no es una prueba, por tanto no hay respuestas correctas ni incorrectas. Por favor conteste cada pregunta y responda con sinceridad, ya que solamente así se podrá garantizar el éxito de esta investigación. Muchas gracias por su ayuda.*

**I. Información biográfica**

Nombre ______________________________ Fecha de hoy _____/_____/________

Edad_____ ☐ Hombre / ☐ Mujer Lugar de residencia actual: ciudad_________________ País_______________

Nivel más alto de formación académica: ☐ Menos de la escuela secundaria ☐ Escuela Secundaria
☐ Un poco de universidad ☐ Universidad (diplomatura, licenciatura.)
☐ Un poco de escuela graduada ☐ Máster
☐ Doctorado ☐ Otra: ____________

## II. Historial lingüístico

*En esta sección, nos gustaría que contestara algunas preguntas sobre su historial lingüístico marcando la casilla apropiada.*

1. ¿A qué edad **empezó a aprender** las siguientes lenguas?

**Español**

☐ Desde el Nacimiento ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

**K'ichee'**

☐ Desde el Nacimiento ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

2. ¿A qué edad **empezó a sentirse cómodo** usando las siguientes lenguas?

**Español**

☐ Tan pronto como recuerdo ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+ ☐ aún no

**K'ichee'**

☐ Tan pronto como recuerdo ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+ ☐ aún no

3. ¿Cuántos años de **clases (gramática, historia, matemáticas, etc.)** ha tenido en las siguientes lenguas (desde la escuela primaria a la universidad)?

**Español**

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

**K'ichee'**

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

4. ¿Cuántos años ha pasado en un **país/región** donde se hablan las siguientes lenguas?

**Español**

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

**K'ichee'**

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

5. ¿Cuántos años ha pasado en **familia** hablando las siguientes lenguas?

**Español**

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

**K'ichee'**

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

6. ¿Cuántos años ha pasado en **un ambiente de trabajo** donde se hablan las siguientes lenguas?

**Español**

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

**K'ichee'**

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ 19 ☐ 20+

### III. Uso de lenguas

*En esta sección, nos gustaría que contestara algunas preguntas sobre su uso de lenguas marcando la casilla apropiada. El uso total de todas las lenguas en cada pregunta debe llegar al 100%.*

7. En una semana normal, ¿qué porcentaje del tiempo usa las siguientes lenguas con **sus amigos**?

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Español** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |
| **K'ichee'** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |
| **Otras lenguas** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |

8. En una semana normal, ¿qué porcentaje del tiempo usa las siguientes lenguas con **su familia**?

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Español** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |
| **K'ichee'** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |
| **Otras lenguas** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |

9. En una semana normal, ¿qué porcentaje del tiempo usa las siguientes lenguas en **la escuela/el trabajo**?

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Español** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |
| **K'ichee'** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |
| **Otras lenguas** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |

10. Cuando se habla a usted mismo, ¿con qué frecuencia **se habla a sí mismo** en las siguientes lenguas?

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Español** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |
| **K'ichee'** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |
| **Otras lenguas** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |

11. Cuando hace cálculos contando, ¿con qué frecuencia **cuenta** en las siguientes lenguas?

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Español** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |
| **K'ichee'** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |
| **Otras lenguas** | ☐ 0% | ☐ 10% | ☐ 20% | ☐ 30% | ☐ 40% | ☐ 50% | ☐ 60% | ☐ 70% | ☐ 80% | ☐ 90% | ☐ 100% |

**IV. Competencia**

*En esta sección, nos gustaría que considerara su competencia de lengua marcando la casilla de 0 a 6.*

| | *0=no muy bien* | | | | | | *6=muy bien* |
|---|---|---|---|---|---|---|---|
| 12. a. ¿Cómo habla en **Español**? | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| b. ¿Cómo habla en **K'ichee'?** | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| 13. a. ¿Cómo entiende en **Español**? | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| b. ¿Cómo entiende en **K'ichee'?** | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| 14. a. ¿Cómo lee en **Español**? | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| b. ¿Cómo lee en **K'ichee'?** | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| 15. a. ¿Cómo escribe en **Español**? | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| b. ¿Cómo escribe en **K'ichee'?** | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |

**V. Actitudes**

*En esta sección, nos gustaría que contestara a las siguientes afirmaciones sobre actitudes lingüísticas marcando las casillas de 0 a 6.*

| | *0=no estoy de acuerdo* | | | | | | *6=estoy de acuerdo* |
|---|---|---|---|---|---|---|---|
| 16. a. Me siento "yo mismo" cuando hablo en **Español**. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| b. Me siento "yo mismo" cuando hablo en **K'ichee'**. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| 17. a. Me identifico con una cultura **Hispanohablante**. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| b. Me identifico con una cultura **K'ichee' hablante.** | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| 18. a. Es importante para mi usar (o llegar a usar) **Español** como un hablante nativo. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| b. Es importante para mi usar (o llegar a usar) **K'ichee'** como un hablante nativo. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| 19. a. Quiero que los demás piensen que soy un hablante nativo de **Español**. | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |
| b. Quiero que los demás piensen que soy un hablante nativo de **K'ichee'.** | ☐ 0 | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 |

# Appendix B. BLP Scores

BLP scores of the individual speakers in all four modules and the overall score: K = K'ichee'-dominant, S = Spanish-dominant, 0 = balanced.

| Speaker | Age | History | Use | Competence | Attitudes | Overall BLP |
|---|---|---|---|---|---|---|
| NF1 | 54 | K 19.068 | K 22.89 | S 2.27 | K 34.05 | K 73.3 |
| NF2 | 44 | K 3.178 | K 4.36 | K 4.54 | K 22.7 | K 32.1 |
| NF3 | 33 | K 9.988 | K 13.08 | K 2.27 | K 34.05 | K 45.9 |
| NF4 | 28 | K 10.442 | K 28.34 | 0 | K 13.62 | K 43.7 |
| NF5 | 33 | K 12.712 | K 14.17 | K 2.27 | K 2.27 | K 31.4 |
| NF6 | 22 | S 5.448 | K 28.34 | S 4.54 | K 54.48 | K 72.4 |
| NM1 | 75 | K 25.878 | K 54.5 | K 15.89 | K 18.16 | K 123.5 |
| NM2 | 23 | S 4.54 | S 21.8 | S 13.62 | K 4.54 | S 35.4 |
| NM3 | 30 | K 14.982 | K 8.72 | S 11.35 | S 2.27 | K 19.2 |
| NM4 | 37 | K 9.988 | K 19.62 | S 20.43 | K 27.24 | K 58.2 |
| NM5 | 60 | K 14.528 | K 16.35 | K 20.43 | K 34.05 | K 77 |
| NM6 | 40 | K 12.712 | K 10.9 | K 9.08 | K 40.86 | K 30.5 |
| CF1 | 33 | S 10.896 | S 51.23 | S 4.54 | 0 | S 63.4 |
| CF2 | 44 | S 14.528 | S 40.33 | S 13.62 | S 11.35 | S 79.8 |
| CF3 | 34 | S 1.816 | S 13.08 | S 2.27 | 0 | S 17.2 |
| CF4 | 19 | S 7.264 | S 32.7 | S 27.24 | 0 | S 79.9 |
| CF5 | 58 | 0 | S 18.53 | S 6.81 | S 2.27 | S 30.3 |
| CF6 | 26 | S 3.632 | S 30.52 | S 6.81 | 0 | S 40.9 |
| CM1 | 53 | K 13.166 | K 2.18 | S 6.81 | K 6.81 | K 15.4 |
| CM2 | 45 | S 21.338 | S 39.24 | S 6.81 | S 4.54 | S 71.9 |
| CM3 | 31 | K 0.908 | S 5.45 | 0 | K 22.7 | K 18.2 |
| CM4 | 63 | K 4.54 | S 45.78 | S 18.16 | S 4.54 | S 62.1 |
| CM5 | 55 | K 7.718 | S 22.89 | S 4.54 | 0 | S 19.7 |
| CM6 | 26 | S 9.534 | S 35.97 | S 15.89 | K 2.27 | S 59.1 |

# Appendix C. Question-Answer Production Task Materials

Utterances produced by the research assistants to give information, elicit broad focus, and elicit contrastive focus in the video presentation of the question-answer task (target words are bold, the tonic syllable is capitalized, and vowel length is not marked in K'ichee').

**K'ichee' materials**

| | |
|---|---|
| Jas xkulmatajik? | "What happened?" |
| Xkam le **uMAM** iwir. | "Her/his grandfather died yesterday." |
| Che xkam le utaat? | "Her/his father died?" |
| Xpe le **uNAN** kamik. | "His mother came today." |
| Che xpe le rixoqil? | "His wife came?" |
| Xwar le **uch'utiNAN** iwir. | "Her/his aunt slept yesterday." |
| Che xwar le uch'utitaat? | "Her/his uncle slept?" |
| Xtzaq le **rixNAM** je la'. | "His sister-in-law fell over there." |
| Che xtzaq le rixoqil? | "His wife fell?" |
| Xoq' le **uNAN** chaq'ab'. | "Her/his mother cried at night." |
| Che xoq' le utaat? | "Her/his father cried?" |
| Xpe le **uch'utiNAN** ojer. | "Her/his aunt came a while ago." |
| Che xpe le uch'utitaat? | "Her/his uncle came?" |
| Xul le **rixNAM** waral . | "His sister-in-law arrived here." |
| Che xul le ranab'? | "His sister arrived?" |
| Xel le **uMAM** chaq'ab'. | "Her/his grandfather left at night." |
| Che xel le rati't? | "Her/his grandmother left?" |
| Xkos le **uNAN** iwir. | "Her/his mother got tired yesterday." |
| Che xkos le utaat? | "Her/his father got tired?" |
| Xwa' le **rixNAM** waral. | "His sister-in-law ate here." |
| Che wa' le ranab'? | "His sister ate?" |

**Spanish materials**

| | |
|---|---|
| ¿Qué pasó? | "What happened?" |

**Oxytones**

| | |
|---|---|
| Juana la **MAM** bailó. | "Juana the Mam danced."[65] |
| ¿Que Juana la k'ichee' bailó? | "Juana the K'ichee'danced?" |
| El señor **aDÁN** habló. | "Mr. Adam spoke." |
| ¿Que el señor Jorge habló? | "Mr. Jorge spoke?" |
| El viejo **aleMÁN** corrió. | "The old German man ran." |
| ¿Que el viejo francés corrió? | "The old French man left?" |
| La señora **guzMÁN** cantó. | "Mrs. Guzman sang." |
| ¿Que la señora Gómez cantó? | "Mrs. Gomez sang?" |
| El viejo **MAM** bebió. | "The old Mam man drank." |
| ¿Que el viejo k'ichee' bebió? | "The old K'ichee' man drank?" |
| El señor **aleMÁN** lloró. | "The German man cried." |
| ¿Qué el señor inglés lloró? | "The English man cried?" |
| La señora **guzMÁN** gritó. | "Mrs. Guzman yelled." |
| ¿Qué la señora López gritó? | "Mrs. Lopez yelled?" |
| El viejo **aDÁN** bailó. | "The old(er) Adam danced" |
| ¿Que el viejo Manuel bailó? | "The old(er) Manuel danced?" |
| El viejo **MAM** comió. | "The old Mam man ate." |
| ¿Que el viejo K'ichee' comió? | "The old K'ichee' man ate?" |
| El viejo **aleMÁN** habló. | "The old German man spoke." |
| ¿Que el viejo americano habló? | "The old American man spoke?" |

[65] Mam is Mayan language that can be used as an adjective in Guatemalan Spanish, like *K'ichee'* or *Alemán*, for someone who speaks Mam or is of Mamean decent.

**Paroxytones**

| | |
|---|---|
| Manuel comió **baNAnas** ayer.<br>¿Qué Manuel comió manzanas ayer? | “Manuel ate bananas yesterday.”<br>¿Manuel ate apples yesterday?” |
| La vieja **aleMAna** pagó.<br>¿Que la vieja americana pagó? | “The old German woman paid.”<br>“The old American woman paid? |
| Su pobre **herMAna** habló.<br>¿Que su pobre cuñada habló? | “Her/his poor sister spoke.”<br>“Her/his poor sister-in-law spoke?” |
| La nueva **NAna** lloró.<br>¿Que la nueva maestra lloró? | “The new nanny cried.”<br>“The new teacher cried?” |
| La señora **aleMAna** habló.<br>¿Qué la señora italiana habló? | “The German lady spoke.”<br>“The Italian lady spoke?” |
| Su bella **herMAna** cantó.<br>¿Que su bella esposa cantó? | “Her/his beautiful sister sang.”<br>“His beautiful wife sang?” |
| Perdió su **MAno** aquí.<br>¿Que perdió su pierna aquí? | “S/he lost her/his hand here.”<br>“S/he lost her/his leg here?” |
| Compró las **baNAnas** ayer.<br>¿Que compró las naranjas ayer? | “S/he bought the bananas yesterday.”<br>“S/he bought the oranges yesterday?” |
| Su nuevo **herMAno** saltó.<br>¿Que su nuevo sobrino saltó? | “Her/his new brother jumped.”<br>“Her/his new nephew jumped?” |
| Su vieja her**MAna** nadó.<br>¿Que su vieja prima nadó? | “Her/his old sister swam.”<br>“Her/his old cousin swam?” |

# Appendix D. Individual Speaker Means (Standard Deviations)

| | | K'ichee' | | | | Spanish Oxytones | | | Spanish paroxytones | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Acoustic Measurement** | **broad** | **in situ** | **are + fronted subject** | **are + in situ** | **broad** | **in situ** | **clefted** | **broad** | **in situ** | **clefted** |
| **NF1** | Duration (ms) | 344 (37) | - | 342 (42) | - | 302 (46) | 333 (41) | - | 202 (21) | 244 (30) | - |
| | Peak Height (st) | 94.6 (1.1) | - | 95.2 (1) | - | 95.3 (1.4) | 95.8 (1.5) | - | 93.3 (2.4) | 93.5 (2) | - |
| | Peak Alignment | .83 (.1) | - | .73 (.11) | - | .85 (.11) | .75 (.12) | - | 1.56 (.22) | 1.26 (.25) | - |
| | Valley Height (st) | 92 (2.3) | - | 90.8 (4) | - | 91.8 (2.2) | 91.6 (.9) | - | 91.6 (1.9) | 90.6 (1.6) | - |
| | Valley Alignment | .51 (.06) | - | .37 (.5) | - | .51 (.08) | .38 (.05) | - | .48 (.06) | .39 (.05) | - |
| | Rise (st) | 2.6 (2.3) | - | 4.4 (2.1) | - | 3.5 (2.3) | 4.2 (1.4) | - | 1.7 (.9) | 2.9 (1.8) | - |
| | Slope | .14 (.07) | - | .61 (.27) | - | .66 (.67) | 1.9 (.54) | - | .008 (.01) | .016 (.01) | - |
| **NF2** | Duration (ms) | 332 (25) | - | 325 (30) | - | 289 (49) | 295 (53) | - | 209 (19) | 235 (36) | - |
| | Peak Height (st) | 97.5 (4.1) | - | 98 (2.8) | - | 93.6 (2.7) | 95.5 (3.7) | - | 91.9 (2.5) | 92.6 (2.1) | - |
| | Peak Alignment | .89 (.06) | - | .86 (.11) | - | .86 (.07) | .79 (.09) | - | 1.42 (.23) | 1.37 (.24) | - |
| | Valley Height (st) | 92 (1.1) | - | 90 (3.7) | - | 90.3 (1.1) | 89.2 (1.2) | - | 90.1 (1.3) | 89 (1.9) | - |
| | Valley Alignment | .37 (.03) | - | .25 (56) | - | .26 (.05) | .25 (.04) | - | .67 (.06) | .61 (.07) | - |
| | Rise (st) | 5.5 (6.7) | - | 8 (4.4) | - | 3.3 (2.6) | 6.3 (3.6) | - | 1.8 (1.7) | 3.6 (1.6) | - |
| | Slope | .28 (.11) | - | .56 (.38) | - | .37 (.26) | .51 (.35) | - | .02 (.01) | .02 (.01) | - |
| **NF3** | Duration (ms) | 353 (30) | - | 360 (36) | - | 364 (54) | 367 (51) | - | 223 (21) | 261 (26) | - |
| | Peak Height (st) | 95.6 (4) | - | 96.5 (4) | - | 94.8 (4.3) | 95.4 (3.7) | - | 92.3 (2.1) | 93.1 (2.2) | - |
| | Peak Alignment | .82 (.09) | - | .76 (.12) | - | .88 (.11) | .75 (.09) | - | 1.54 (.23) | 1.29 (.21) | - |
| | Valley Height (st) | 91 (1) | - | 90.7 (1) | - | 90.5 (1.3) | 89.1 (.1) | - | 91.1 (1.3) | 90 (1) | - |
| | Valley Alignment | .36 (.03) | - | .25 (.03) | - | .31 (.04) | .26 (.04) | - | .68 (.07) | .68 (.07) | - |
| | Rise (st) | 4.6 (3.5) | - | 5.8 (4) | - | 4.3 (3.6) | 6.3 (4.9) | - | 1.2 (1.7) | 3.1 (1.7) | - |
| | Slope | .21 (.2) | - | .45 (.38) | - | .38 (.36) | .44 (.35) | - | .01 (.01) | .01 (.02) | - |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **NF4** | Duration (ms) | 363 (42) | - | 371 (36) | - | 297 (51) | 302 (46) | - | 201 (18) | 233 (25) | - |
| | Peak Height (st) | 94.9 (1.7) | - | 97.7 (1.6) | - | 94.6 (2.7) | 95.3 (2.1) | - | 92.4 (1.3) | 93 (2.3) | - |
| | Peak Alignment | .87 (.06) | - | .83 (.06) | - | .84 (.07) | .73 (.1) | - | 1.62 (.22) | 1.37 (.25) | - |
| | Valley Height (st) | 92.5 (2.5) | - | 91.8 (1.8) | - | 92.3 (1.4) | 91.8 (.1) | - | 91.1 (1.8) | 90.6 (1.6) | - |
| | Valley Alignment | .6 (.09) | - | .26 (.05) | - | .51 (.06) | .35 (.04) | - | .8 (.08) | .48 (.05) | - |
| | Rise (st) | 2.4 (1.4) | - | 5.9 (3.1) | - | 2.3 (2.7) | 3.5 (2.9) | - | 1.3 (.7) | 2.4 (2) | - |
| | Slope | .28 (.15) | - | 1.1 (.72) | - | .11 (.1) | .21 (.1) | - | .009 (.01) | .011 (.01) | - |
| **NF5** | Duration (ms) | 356 (37) | - | 359 (47) | - | 297 (64) | 293 (62) | - | 238 (28) | 246 (21) | - |
| | Peak Height (st) | 94.8 (1.2) | - | 95.1 (1.4) | - | 93.5 (1.9) | 94.3 (2.3) | - | 92.9 (2.1) | 94.1 (1.3) | - |
| | Peak Alignment | .86 (.07) | - | .77 (.08) | - | .84 (.09) | .76 (.08) | - | 1.17 (.18) | 1.15 (.16) | - |
| | Valley Height (st) | 92.4 (1) | - | 91.8 (1.3) | - | 90.7 (1.3) | 90.2 (1.1) | - | 92.2 (1.5) | 90.3 (1.3) | - |
| | Valley Alignment | .51 (.06) | - | .36 (.05) | - | .57 (.11) | .42 (.08) | - | .81 (.1) | .78 (.06) | - |
| | Rise (st) | 2.4 (1.2) | - | 3.3 (1.9) | - | 2.8 (1.5) | 4.1 (2) | - | .7 (1.1) | 3.8 (1.3) | - |
| | Slope | .14 (.06) | - | .43 (.24) | - | .55 (.44) | 1.3 (1.4) | - | .029 (.02) | .037 (.03) | - |
| **NF6** | Duration (ms) | 338 (33) | - | 335 (33) | - | 286 (53) | 285 (43) | - | 234 (29) | 246 (27) | - |
| | Peak Height (st) | 94.2 (.9) | - | 95.1 (1.4) | - | 94.4 (1.7) | 95.2 (1.8) | - | 92.7 (1.5) | 94.2 (1.6) | - |
| | Peak Alignment | .94 (.05) | - | .86 (.08) | - | .92 (.11) | .77 (.06) | - | 1.58 (.3) | 1.45 (.2) | - |
| | Valley Height (st) | 91.3 (.7) | - | 91.5 (.9) | - | 91.3 (1.1) | 91.2 (.9) | - | 91.2 (.7) | 90.6 (.9) | - |
| | Valley Alignment | .68 (.07) | - | .69 (.07) | - | .67 (.11) | .58 (.08) | - | .3 (.04) | .29 (.03) | - |
| | Rise (st) | 2.9 (1) | - | 3.6 (1.4) | - | 3.1 (1.4) | 4 (1.3) | - | 1.5 (1.1) | 3.6 (1.3) | - |
| | Slope | .11 (.07) | - | .69 (.5) | - | 1.1 (1.3) | 1.1 (.8) | - | .007 (.01) | .01 (.01) | - |
| **NM1** | Duration (ms) | 295 (23) | - | 289 (28) | - | 283 (43) | 337 (59) | 264 (21) | 196 (22) | 224 (30) | - |
| | Peak Height (st) | 91.1 (1) | - | 91.5 (1.2) | - | 88.7 (1.5) | 89.4 (1.7) | 88.8 (1.1) | 84.4 (1.6) | 84.9 (1.3) | - |
| | Peak Alignment | .83 (.08) | - | .78 (.06) | - | .77 (.13) | .62 (.12) | .76 (.16) | 1.04 (.11) | 1.03 (.11) | - |
| | Valley Height (st) | 87.1 (.9) | - | 86.7 (1) | - | 83.9 (1.7) | 82.8 (1.3) | 82.9 (1.1) | 81.9 (1) | 81 (1.3) | - |
| | Valley Alignment | .25 (.02) | - | .25 (.02) | - | .13 (.02) | .11 (.02) | .13 (.01) | .18 (.02) | .16 (.02) | - |
| | Rise (st) | 4 (1.5) | - | 4.8 (1.4) | - | 4.8 (1.7) | 6.6 (1.8) | 5.9 (1.6) | 2.5 (.8) | 3.9 (1) | - |
| | Slope | .26 (.07) | - | .31 (.09) | - | .28 (.08) | .32 (.1) | .32 (.07) | .02 (.01) | .02 (.01) | - |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **NM2** | Duration (ms) | 281 (30) | - | 281 (37) | - | 253 (32) | 347 (64) | - | 203 (23) | 248 (3) | - |
| | Peak Height (st) | 85.8 (1.8) | - | 88.8 (1.7) | - | 84.8 (1.90 | 86.2 (2.5) | - | 87.6 (.12) | 88 (1.5) | - |
| | Peak Alignment | .83 (.09) | - | .73 (.11) | - | .88 (.17) | .55 (18) | - | 1.4 (.2) | .91 (.1) | - |
| | Valley Height (st) | 83.8 (2.2) | - | 83.5 (2.4) | - | 82.1 (1.1) | 80.9 (1.30 | - | 84.3 (1.3) | 82.9 (1.7) | - |
| | Valley Alignment | .01 (.002) | - | .01 (.003) | - | .13 (.02) | .13 (.03) | - | .7 (.08) | .29 (.04) | - |
| | Rise (st) | 2 (2.4) | - | 5.3 (2) | - | 2.7 (1.5) | 5.3 (2.1) | - | 3.3 (1.1) | 5.1 (1.6) | - |
| | Slope | .07 (.04) | - | .23 (.09) | - | .1 (.06) | .39 (.03) | - | .026 (.01) | .034 (.01) | - |
| **NM3** | Duration (ms) | 325 (38) | - | 338 (38) | - | 316 (61) | - | 316 (66) | 196 (23) | 213 (25) | 215 (28) |
| | Peak Height (st) | 87.2 (3.1) | - | 88.9 (2.7) | - | 85.3 (1.8) | - | 86.7 (3.1) | 83.9 (2.7) | 84.6 (1.3) | 84 (3.4) |
| | Peak Alignment | .81 (.13) | - | .61 (.1) | - | .91 (.23) | - | .68 (.1) | 1.3 (.26) | .8 (.19) | 1 (.07) |
| | Valley Height (st) | 83.3 (1) | - | 83.7 (1.5) | - | 82.4 (1.2) | - | 81.7 (3) | 81.5 (1.7) | 78.3 (1.3) | 79.9 (1) |
| | Valley Alignment | .25 (.03) | - | .13 (.01) | - | .39 (.08) | - | .13 (.02) | .78 (.09) | .31 (.04) | .31 (.03) |
| | Rise (st) | 3.9 (1.4) | - | 5.2 (1.4) | - | 3.1 (1.7) | - | 5 (2.1) | 2.4 (1.3) | 6.3 (3.3) | 4.1 (1.7) |
| | Slope | .14 (.07) | - | .28 (.12) | - | .21 (.15) | - | .25 (.08) | .02 (.41) | .07 (.07) | .04 (.03) |
| **NM4** | Duration (ms) | 326 (33) | - | 318 (39) | - | 275 (41) | 308 (55) | 235 (24) | 204 (27) | 225 (42) | 229 (28) |
| | Peak Height (st) | 84.5 (2.7) | - | 84.8 (3.9) | - | 85.3 (2.6) | 86 (1.1) | 85.7 (2) | 84.1 (1.6) | 85.7 (1.3) | 84.7 (2) |
| | Peak Alignment | .84 (.09) | - | .7 (.1) | - | .85 (1.16) | .57 (.07) | .61 (.16) | 1.23 (1.8) | .97 (.18) | 1.1 (.11) |
| | Valley Height (st) | 82.1 (2.2) | - | 82 (2.2) | - | 80.7 (2) | 80.7 (1.8) | 81 (1.5) | 82.1 (1) | 80.6 (.71) | 80.7 (1.5) |
| | Valley Alignment | .38 (.04) | - | .3 (.04) | - | .38 (.06) | .01 (.05) | .01 (.06) | .66 (.08) | .3 (.05) | .32 (.04) |
| | Rise (st) | 2.4 (.9) | - | 2.8 (1.6) | - | 4.7 (1.9) | 5.3 (1.9) | 4.7 (1.7) | 2 (1.3) | 5.1 (1.4) | 4.1 (2.1) |
| | Slope | .11 (.07) | - | .14 (.16) | - | .27 (.15) | .19 (.07) | .22 (.09) | .02 (.01) | .04 (.02) | .03 (.01) |
| **NM5** | Duration (ms) | 328 (33) | - | 320 (44) | - | 270 (49) | 326 (67) | - | 198 (36) | 225 (55) | - |
| | Peak Height (st) | 84.4 (3.6) | - | 85.4 (4.1) | - | 86.8 (2) | 87.4 (1.4) | - | 83.1 (1.5) | 87.9 (2.1) | - |
| | Peak Alignment | .9 (.22) | - | .73 (.07) | - | .75 (.25) | .56 (.14) | - | .96 (.31) | .81 (.18) | - |
| | Valley Height (st) | 82 (2.5) | - | 81.5 (2.5) | - | 82.2 (1.2) | 82.4 (1.3) | - | 82.4 (2.1) | 80.6 (2.1) | - |
| | Valley Alignment | .13 (.01) | - | .01 (.06) | - | .13 (.02) | .04 (.06) | - | .24 (.05) | .21 (.04) | - |
| | Rise (st) | 2.4 (1.4) | - | 3.9 (1.9) | - | 4.6 (2.4) | 5 (1.8) | - | .7 (.8) | 7.3 (1.2) | - |
| | Slope | .15 (.05) | - | .19 (.09) | - | .29 (.08) | .34 (.12) | - | .01 (.02) | .05 (.04) | - |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NM6** | Duration (ms) | 299 (33) | - | 287 (39) | - | 274 (54) | - | 294 (50) | 195 (25) | 202 (32) | 197 (24) |
| | Peak Height (st) | 86.9 (1.2) | - | 88.4 (1.9) | - | 86 (1.5) | - | 86. 9 (1.4) | 83 (2.8) | 85.9 (4) | 85.2 (1.8) |
| | Peak Alignment | .8 (.14) | - | .64 (.07) | - | .85 (.07) | - | .74 (.11) | 1.15 (.08) | 1.04 (.23) | 1.12 (.1) |
| | Valley Height (st) | 83.7 (1.1) | - | 83.3 (.9) | - | 82.2 (.8) | - | 81.3 (1.5) | 81.5 (1.1) | 79.4 (1.8) | 80.8 (2.5 |
| | Valley Alignment | .13 (.02) | - | .01 (.06) | - | .01 (.04) | - | .01 (.07) | .29 (.04) | .28 (.05) | .28 (.04) |
| | Rise (st) | 3.2 (1.6) | - | 5.1 (.9) | - | 3.8 (1.6) | - | 5.6 (2) | 1.5 (1.2) | 6.5 (1.9) | 4.4 (1.7) |
| | Slope | .15 (.1) | - | .15 (.08) | - | .16 (.05) | - | .15 (.05) | .016 (.01) | .038 (.04) | .027 (.01) |
| **CF1** | Duration (ms) | 291 (43) | 337 (24) | 316 (48) | - | 286 (39) | 307 (41) | - | 187 (20) | 218 (30) | - |
| | Peak Height (st) | 94.5 (1) | 97.7 (3.3) | 94.8 (.9) | - | 94.4 (1.6) | 94.6 (1.3) | - | 92.9 (1.1) | 93.5 (1.5) | - |
| | Peak Alignment | .8 (.13) | .51 (.08) | .74 (.07) | - | .83 (.12) | .61 (.18) | - | 1.25 (.2) | 1.08 (.22) | - |
| | Valley Height (st) | 92.7 (2.1) | 91.1 (.6) | 91.5 (1) | - | 91.4 (.8) | 90.9 (1) | - | 91 (.9) | 91.1 (1.1) | - |
| | Valley Alignment | .41 (.06) | .31 (.02) | .49 (09) | - | .29 (.07) | .25 (.03) | - | .76 (.08) | .65 (.09) | - |
| | Rise (st) | 1.8 ( .9) | 6.6 (1.7) | 3.3 (.9) | - | 3 (1.3) | 3.7 (1.3) | - | 1.9 (.8) | 2.4 (1.3) | - |
| | Slope | .33 (.32) | .62 (.3) | .55 (.44) | - | .27 (.16) | 1.5 (.87) | - | .022 (.03) | .035 (.2) | - |
| **CF2** | Duration (ms) | 339 (37) | - | 368 (38) | - | 280 (46) | 350 (76) | 336 (73) | 211 (23) | 248 (48) | 232 (33) |
| | Peak Height (st) | 94.3 (1.2) | - | 95 (.8) | - | 94.7 (2.1) | 99.8 (2.2) | 96.7 (3.7) | 92.3 (1) | 95.3 (2.8) | 92.5 (1) |
| | Peak Alignment | .88 (.1) | - | .79 (.1) | - | .87 (.1) | .75 (.06) | .77 (.09) | 1.4 (.2) | .91 (.21) | 1.14 (.08) |
| | Valley Height (st) | 91.3 (.9) | - | 91.6 (1) | - | 92.2 (3) | 90.2 (1.7) | 93.8 (2.4) | 90.1 (1.4) | 88.9 (1.1) | 90.9 (1.5) |
| | Valley Alignment | .41 (.05) | - | .38 (.04) | - | .38 (.06) | .13 (.03) | .26 (.05) | .27 (.04) | .1 (.02) | .12 (. 1) |
| | Rise (st) | 3 (1.2) | - | 3.5 (.9) | - | 2.5 (1.1) | 9.6 (3.6) | 2.9 (1.8) | 2.2 (1.1) | 6.4 (3.3) | 1.6 (.9) |
| | Slope | .24 (.14) | - | .33 (.16) | - | .18 (.07) | .42 (.44) | .4 (.15) | .009 (.01) | .022 (.03) | .013 (.01) |
| **CF3** | Duration (ms) | 329 (28) | 348 (21) | - | - | 328 (56) | 370 (51) | - | 226 (25) | 238 (32) | - |
| | Peak Height (st) | 98.4 (2.3) | 99.4 (3.1) | - | - | 96 (3.2) | 97.4 (3) | - | 95.8 (1.8) | 96.6 (1.2) | - |
| | Peak Alignment | .83 (.05) | .8 (.06) | - | - | .84 (.09) | .73 (.07) | - | 1.6 (.12) | 1.4 (.26) | - |
| | Valley Height (st) | 94.2 (1.6) | 94.1 (1.8) | - | - | 93.2 (2) | 92.6 (1.7) | - | 94.8 (1.3) | 93.9 (2) | - |
| | Valley Alignment | .13 (.07) | .07 (.06) | - | - | .13 (.02) | .07 (.02) | - | .4 (.05) | .38 (.05) | - |
| | Rise (st) | 4.2 (1.3) | 5.3 (1.9) | - | - | 2.8 (2) | 4.8 (1.8) | - | 1 (.9) | 2.7 (.9) | - |
| | Slope | .29 (.08) | .42 (.11) | - | - | .37 (.13) | .39 (.18) | - | .06 (.02) | .11 (.07) | - |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| **CF4** | Duration (ms) | 352 (33) | - | - | 370 (60) | 325 (59) | 375 (56) | - | 228 (19) | 246 (31) | - |
| | Peak Height (st) | 95 (1.3) | - | - | 96.8 (2.5) | 94.1 (1.3) | 94.8 (1.3) | - | 93.4 (1.6) | 93.9 (1.5) | - |
| | Peak Alignment | .93 (.07) | - | - | .85 (.09) | .92 (.1) | .79 (.14) | - | 1.57 (.19) | .79 (.38) | - |
| | Valley Height (st) | 93.4 (1.4) | - | - | 91.6 (2.1) | 91.5 (2.4) | 91.1 (.7) | - | 91.6 (1.2) | 90.6 (2.7) | - |
| | Valley Alignment | .56 (.06) | - | - | .47 (.04) | .51 (.12) | .49 (.07) | - | .09 (.07) | .09 (.01) | - |
| | Rise (st) | 1.6 (1.5) | - | - | 5.2 (2.6) | 2.6 (1.9) | 3.7 (2.1) | - | 1.8 (1.3) | 3.3 (1.8) | - |
| | Slope | .28 (.03) | - | - | .41 (.19) | .17 (.12) | .33 (.33) | - | .07 (.03) | .12 (.02) | - |
| **CF5** | Duration (ms) | 352 (32) | 421 (72) | 408 (44) | - | 314 (34) | 417 (56) | - | 233 (25) | 302 (52) | - |
| | Peak Height (st) | 94.1 (1.2) | 97.1 (2.5) | 94.9 (.8) | - | 94 (1.6) | 96.1 (2.5) | - | 93 (1.2) | 93.8 (1.3) | - |
| | Peak Alignment | .88 (.08) | .79 (.09) | .86 (.09) | - | .89 (.23) | .78 (.08) | - | 1.29 (.18) | 1.13 (.22) | - |
| | Valley Height (st) | 92.2 (1.5) | 90.8 (.5) | 91.9 (.7) | - | 91.3 (1.4) | 90.5 (1.3) | - | 92 (1.2) | 90.5 (2.2) | - |
| | Valley Alignment | .48 (.07) | .32 (.03) | .48 (.07) | - | .48 (.06) | .32 (.04) | - | .76 (.12) | .43 (.04) | - |
| | Rise (st) | 1.9 (.9) | 6.3 (1) | 3 (1.4) | - | 2.7 (1.9) | 5.6 (2.9) | - | 1.1 (.8) | 3.3 (1.9) | - |
| | Slope | .32 (.17) | .53 (.51) | .26 (.11) | - | .18 (.07) | .28 (.14) | - | .009 (.01) | .028 (.04) | - |
| **CF6** | Duration (ms) | 368 (40) | - | 432 (68) | - | 321 (41) | 344 (39) | - | 197 (19) | 233 (42) | - |
| | Peak Height (st) | 94.1 (1.4) | - | 96.5 (1.9) | - | 93.2 (1.7) | 94.6 (2.4) | - | 92.5 (2) | 93.3 (1.5) | - |
| | Peak Alignment | .89 (.08) | - | .79 (.05) | - | .92 (.09) | .7 (.15) | - | 1.5 (.19) | 1.2 (.17) | - |
| | Valley Height (st) | 91.6 (.9) | - | 91.3 (.8) | - | 91.3 (.9) | 89.9 (1.5) | - | 91.4 (1.1) | 89.2 (1.6) | - |
| | Valley Alignment | .49 (.07) | - | .4 (.04) | - | .46 (.06) | .46 (.07) | - | .61 (.16) | .53 (.09) | - |
| | Rise (st) | 2.5 (.9) | - | 5.2 (1.7) | - | 1.9 (1.7) | 4.7 (2.4) | - | 1.1 (1.1) | 4.1 (1.9) | - |
| | Slope | .2 (.1) | - | .41 (.15) | - | .37 (.22) | 1.04 (.85) | - | .011 (.01) | .024 (.02) | - |
| **CM1** | Duration (ms) | 332 (36) | - | 427 (39) | - | 324 (41) | 416 (81) | - | 214 (40) | 301 (72) | - |
| | Peak Height (st) | 90.9 (3.9) | - | 90.7 (5.7) | - | 86.8 (3.3) | 87.4 (4.2) | - | 84.6 (1.9) | 86.9 (2.8) | - |
| | Peak Alignment | .88 (.09) | - | .71 (.11) | - | .82 (.11) | .67 (.16) | - | 1.39 (.27) | .91 (.29) | - |
| | Valley Height (st) | 85.9 (3.9) | - | 84.4 (4.1) | - | 83 (2.6) | 82.2 (2.2) | - | 83.5 (2.5) | 81.5 (1.5) | - |
| | Valley Alignment | .43 (.13) | - | .3 (.04) | - | .45 (.09) | .4 (.21) | - | .48 (.08) | .35 (.09) | - |
| | Rise (st) | 5.1 (2.7) | - | 6.3 (4) | - | 3.8 (3.1) | 5.2 (4.5) | - | 1.1 (2.1) | 5.4 (2.3) | - |
| | Slope | .29 (.21) | - | 1.1 (.69) | - | .35 (.14) | 1.2 (2.2) | - | .02 (.01) | .03 (.03) | - |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| | Duration (ms) | 300 (76) | 367 (36) | 346 (59) | - | 296 (47) | 342 (68) | 287 (58) | 174 (35) | 252 (43) | 159 (21) |
| | Peak Height (st) | 85.8 (3.9) | 87.9 (2.9) | 84.6 (5.7) | - | 82.6 (2.8) | 86.2 (3.2) | 85.8 (4.4) | 83.2 (3.7) | 84.4 (2.5) | 82.5 (2.7) |
| | Peak Alignment | .92 (.13) | .54 (.07) | .62 (.17) | - | .84 (.09) | .61 (.17) | .72 (.12) | 1.57 (.23) | .74 (.08) | 1.29 (.24) |
| **CM2** | Valley Height (st) | 81 (2.2) | 78.5 (2.4) | 81.8 (2.6) | - | 81 (1.9) | 77.2 (1.4) | 79.2 (2) | 80.7 (3.7) | 79.4 (2.2) | 81.5 (2) |
| | Valley Alignment | .26 (.05) | .19 (.18) | .21 (..09) | - | .26 (.14) | .26 (.09) | .26 (.11) | .6 (.12) | .22 (.04) | .35 (.08) |
| | Rise (st) | 4.8 (2.8) | 9.4 (4.5) | 2.8 (2) | - | 1.6 (.7) | 9 (2.5) | 6.6 (3.1) | 2.5 (1.1) | 5 (2.6) | 1 (.9) |
| | Slope | .19 (.1) | .87 (.46) | .61 (.31) | - | .19 (.15) | .71 (.53) | .28 (.2) | .016 (.01) | .026 (.02) | .022 (.02) |
| | Duration (ms) | 333 (46) | 363 (60) | - | - | 316 (89) | 357 (57) | - | 171 (26) | 184 (30) | - |
| | Peak Height (st) | 85.5 (3.4) | 86 (3.4) | - | - | 88.5 (4.3) | 89 (3.8) | - | 82.2 (2.9) | 83 (2.6) | - |
| | Peak Alignment | .86 (.15) | .66 (.15) | - | - | .88 (.13) | .68 (.17) | - | 1.7 (.35) | 1.28 (.59) | - |
| **CM3** | Valley Height (st) | 80.7 (1.6) | 79.7 (2) | - | - | 81.9 (1.8) | 81 (2) | - | 78.7 (1.7) | 79.2 (1.8) | - |
| | Valley Alignment | .31 (.18) | .13 (.12) | - | - | .33 (.1) | .13 (.04) | - | .27 (.12) | .25 (.17) | - |
| | Rise (st) | 4.8 (2.7) | 6.3 (3.9) | - | - | 6.6 (3.6) | 8 (4.1) | - | 3.6 (2.5) | 3.7 (1.8) | - |
| | Slope | .19 (.12) | .24 (.22) | - | - | .23 (.2) | .27 (.2) | - | .015 (.01) | .078 (.37) | - |
| | Duration (ms) | 332 (39) | 423 (91) | - | 323 (21) | 364 (53) | 404 (41) | - | 233 (31) | 271 (41) | - |
| | Peak Height (st) | 85.5 (2) | 85.2 (4) | - | 85.2 (2.2) | 84.4 (2.5) | 83.9 (2.4) | - | 84.4 (1.7) | 84.3 (2.6) | - |
| | Peak Alignment | .87 (.1) | .76 (.09) | - | .84 (.09) | .83 (.1) | .77 (.1) | - | 1.54 (.2) | 1.39 (.24) | - |
| **CM4** | Valley Height (st) | 81.6 (1.5) | 80.8 (1.2) | - | 81.2 (1.3) | 81.1 (1.4) | 80 (1.2) | - | 80.8 (1.5) | 80.3 (1.3) | - |
| | Valley Alignment | .25 (.18) | .26 (.13) | - | .27 (.09) | .22 (.09) | .13 (.02) | - | .33 (.16) | .21 (.19) | - |
| | Rise (st) | 3.9 (1.7) | 4.4 (2) | - | 4 (2.1) | 3.3 (1.7) | 3.9 (2.2) | - | 3.6 (1.6) | 4 (2) | - |
| | Slope | .14 (.07) | .16 (.06) | - | .21 (.2) | .26 (.13) | .29 (.11) | - | .013 (.07) | .013 (.06) | - |
| | Duration (ms) | 280 (42) | 327 (59) | - | - | 265 (42) | 297 (49) | - | 181 (20) | 197 (25) | - |
| | Peak Height (st) | 84.3 (1.8) | 84.9 (2.1) | - | - | 84.1 (2.2) | 85.3 (2.3) | - | 82.3 (1.6) | 83.1 (1.9) | - |
| | Peak Alignment | .90 (.12) | .90 (.1) | - | - | .90 (.09) | .86 (.1) | - | 1.58 (.26) | 1.09 (.49) | - |
| **CM5** | Valley Height (st) | 81.5 (1.2) | 81.2 (1.2) | - | - | 83.2 (2) | 83.2 (3.1) | - | 80.5 (1.1) | 79.9 (.9) | - |
| | Valley Alignment | .72 (.15) | .51 (.08) | - | - | .67 (.14) | .53 (.11) | - | .011 (.01) | .005 (.01) | - |
| | Rise (st) | 2.8 (1.2) | 3.7 (1.6) | - | - | .9 (3) | 2.1 (2.5) | - | 1.8 (.16) | 3.2 (1.5) | - |
| | Slope | .23 (.18) | .27 (.24) | - | - | .21 (.28) | .42 (.79) | - | .009 (.01) | .013 (.01) | - |

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|---|---|---|---|---|---|---|---|---|---|---|
| **CM6** | Duration (ms) | 323 (52) | - | 355 (75) | - | 306 (41) | 344 (42) | - | 176 (19) | 203 (34) | - |
| | Peak Height (st) | 86 (1.4) | - | 88.2 (1.7) | - | 85.5 (2.8) | 86.6 (2.1) | - | 83.4 (1) | 83.6 (.7) | - |
| | Peak Alignment | .85 (.08) | - | .75 (.09) | - | .82 (.1) | .69 (.09) | - | 1.39 (.37) | 1.11 (.23) | - |
| | Valley Height (st) | 83.8 (.8) | - | 83.9 (.7) | - | 82.2 (2.3) | 80.3 (2.6) | - | 82.1 (1.1) | 82.3 (.8) | - |
| | Valley Alignment | .26 (.05) | - | .26 (.05) | - | .26 (.04) | .26 (.03) | - | .33 (.04) | .28 (.03) | - |
| | Rise (st) | 2.2 (1.1) | - | 4.3 (1.9) | - | 3.3 (3.1) | 6.3 (3.8) | - | 1.3 (.8) | 1.3 (.6) | - |
| | Slope | .09 (.04) | - | .23 (.1) | - | .19 (.05) | .2 (.09) | - | .007 (.04) | .009 (.04) | - |

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