

The Intonation of Peruvian Amazonian Spanish: Rising Accents and Segmental Factors

DISSERTATION

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Abstract

This dissertation examines tonal alignment in one variety of Peruvian Amazonian Spanish (PAS). Previous studies across languages have modeled tonal alignment using two main hypotheses. The Segmental Anchoring Hypothesis (SAH) posits that tonal events anchor to specific landmarks in the segmental string (Arvaniti et al. 1998). The Non-Segmental Anchoring Hypothesis, on the other hand, posits that the alignment of the tonal events with the segmental string is conditioned by several factors; it does not have a specific anchor in the segmental string. Using the Autosegmental Metrical (AM) framework, I acoustically analyze the intonational contours of PAS declaratives produced in a reading task. This allows me to test the conflicting models on tonal alignment in PAS, and the potential effects of segmental information on F0 peak location. Furthermore, I explore spontaneous speech data from PAS. Finally, I use the results in this dissertation to revisit and reassess the current phonological representations for PAS rising accents in Sp_ToBI.

In order to achieve these goals, I collected production data from 13 monolingual PAS speakers from the Amazonian city of Pucallpa. Informants completed two tasks. In the reading task, I elicited three different types of sentences: broad, narrow, and contrastive focus declaratives. These sentences varied in length (which served as a proxy for segmental duration), ranging from 2 to 5 content words. Stressed syllables included

both CV and CVC syllables. In this task, participants were asked to read sentences following a prompting question, which elicited a specific pragmatic meaning. I conducted acoustic analysis of this data, focusing on F0 peak location, F0 rise time, and F0 tonal height. These measurements were then analyzed statistically. The second task consisted of a short interview, meant to elicit spontaneous data.

Results from the tonal alignment analysis show that across declarative types, and regardless of segmental information, F0 peaks are realized within the boundaries of the stressed syllable, and more specifically, within the stressed vowel. Additionally, results also show that F0 rise time is not temporally fixed. These two findings provide evidence in favor of SAH in PAS, with the stressed vowel serving as the segmental anchor.

Therefore, I claim that PAS is a Spanish variety in which segmental anchors are primary. These results differ from previous studies on Spanish, such as Prieto & Torreira (2007). Spontaneous data of PAS declaratives corroborate the findings reported from the reading task. Spontaneous data from PAS show that F0 peaks align consistently with the stressed syllable, and more precisely, with the stressed vowel.

Lastly, the acoustic and statistical analyses in this dissertation provide additional support for the phonological representations of PAS rising accents that were proposed in García (2011). Specifically, for broad focus words and narrow/contrastive non-focused words, I propose a bitonal pitch accent: L+H*. For narrow and contrastive focused words, I maintain a tritonal pitch accent: L+H*+L, which denotes that the F0 contour both rises and falls within the stressed syllable.

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Publications

García, Miguel. 2014. Sobre la duración vocálica y la entonación en el español amazónico peruano. *Lengua y Sociedad*, 14(2), 5-29.

García, Miguel. Forthcoming. Segmental Anchoring in Peruvian Amazonian Spanish intonation.” *Inquiries in Hispanic Linguistics: From theory to empirical evidence*, ed. by Alejandro Cuza, Lori Czerwionka, and Daniel Olson. Amsterdam: John Benjamins.

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Chapter 1: Introduction

1.1 Topic under Investigation

Research on Spanish intonation has flourished in the past two decades. These works have provided valuable descriptions of several Spanish varieties as well as helped obtain a general depiction of Spanish intonation. One area that has received major attention is tonal alignment. In this dissertation, the term tonal alignment refers to the temporal mapping of intonational (Fundamental Frequency – F0) contours to segments (i.e. consonants, vowels) in a sentence (Prieto 2011)—that is, where and when tonal events occur in relation to the segmental composition of the utterance. This definition will be expanded in §2.4. In this dissertation, I examine Peruvian Amazonian Spanish (henceforth PAS), as spoken in the city of Pucallpa, Peru, and seek to provide a detailed account of PAS declaratives with regard to tonal alignment.

Two main conflicting hypotheses have been proposed to model tonal alignment across languages. The Segmental Anchoring Hypothesis (henceforth SAH) suggests that tonal events in the F0 contour anchor to specific segments in the sentence (Arvaniti et al. 1998). The opposite view, referred to as the Non-Segmental Anchoring Hypothesis in this dissertation, argues that tonal events are not anchored to specific segments, but rather other factors, such as syllable structure and speech rate for instance, affect tonal alignment. Relevant works in this debate explore several languages: Swedish (Bruce

1977), American English (Steele 1986, Silverman & Pierrehumbert 1990, van Santen & Hirschberg 1994, Arvaniti & Garding 2007), Dutch (Caspers & van Heuven 1993, Ladd et al. 2000, Schepman et al. 2006), Modern Greek (Arvaniti et al. 1998), German (Grabe 1998, Atterer & Ladd 2004), Chinese (Xu 1998), British English (Ladd et al. 1999), Italian (Gili Fivela & Savino 2003), Japanese (Ishihara 2003), French (Welby & Loevenbruck 2005), and Spanish (Prieto & Torreira 2007).

To my knowledge, only two studies have explicitly examined the effects of linguistic factors on tonal alignment in Spanish (Prieto et al. 1995 for Mexican Spanish, Prieto & Torreira 2007 for Peninsular Spanish), but only one of them (the latter) did so with regard to the two conflicting hypotheses aforementioned. Needless to say, much less is known about other Spanish varieties, particularly understudied varieties such as PAS. This dissertation then adds to the limited literature on tonal alignment in Spanish with reference to the two conflicting segmental anchoring hypotheses. This is key because PAS declaratives exhibit intonational patterns that differ from Mexican Spanish and Peninsular Spanish (García 2011), and thus an examination of PAS declaratives could provide us with further insight into tonal alignment in Spanish more broadly. This dissertation also seeks to advance our understanding of the PAS intonation system. Although we currently have a basic description of PAS intonational patterns, I aim to provide a more in-depth description of PAS declaratives by examining both laboratory (i.e. reading) as well as spontaneous speech data. As will be detailed later in Chapter 3, the methodology used in this dissertation has not been employed in earlier works on PAS. Therefore, this dissertation offers a more thorough analysis of PAS intonation.

1.2 Dissertation Goals

This dissertation has three main goals: (1) to examine tonal alignment in PAS declaratives taking into consideration segmental information, (2) to explore tonal alignment in PAS using spontaneous data, and (3) to revisit the current phonological representations of PAS rising accents in light of new data presented in this dissertation.

Regarding the first goal, only two studies have explored PAS intonational patterns: García (2011) and Elías-Ulloa (2015). These two studies constitute the seminal works on PAS intonation. In García (2011), the aim was to explore PAS declaratives and to identify where the F0 peak (i.e. F0 maxima) in the intonational contours were located with respect to the stressed syllable, namely, if F0 peaks were located within or after the stressed syllable. Elías-Ulloa (2015) also examined PAS intonational patterns but did not consider declaratives. Instead, he focuses on yes-no questions of a bilingual variety (Shipibo-Konibo Spanish) spoken in the Peruvian Amazonia, and qualitatively compared these patterns with those found in PAS yes-no questions, as spoken in Pucallpa. However, neither of these two studies purposely explored the potential effects of segmental information on PAS intonational contours. Hence, this dissertation represents the first work on PAS that studies its intonational patterns in tandem with segmental information.

As for the second goal, most research on Spanish intonation has been based on laboratory data (cf. Face 2003, Willis 2003, Prieto & Roseano 2010, Colantoni 2011, among others). Two advantages of using laboratory data are the homogeneity in the utterances produced by the speakers, and the possibility of manipulating various factors

(e.g. number of syllables per word, syllable structure) during the preparation of the target sentences. Different results according to each type of data have been also reported. Face (2003), for example, finds discrepancies in the intonation of Peninsular Spanish declaratives between laboratory and spontaneous speech data. Face reports that certain intonational patterns presumably very common in laboratory speech are not present in spontaneous speech. Lickley et al. (2005) further argue that reading data represent as valid a tool as spontaneous data to approach intonation. This dissertation then adds to those studies that examine intonation through the use of both laboratory and spontaneous data. For PAS, this work is the first attempt to describe the intonational patterns of its declaratives in a less controlled context. Finally, regarding the third goal, I discuss the phonological representations of PAS rising accents based on new data obtained in the present dissertation. I begin by reviewing the previous phonological representations of rising pitch accents in Spanish, and then revisit the current proposal for PAS (García 2011). I develop this analysis in the Autosegmental-Metrical (AM) framework of intonation (Pierrehumbert 1980, Ladd 1996), and the ToBI annotation system for Spanish (Sp_ToBI) (Beckman et al. 2002, Face & Prieto 2007, Estebas-Vilaplana & Prieto 2008).

In order to address these three goals, I collected speech data from 13 monolingual PAS speakers born and raised in the city of Pucallpa, in Peru's Amazonian region. Peruvian Amazonian Spanish is one of the three main Spanish varieties spoken in Peru (Escobar 1978, Ramírez 2003). It is also the least studied variety when compared to the other two main Spanish varieties in the country, Coastal (Lima) Spanish and Andean Spanish. Although impressionistic descriptions of PAS exist, mainly from the

foundational work of Escobar (1978) and Ramírez (2003), empirical studies on PAS are few and far between. Some of these early works include Erickson (1986), Vigil Oliveros (1993), and Caravedo (1995, 1997). However, a more recent boom of research on PAS has emerged in the field of Hispanic Linguistics (Saldaña Fernández 2009, Jara Yupanqui 2012, Jara Yupanqui & Valenzuela 2013, García 2014, Koops & Vallejos 2014, Vallejos 2014, Elías-Ulloa 2015, O'Rourke & Fafulas 2015). As part of this increased attention toward the Amazonian Spanish variety, in November 2015, the *First Symposium on Amazonian Spanish* was held in Lima, Peru, at the Pontificia Universidad Católica del Perú. This symposium brought together scholars working on Amazonian Spanish, not only in Peru but also in other Latin American countries such as Colombia and Ecuador. I must note here that when I use the term PAS in this dissertation, I refer specifically to the Peruvian Amazonian variety spoken in the city of Pucallpa. I do so because it has been argued that there may be more than one Peruvian Amazonian Spanish variety (Ramírez 2003). Also, this clarification does not restrict the possibility for future works in other main Peruvian Amazonian cities, such as Iquitos or Puerto Maldonado, particularly but not exclusively regarding intonation.

As will be detailed in Chapter 3, the data analyzed in this dissertation were collected in the summer of 2014 in the city of Pucallpa. Thirteen monolingual PAS speakers completed two different tasks: a reading task and an interview task. In the reading task, I collected three types of declaratives according to the type of focus: broad, narrow, and contrastive. In each focus group, sentences contained 2-, 3-, 4-, and 5-content words; the syllabic structure included both CV and CVC stressed syllables; and

all positions in the sentences were part of the analysis. Unlike the reading task, sentences from the interview task were analyzed qualitatively. Data from the interview task contained mostly broad focus declaratives, though narrow and contrastive focus declaratives were also collected. I then performed acoustic analyses of all sentences in *Praat* (Boersma & Weenink 2016), and acoustically measured different tonal events in relation to segmental structure, in order to quantitatively examine significant patterns in the data.

Tonal alignment across the three types of declaratives was examined both as a categorical variable as well as a continuous variable. As a categorical variable, I first examined the location of the F0 peak: whether it fell before, within, or after the stressed syllable, and in relation to syllabic elements (i.e. onset, vowel, coda). Tonal alignment was also examined as a percentage into the stressed syllable and the stressed vowel in order to explore if F0 peaks were realized at a specific proportion within the stressed syllable and the stressed vowel. The effects of number of words in a sentence, syllable structure, position of the word in the sentence, and type of focus on tonal alignment were examined using a series of statistical models in R (R Development Core Team 2016). In addition to tonal alignment, F0 rise time was explored as a way to test the two anchoring hypotheses. Moreover, tonal height was also examined in order to complement the results of tonal alignment found in PAS declaratives. This systematic examination of the tonal events and their interaction with segmental information presents a novel methodology in the examination of PAS intonational patterns, and allows me to contribute to our understanding of the relationship between intonation and segmental information in

Spanish intonational phonology more generally. Last but not least, I also revisit the phonological representations of tonal events in PAS declaratives based on quantitative analysis of acoustic data, and a thorough examination of the theoretical implications of its different pitch accents.

1.3 Overview of Dissertation

The following chapters in this dissertation are organized as follows. In Chapter 2, I present a review of previous literature relevant for the present study. I start with an overview of the Autosegmental-Metrical (AM) framework and the ToBI annotation system, both of which will guide my intonational analysis. I then proceed with a review of the major works examining rising pitch accents of declaratives in Spanish intonation, including Peruvian Spanish. I also provide a brief summary of recent studies examining intonation using spontaneous data. In this chapter, I also review relevant works on tonal alignment across languages in relation to the two anchoring hypotheses. This chapter concludes with my research questions. Chapter 3 provides a detailed description of the methodology used in this study. Here, I describe the region of study, participants, procedures, stimuli, tasks, data analysis, and my hypotheses. The results of the analysis in both tasks are reported in Chapter 4. This is followed by a discussion and an interpretation of the results presented in Chapter 5. In this chapter, I evaluate the segmental anchoring hypotheses in PAS, as well as revisit the current phonological representations of PAS rising accents. Finally, in Chapter 6, I return to my research

questions, answering them based on the findings of this dissertation. I also lay out the main contributions of this dissertation, and possible directions for future research.

Chapter 2: Literature Review

This chapter critically reviews the previous literature relevant to understand both intonation and tonal alignment, focusing on Spanish, and to motivate the dissertation research questions. First, I introduce the theoretical model within which I develop my intonational analysis, i.e. the Autosegmental-Metrical (AM) framework of intonational phonology (§2.1). I continue with a brief description of *ToBI*, a system of prosodic transcription for intonation (§2.2). More specifically, I focus on the Spanish version of *ToBI*, i.e. Sp_ToBI (§2.2.1). Then, I give an overview of Spanish intonation (§2.3), focusing on the rising pitch accents (§2.3.1). I follow up this subsection with a discussion of the recent research on declaratives in Peruvian Spanish intonation (§2.3.2). Next, I review previous studies examining intonation using both laboratory and spontaneous speech data (§2.3.3). The second part of this chapter is devoted to tonal alignment (§2.4), and the models proposed to describe it (§2.4.1 and §2.4.2). I then discuss the reasons why Peruvian Amazonian Spanish constitutes a useful and intriguing testing ground for the models of tonal alignment (§2.4.3). The chapter concludes with my research questions (§2.5).

2.1 The Autosegmental-Metrical Framework

The Autosegmental-Metrical (AM) framework was first introduced by Pierrehumbert (1980) in her seminal work on American English intonation. The main goal of this framework was to offer a phonological characterization of the intonational (Fundamental Frequency – F0) contours in American English. It also devised a set of mapping rules by which the main tonal events in the intonational contours associate phonologically with the segmental string. The AM framework, a term later coined by Ladd (1996), was inspired by early work on English (Lieberman 1975), African tonal languages (Goldsmith 1976), and Swedish (Bruce 1977), and is currently the most widely used phonological framework for intonation analysis. While Pierrehumbert's (1980) dissertation served as a point of departure for the AM framework, subsequent studies helped revise it (Beckman & Pierrehumbert 1986, Pierrehumbert & Beckman 1988). Several scholars also began to apply the tenets of AM to different languages, including Catalan, German, Greek, Dutch, Portuguese, and Spanish, among others (see for example Ladd 1996, Jun 2005, 2014, and Sosa 1991 and Hualde 2003 for Spanish).

The AM framework receives its name from two underlying ideas. First, it is considered 'autosegmental' in the sense that tonal events, or tones, in the intonational contour behave independently from the segmental string. Second, it is 'metrical' because tones, although independent from the segments, associate with strong phonological units by a set of mapping rules (Pierrehumbert 1980, Ladd 1996, Gussenhoven 2002).

In the AM framework, intonational contours consist of sequences of High (H) and Low (L) tones associated with prominent phonological units in the segmental string.

Tones can be of two types: *pitch accents* and *edge tones*. Pitch accents are tonal events associated with prominent syllables, and can be monotonal (e.g. L or H) or bitonal (e.g., L+H, H+L). Commonly, a bitonal pitch accent formed by a sequence L+H is a rising accent, while a sequence H+L is a falling accent. Pitch accents are also distinguished by their position in the phrase. The last pitch accent in the phrase is known as the *nuclear accent*, while those pitch accents in non-final positions are referred to as *prenuclear accents*. In terms of notation, an asterisk symbol (*) indicates the tone associated with the metrically strong syllable (i.e. the stressed syllable). This asterisk symbol is always placed after the tone (e.g. L*, L+H*). Generally, the first tone of a bitonal pitch accent is known as the leading tone, whereas the second tone is known as the trailing tone. For example, in the bitonal rising pitch accent, L+H*, the High tone (i.e. starred one) is the one associated with the strong syllable, and the Low tone is the leading tone.

Phonetically, the High and Low tones of the pitch accent manifest in the intonational contour as F0 peaks (i.e. F0 maxima) or F0 valleys (i.e. F0 minima), respectively. While a pitch accent is phonologically associated with the stressed syllable, the phonetic realization of the tones in relation to the segments (i.e. alignment) may vary. As Ladd (1996:55) explains:

“Alignment must be defined as a *phonetic* property of the relative timing of events in the F0 contour and events in the segmental string. Association, on the other hand, is the abstract structural property of ‘belonging together’ in some way.” (emphasis in the original)

Therefore, in L+H*, the pitch accent associates phonologically as a whole with the stressed syllable. The asterisk marks the association between the High tone and the metrically strong segmental unit (i.e. stressed syllable). Phonetically, this starred tone also indicates the alignment of the High tone (i.e. F0 peak) with the stressed syllable. That is, the F0 peak in the intonational contour is realized within the temporal boundaries of the stressed syllable.

Edge tones, on the other hand, are tonal events associated with the edges of the phrases. Edge tones are essentially monotonal (i.e. L or H). In the original AM framework, the two types of edge tones are: *boundary tones* and *phrase accents* (Pierrehumbert 1980). Boundary tones refer to those tones associated with the final edge of the phrases, while phrase accents (or phrase tones) ensue between the nuclear accent and the boundary tone (Ladd 1996:80). In a later revision of the AM framework, two boundary tones were proposed: the *intonational phrase* tone and the *intermediate phrase* tone (Beckman & Pierrehumbert 1986). An intonational phrase boundary tone associates with the end of the phrase (cf. Pierrehumbert & Beckman 1988). An intermediate phrase boundary tone, however, is contained within the intonational phrase, and is used to mark a minor phonological unit (Ladd 1996:93). Regarding the notations, intonational phrase boundary tones are marked with a percent sign placed after the tone, e.g. L%, H%. Intermediate phrase boundary tones, on the other hand, are marked with a hyphen placed after the tone, e.g. L-, H-. The AM framework also accounts for the lowering of the pitch of subsequent High (H) tones across utterances. This consistent tonal pitch lowering is described as *downstep* (Pierrehumbert 1980, Pierrehumbert & Beckman 1988). A

downstepped tone is marked with an inverted exclamation sign (!) placed before the tone, e.g. !H*. Therefore, a downstepped High tone, !H*, is much lower (in pitch height) than a preceding High tone.

In summary, in the AM framework, intonational contours are phonologically analyzed as a sequence of tonal events, which occur in well-defined locations (i.e. stressed syllables and end of phrases). Correspondingly, these tonal events can be of two types: pitch accents and edge tones, and they are made up of a binary set of tones, High (H) and Low (L). Finally, High tones can undergo a phonological phenomenon known as downstep.

In the last updated version of the AM framework, the tonal distribution is as follows: six pitch accents, H*, L*, L*+H, L+H*, H+L*, and H*+L¹; two intermediate phrase boundary tones, L-, H-; and, two intonational phrase boundary tones, L%, H%. It is important to note that the number of pitch accents and edge tones can vary across languages. In other words, not every language will make use of all of them, and further modifications to this tonal distribution have been, and can be, proposed for specific languages. In fact, and as will be discussed below (§2.3), in the current Spanish repertoire there are three rising pitch accents, and more than two intonational phrase boundary tones (Estebas-Vilaplana & Prieto 2008). Nonetheless, the fundamentals of the AM framework remain present. An example of the continuous development in intonation, based on the

¹ The original AM proposal consisted of seven pitch accents. The falling bitonal pitch accent, H*+H, was disregarded in a later revision of the AM framework (Beckman & Pierrehumbert 1986).

tenets of the AM framework, is the system of prosodic annotation, *ToBI*, to which I turn now.

2.2 ToBI

In the 1990's, a system of phonological transcription and annotation for intonation, *ToBI*, *Tones and Break Indices*, was developed (Silverman et al. 1992, Beckman & Hirschberg 1994, Beckman & Ayers 1997). The ToBI system is a “set of conventions for labelling prosodic features” used for specific languages, based on the AM framework (Ladd 1996:95). At the core of the ToBI system, the goal is to share common transcription tools among researchers which would ultimately allow for cross-linguistical, and dialectal, comparisons in the analysis of intonation. In fact, scholars have already used the ToBI conventions to describe several languages (see Jun 2005, 2014, for a survey of the main ToBI systems). Prieto & Roseano's (2010) volume *Transcription of Intonation of the Spanish Language*, for example, compiles the analysis of ten different varieties within the ToBI system for Spanish, Sp_ToBI. Similarly, Frota & Prieto's (2015) volume *Intonation in Romance* draws comparisons among typologically similar languages.

The ToBI system shares with the AM framework several communalities. First, F0 contours are understood as a sequence of tones (i.e. H, L). Second, these tones can be of two types: *pitch accents* and *edge tones*. Third, the downstep diacritic (!), introduced in the AM framework, acts as a standard notation across ToBI systems. Nonetheless, the number of pitch accents or edge tones depend on each language, and the tonal

distribution eventually varies based on ongoing investigations among, and within, languages.

Generally, a standard ToBI transcription consists of at least four labeling tiers. The two main tiers are the tones (*To*) and the break indices (*BI*) tiers, followed by the words and miscellaneous tiers. The phonological analysis of the tones, based on the F0 contours, appears in the tones tier. The break indices tier includes the strength among lexical items or between pauses, ranging from 0 (the weakest boundary, e.g. coalescence of two vowels across syllable boundaries) to 4 (the strongest boundary, e.g. intonational phrases). In the word tier, the prosodic words are transcribed orthographically. Any comments, laughs, or disfluencies in the speech are recorded in the miscellaneous tier.

For the purposes of this dissertation, I will not delve into a narrow ToBI transcription, including all the tiers detailed in the previous paragraph. I will only focus on the tones tier, since one of my goals is to revisit the current phonological representations of Spanish rising accents in the most up-to-date Sp_ToBI version (Prieto et al. 1994, Beckman et al. 2002, Estebas-Vilaplana & Prieto 2008). The development of the rising accents representations in Sp_ToBI is the topic of the following sections (§2.2.1 and §2.3).

2.2.1 Sp_ToBI

In October 1999, the first workshop on Sp_ToBI was held at The Ohio State University. The main goal was to develop a transcription system for Spanish intonation within the ToBI framework that could be used later for the prosodic transcription of several

varieties. The result of this first workshop was the publication of the preliminary transcription and labeling conventions of Sp_ToBI (Beckman et al. 2002). Three workshops, held in Barcelona (2005, 2008) and Las Palmas de Gran Canaria (2009) succeeded the first one. In these later meetings, researchers examined a wider number of Spanish varieties, and two revisions followed the first version of 2002 (Face & Prieto 2007, Estebas-Vilaplana & Prieto 2008). In the next paragraphs, I will briefly describe the first proposal of Sp_ToBI (Beckman et al. 2002). This description will help situate the developments of the Sp_ToBI system in the following years.

In Beckman et al. (2002), three pitch accents were originally proposed for the intonational patterns of Spanish (i.e. two rising accents and one falling accent). These pitch accents are schematized in Figure 1, Figure 2, and Figure 3 shown below. In the figures, the bolded line represents the intonational (F0) contour. The shaded areas indicate the stressed syllable. For the rising pitch accent L^*+H , the F0 starts to rise at the beginning of the stressed syllable and the F0 peak is reached after the stressed syllable (see Figure 1). For the rising pitch accent $L+H^*$, the F0 peak occurs within the stressed syllable (see Figure 2).² Although these descriptions suggest that the location of the F0 peak is what distinguishes both rising accents, Beckman et al. label them as “late rising accent” and “early rising accent”, respectively. As for the falling rising accent, $H+L^*$, there is a F0 fall from a higher pitch during the stressed syllable (see Figure 3).

² In their description of $L+H^*$, Beckman et al. (2002) do not make it explicit where the F0 contour starts to rise, but throughout the paper it is shown that the F0 rise starts in the vicinity of the stressed syllable.

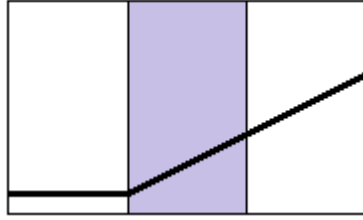


Figure 1: Late rising pitch accent, L^*+H , in Beckman et al. (2002).

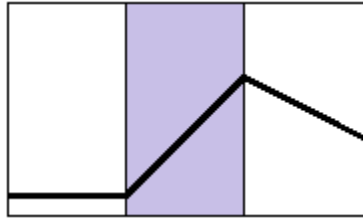


Figure 2: Early rising pitch accent, $L+H^*$, in Beckman et al. (2002).

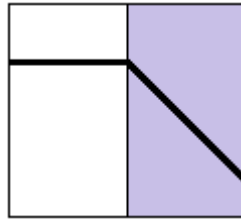


Figure 3: Falling pitch accent, $H+L^*$, in Beckman et al. (2002).

Additionally, two downstepped pitch accent variants were proposed: $L^*+!H$ and $L+!H^*$. Crucially for the labeling, the downstep diacritic (!) precedes the High tone in these representations. Furthermore, the Sp_ToBI includes an upstepped variant of the early rising accent, $!L+H^*$. *Upstep* is understood as the opposite of downstep where the upstepped tone is higher than the preceding one. The upstep diacritic (i) is placed before the Low tone.

There were two place holders for cases where further examination was needed before making a decision. First, the label H* was used for a clear small F0 peak during the stressed syllable. Second, an asterisk * was used for cases where the shape of the rise was ambiguous to even consider it as a H*. As for the edge tones, Beckman et al. (2002) distinguish only two boundary tones: the low boundary tone, L%, which represents a lower F0 contour after a rising accent, or the continuous low F0 after the falling rising accent; and the high boundary tone, H%, representing a rise to a higher F0 level after any pitch accent. A third place holder was proposed for boundary tones: M%, mostly to differentiate between a half rise and a full rise.

The previous paragraphs describe the tonal distribution (i.e. the tones tier) of the first Sp_ToBI version. We must note, however, that the study of intonation in Spanish did not start with the initial labeling conventions of Sp_ToBI in 2002. In fact, several studies made significant contributions long before then, and several others helped modify it later on. The next section (§2.3) will discuss some of those previous studies as well as the revisions of Beckman et al.'s (2002) proposal, focusing particularly on the Spanish rising accents.

2.3 Spanish Intonation

Groundbreaking work on Spanish intonation was first published by Navarro Tomás in his *Manual de Entonación Española* (1944). Navarro Tomás' early descriptions made substantial contributions with respect to the F0 behavior in Spanish intonation. Navarro Tomás noticed that: (1) the rise of the F0 contour spans over the stressed syllable; and,

(2) in prenuclear accents, the weak syllable following the stressed syllable contains a higher pitch than the stressed syllable. However, Navarro Tomás' characterization of Spanish intonation lacked a theoretical framework. Hence, no phonological representations were posited. Subsequent experimental studies, however, validated these early findings (Garrido et al. 1993, Prieto et al. 1996, Beckman et al. 2002, among others). Several of these later studies will be described in what follows. In the next section (§2.3.1), I present these studies according to how many rising pitch accents have been proposed for Spanish: one, two, and three. This order will highlight the progression in the research in this area of Spanish intonation.

2.3.1 Spanish Rising Accents

2.3.1.1 One Pitch Accent

In a series of phonetic studies, Prieto and colleagues (Prieto et al. 1994, Prieto & Shih 1995, Prieto et al. 1995, Prieto et al. 1996, and Prieto 1998) examine declarative sentences in Mexican Spanish.³ In their work, rises in the intonational contours are analyzed as simple F0 peaks. Following Pierrehumbert (1980), these F0 peaks were represented as H*. In Pierrehumbert's AM notation, an H* accent on a syllable denotes a high F0 value. Since the purpose of Prieto's studies was not specifically to propose a phonological representation of Spanish rising accents, the use of H* was convenient as a

³ While the majority of studies on Spanish intonation make reference to Mexican Spanish, Peninsular Spanish, Peruvian Spanish, etc., it is important to recognize that they are not necessarily representative of the Spanish spoken in all of Mexico, Spain, or Peru. Differences in intonational patterns may emerge even within one country.

means of labeling. According to Prieto, at least in Mexican Spanish, there was no evidence of a phonological contrast between H* and L+H* (1998:263). Furthermore, Prieto explains that the F0 valleys observed between the F0 peaks can be best interpreted as “sags” rather than valleys, or L tones, in the phonological representation. Similar to the proposal of Prieto and colleagues, Nibert (2000) suggests that the rising pitch accents in Spanish intonation belong to only one phonological representation, H*. For cases where the F0 peak is reached within the stressed syllable, Nibert argues that an intermediate phrase boundary tone, L-, causes the F0 peak retraction to the stressed syllable.

Hualde (2002) also argues in favor of only one rising pitch accent in Spanish. For him, the displacement of the F0 peak to the post-stressed syllable is the unmarked contour of all rising pitch accents in Spanish declaratives. While Hualde agrees with Prieto’s studies and Nibert (2000) on the idea that there is no phonological contrast between H*, L*+H, or L+H*, he disagrees on the label H* as the appropriate representation. In fact, for Hualde, the presence of the F0 valley is consistent among Spanish pitch accents. Therefore, the Low tone must be included in the phonological representation. Hualde proposes the representation (L+H)*, which indicates that the F0 valley and the F0 peak (i.e. both tones) associate with the stressed syllable, both in prenuclear and nuclear positions. Focusing on the nuclear accent, Hualde explains that the F0 peak is realized within the stressed syllable due to the presence of a Low boundary tone (L%). Hence, due to tonal crowding, the F0 peak is retracted leftward, and falls into the stressed syllable. For Hualde, the two patterns commonly analyzed as L*+H and L+H* in Spanish are phonetic realizations of the same rising pitch accent: (L+H)*.

2.3.1.2 Two Pitch Accents

Several scholars disagree with the one pitch accent proposal for Spanish rising accents. Sosa (1999), for example, is one of the first scholars to distinguish between prenuclear and nuclear accents in Spanish. Sosa argues that prenuclear accents in declaratives should be represented as L*+H. According to him, prenuclear pitch accents are characterized by a F0 peak realized after the stressed syllable. Thus, only the F0 valley associates with the stressed syllable (accordingly, the asterisk is positioned next to the L tone). As for the nuclear pitch accent, where the F0 contour reaches its peak within the boundaries of the stressed syllable, Sosa proposes either L+H* or H* as possible phonological representations. Sosa's study made two important contributions. First, Sosa recognizes the existence of a Low tone in the representation of Spanish rising accents. A similar observation made later by Hualde (2002). Sosa also makes the distinction between prenuclear and nuclear accents. In fact, this distinction was later maintained in upcoming descriptions of Spanish intonation.

In a later study, Face (2001a) also challenges the one pitch accent proposal and shows that indeed there are two phonological rising pitch accents in Spanish. In order to do so, Face examines F0 peak alignment of prenuclear rising pitch accents in broad focus sentences, and compares them to cases of narrow focus in non-final position. The term broad focus refers to cases where no word is emphasized more than others in a sentence, and the entire sentence contains new information. Narrow focus refers to cases where only one element of the sentence is emphasized (Ladd 1980). For example, a question such as *¿Qué pasó?* 'What happened?' would trigger a broad focus sentence since no

single word in the response is emphasized more than others. For example, a possible response to the above-mentioned question would be *Lorena donaba la corona*, ‘Lorena was donating the crown’. The entire sentence is new information. On the other hand, a question such as *¿Qué donaba Mariana?* ‘What was Mariana donating?’ would elicit a narrow focus sentence since what Mariana donated is emphasized, and thus only one constituent contains new information. For a narrow focus question, such as the one above, the response would be *Lorena donaba la corona*, where *la corona* is new information.

Face (2001a) finds that in broad focus declaratives the F0 peak occurs after the stressed syllable in prenuclear accents. In narrow focused words, and crucially in non-final positions, the F0 peak occurs within the temporal boundaries of the stressed syllable. For Face, this is evidence that these two rising accents are phonologically contrastive. They convey different meanings. Therefore, the phonological representation of Spanish rising accents must capture this contrast. Face proposes two phonological representations: L^*+H , for words in broad focus declaratives (in prenuclear accents), and $L+H^*$, for narrow focused words. Moreover, the pitch accent L^*+H is referred to as *late peak alignment* whereas the $L+H^*$ is referred to as *early peak alignment*.

Note that the asterisk (*) in Face’s (2001a) proposal indicates phonetic alignment of the F0 peak with the stressed syllable rather than association. According to Face, in broad focus pitch accents, only the F0 valley aligns with the stressed syllable. Thus, L^*+H is an ideal representation. For cases of narrow focused words, however, both the F0 valley and the F0 peak align with the stressed syllable. Based on these observations,

Face proposes a more accurate representation for the *early peak alignment*; namely, (L+H)*.⁴ Face also acknowledges limitations to his proposal (2001a:242). Specifically, he recognizes that the parenthetical notation is not standard in the AM framework, and hence may be problematic for the phonological representation of Spanish rising accents.⁵

As discussed above, Beckman et al. (2002) outline for the first time the preliminary labeling conventions of Sp_ToBI. Beckman et al. propose two rising pitch accents: L*+H, a *late rising accent*, and L+H*, an *early rising accent*. Generally, the late rising accent is found in prenuclear positions of broad focus declaratives, whereas the early rising accent is found mostly in nuclear position, and as a focal accent. For convenience, the corresponding schemas appear below in Figure 4.



Figure 4: Rising pitch accents, L*+H (left) and L+H* (right), in Beckman et al. (2002).

⁴ The representation proposed by Face (2001a) is technically different from the one proposed by Hualde (2002), in terms of what they actually symbolize. For Hualde, (L+H)* indicates that both tones are associated equally with the stressed syllable. For Face, however, this representation indicates that both tones are phonetically aligned with the stressed syllable.

⁵ In a later study, Face (2002) dismissed this parenthetical notation. Based on the examination of pitch accent structure, he poses L*+H for broad focus rising accents, and L+H* for focal pitch accents.

We must note that these two rising accents are described in reference to the timing of the F0 rise (i.e. late rising vs. early rising), though in both cases the F0 starts rising at the onset of the stressed syllable. As pointed out by Face (2014), a more accurate description of these pitch accents would have been late-peak vs. early-peak rising accents since it is the location of the F0 peak the only phonetic distinction between them. Only subsequent studies will show that the F0 rise also plays a significant role in the distribution of Spanish rising accents (Willis 2003, Face & Prieto 2007).

2.3.1.3 Three Pitch Accents

Up until Beckman et al. (2002), only two rising pitch accents had been suggested to describe the rising accents in Spanish intonation. It was not until the examination of Dominican Spanish (DS) from the Cibao region by Willis (2003) that for the first time three pitch accents were proposed for Spanish. Specifically, Willis identified an unattested F0 pattern among Spanish rising accents. This new rising pitch accent was labelled as the *Late Low – Late High* pitch accent, L*+H, which is the unmarked prenuclear accent in DS broad focus declaratives. This pitch accent was described phonetically as having a F0 valley (i.e. Low tone) throughout the stressed syllable, and the F0 rise starting in the post-stressed syllable. The F0 peak is also reached after the stressed syllable. The second rising accent found in DS is the *Early Low – Late High* pitch accent, (L+H)*, for cases of contrastive focus.⁶ In this pitch accent, the F0 rise

⁶ Contrastive focus is commonly understood as a subset of narrow focus. While in both types of focus only one word in the sentence is emphasized, in contrastive focus declaratives the focused word is contrasted with another word from a preceding context.

starts at the onset of the stressed syllable, but the F0 contour reaches its peak after the stressed syllable. This pitch accent has a similar F0 pattern than the one described in Beckman et al. for cases of broad focus in Peninsular Spanish (see left graph in Figure 4). These two distinct rising pitch accents were the two main pitch accents found in DS.

The third pitch accent is the early-rising accent found in Beckman et al. (2002) for cases of focus in Peninsular Spanish. Willis (2003) labels it as *Early Low – Early High*, L+H*. In this pitch accent, the F0 rise starts in the stressed syllable, and the F0 peak is realized within the same stressed syllable. It must be noted here that this pitch accent did not occur in Willis' reading data but only in spontaneous data for cases of contrastive focus. This observation led Willis to consider a possible allotonic variation between (L+H)* and L+H*, as contrastive focus pitch accents in DS.

Regarding the labeling of these rising accents, for the *Late Low – Late High* pitch accent, L*+H, Willis observes that the F0 valley is mostly associated with the stressed syllable. The asterisk (*) in this representation denotes association. For the *Early Low – Late High* pitch accent, Willis finds that the F0 rise (i.e. both High tone and Low tone) is more central to the stressed syllable. Hence, Willis proposes the representation (L+H)*. The interpretation of this representation contrasts with the one presented by Hualde (2002) and Face (2001a). Recall that for Hualde, both tones associate to the stressed syllable. For Face, both tones phonetically align with the stressed syllable. In Willis' proposal, however, the F0 rise, rather than any particular tone, is more central to the stressed syllable. Finally, for the *Early Low – Early High* pitch accent, the F0 peak is more central to the stressed syllable. Thus, this pitch accent is represented as L+H*.

Table 1 below shows the distribution of the F0 patterns of the three rising pitch accents, L*+H, (L+H)*, and L+H*, in Beckman et al. (2002) and Willis (2003).

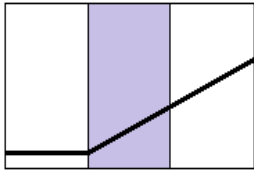
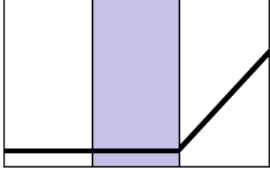
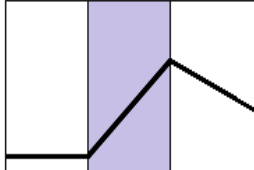
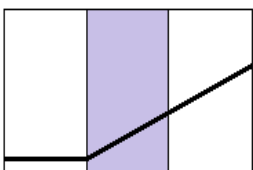
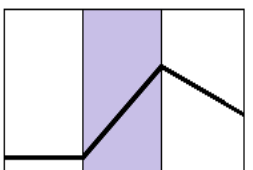
	Beckman et al. (2002)	Willis (2003)	
Broad Focus			
Narrow / Contrastive Focus			
		<i>Reading data (most common)</i>	<i>Spontaneous data</i>

Table 1: Comparison between rising accents found in Beckman et al. (2002) and Willis (2003).

Willis' (2003) investigation of DS is a major contribution to the analysis of Spanish rising accents for at least two reasons. First, it veers the attention to the location of the F0 valley (i.e. Low tone) in the description of pitch accents in Spanish. Until then, the distinction between Spanish rising accents revolved around the location of the F0 peak in relation to the stressed syllable (i.e. within or after; early or late). Willis demonstrates that, for some Spanish varieties, the start of the F0 rise can also play a significant role in the pragmatic meanings of the sentences. Second, Willis suggests an increase from two to three representations in the repertoire of rising pitch accents in Spanish in order to include, and phonologically account for, his new findings. Additional

evidence for this 3-way distinction among Spanish rising accents was presented a few years later in other Spanish varieties as well.

Face & Prieto (2007), for example, also acknowledge the existence of three rising accents in Spanish. Examining Castilian Spanish, Face & Prieto discover a third rising accent similar to the one found by Willis (2003). In their study, however, Face & Prieto offer a different phonological analysis of the 3-way distinction by sorting out the ambiguity of the star (i.e. association vs. alignment). Additionally, the authors make use of the concept of *secondary association* to develop their analysis. Figure 5 below shows the 3-way distinction proposed by Face & Prieto.

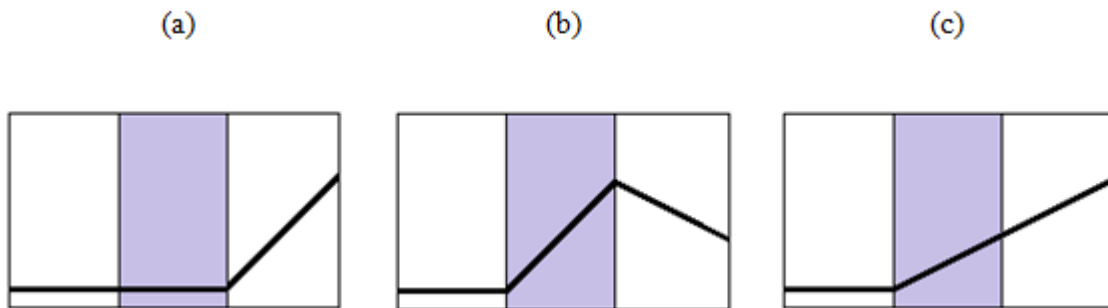


Figure 5: 3-way distinction in rising pitch accents found in Face & Prieto (2007).

For Face & Prieto (2007), the star (*) indicates primary phonological association between the tone and its tone-bearing unit (i.e. stressed syllable). The star also denotes which tone is the head of the pitch accent, as it does in the AM theory. Additionally, and in Face & Prieto's words, "the stronger tone (H or L) [is] starred according to perception of the prominent syllable" (2008:14). For the sake of clarity, let us look at graph (a) in

Figure 5. In this graph, the F0 contour is low throughout the stressed syllable, and according to the authors, it causes the stressed syllable to be perceived as low. Therefore, for Face & Prieto, the Low tone is the head of this pitch accent, and they represent it as L*+H.

In both graphs (b) and (c), there is a F0 rise throughout the stressed syllable, which makes it perceived as high. For this reason, the High tone is the head of the pitch accent, and they are both represented as L+H*. The distinction between these two pitch accents is whether or not the High tone has a *secondary association* to the stressed syllable. Thus, when the F0 peak aligns with the stressed syllable (i.e. graph b in Figure 5), the High tone has a secondary association to the stressed syllable. The phonological representation for this pitch accent is L+H*]σ. The symbol]σ in the representation indicates this secondary association. On the other hand, when the F0 peak is reached after the stressed syllable (i.e. graph c in Figure 5), the High tone has only a primary association. This pitch accent is phonologically represented as L+H*. In sum, Face & Prieto (2007) elaborate on the concept of secondary association of the High tone as responsible for the phonetic alignment of the F0 peak with the stressed syllable.

Generally, Face & Prieto (2007) distinguish between *late rising* pitch accents and *early rising* pitch accents. L*+H, for instance, is the only late rising accent, and is commonly found in focus position of absolute interrogatives, initial prenuclear accents in confirmation-seeking yes-no questions, and in soft request and commands. The other two pitch accents, L+H* and L+H*]σ, are referred to as early rising accents, and they appear in broad focus prenuclear accents and in narrow focused words, respectively.

Two years later, Estebas-Vilaplana & Prieto's (2008) study became the latest labeling proposal for Spanish intonation in the Sp_ToBI framework. The data of this study come from speakers of Madrid and Seville Spanish, as well as from Mexican Spanish, although only Peninsular Spanish data is presented in the article. Similar to Face & Prieto (2007), Estebas-Vilaplana & Prieto's study also recognizes the 3-way phonological contrast among rising accents in Spanish. However, this new proposal is different with regard to the pragmatic meanings of the pitch accents as well as in the labeling notation. In their proposal, Estebas-Vilaplana & Prieto abandon the concept of secondary association put forth by Face & Prieto.

First, Estebas-Vilaplana & Prieto (2008) maintain the pitch accent L^*+H , as formerly proposed in Willis (2003) and Face & Prieto (2007). This pitch accent is commonly found in prenuclear accents of anti-expected questions. Second, the pitch accent $L+>H^*$ indicates that the F0 contour rises throughout the stressed syllable, but the F0 peak is reached in the following syllable. The symbol $>$ denotes the F0 peak displacement to the post-stressed syllable.⁷ This pitch accent is found in cases of prenuclear accents in broad focus declaratives, similar to the findings of Face & Prieto. Lastly, the pitch accent $L+H^*$ represents both a F0 rise and a F0 peak within the stressed syllable. This pitch accent is commonly found in nuclear position of broad focus declaratives and in contrastive focused words. Table 2 below shows all the phonological

⁷ This symbol ($>$), positioned before the High tone, is also used in the American English version of ToBI (Beckman et al. 2005).

representations of rising pitch accents proposed for Spanish, presented in chronological order.

Proposals	Rising Pitch Accents		
Prieto's studies	H*		
Sosa (1999)	L*+H	L+H*/H*	
Nibert (2000)	H*		
Face (2001a)	L*+H	(L+H)*	
Hualde (2002)	(L+H)*		
Beckman et al. (2002)	L*+H	L+H*	
Willis (2003)	L*+H	(L+H)*	L+H*
Face & Prieto (2007)	L*+H	L+H*	L+H*]σ
Estebas-Vilaplana & Prieto (2008)	L*+H	L+>H*	L+H*

Table 2: Proposals of the phonological representations of the rising pitch accents in Spanish from Prieto et al.'s studies to Estebas-Vilaplana & Prieto (2008).

2.3.1.4 Summary

As the previous section shows, research in the past decades has enriched and expanded our understanding of Spanish intonation. Nonetheless, the issue of phonological representations of Spanish pitch accents has not been a source of agreement among scholars. One controversial issue has been the number of rising pitch accents necessary to describe the various intonational patterns found in Spanish. This disagreement, I believe, should not be taken as a drawback in the research of Spanish intonation. It rather highlights one of the main goals of the Sp_ToBI system—namely, the need to update current phonological representations in order to capture the intonational differences among newly studied Spanish varieties. Varieties such as Dominican Spanish and

Castilian Spanish called for new proposals to fully characterize their intonational patterns. As a result, scholars extended the repertoire of Spanish pitch accents.

A question that arises, however, is whether the 3-way distinction in the rising pitch accents is truly distinctive phonologically. Generally, in the literature, one way to attest phonological contrast has been to examine if pitch accents convey different meanings at the production level (e.g. Beckman et al. 2002, Willis 2003, Face & Prieto 2007). If they do, then they are phonologically contrastive, and this contrast ought to be captured in the representation. Face (2011), however, takes another stance at phonological contrast: perception. Examining Castilian Spanish (one of the varieties studied in Estebas-Vilaplana & Prieto 2008), Face argues against the 3-way distinction in the rising pitch accents. More specifically, Face shows that the distinction between $L+H^*$ and $L+\>H^*$ is not phonologically motivated. Instead, these two pitch accents are different phonetic realizations of one pitch accent, $L+H^*$. Face claims that speakers do not rely exclusively on F0 peak alignment when recognizing narrow focus. Rather, he notes that listeners utilize other cues such as F0 peak height and pitch range to identify narrow focus. These different approaches, i.e. production and perception, to phonological contrast highlight the importance of clarifying the meaning of phonological contrast among rising accents. Specifically, is phonological contrast tied to the speaker's perspective or the listener's? In this dissertation, I deal with production data, and therefore when I refer to phonologically contrastive pitch accents, I do so with regard to production, and whether or not speakers convey different meanings when uttering their

responses. The larger question of the definition of phonologically contrastive elements, in both production and perception, is beyond the scope of this dissertation.

2.3.2 Peruvian Spanish Intonation

The previous section (§2.3.1) has discussed the main findings in relation to the status and the phonological representations of Spanish rising pitch accents. My dissertation however analyzes Spanish data from the Amazonian region of Peru. Thus, it is useful to situate my research not only within the spectrum of Spanish intonation, but also within the Peruvian context. This section, therefore, will examine the limited, but existing, research on Peruvian Spanish intonation focusing on the findings related to its rising pitch accents in declaratives.

2.3.2.1 O'Rourke (2005)

The first study on Peruvian Spanish intonation was carried out by O'Rourke (2005). In her dissertation, O'Rourke examines the intonational patterns of two Peruvian Spanish varieties (Lima and Cuzco), along with Cuzco Quechua, in broad and contrastive focus declaratives.⁸ For Lima Spanish, she finds that in broad focus prenuclear accents, the F0 peaks align with the post-stressed syllable, a similar pattern found in other Spanish varieties such as Peninsular and Mexican Spanish. For the Cuzco group, however, there is

⁸ O'Rourke (2005) also investigates interrogatives in Quechua and Spanish. Specifically, in Spanish, O'Rourke examined pronominal and yes/no questions. Given that in the present dissertation I only examine Spanish declaratives in Peruvian Spanish, I disregard the discussion on interrogatives.

a slight variation in their prenuclear accents. While some speakers align their F0 peaks after the stressed syllables, others align their F0 peaks within the syllable, something that sets them apart from Lima speakers.

In contrastive focus declaratives, for Lima Spanish, the F0 peaks are reached within the stressed syllable. In the Cuzco Spanish group, however, this pattern is more variable since only two out of the 17 speakers tend to align the F0 peak with the stressed syllables. Other speakers did not exhibit any focus cues at all, such as F0 peak within the stressed syllable, higher F0 peak, or longer stressed syllable duration. This observation led O'Rourke to conclude that Cuzco Spanish speakers may use other non-prosodic strategies to convey focus. The nature of these other cues was left for further research. An important methodological factor in O'Rourke's (2005) study is that she only examines contrastive focus in phrase-initial position of SVO declaratives (i.e. subject). Thus, it is unclear if the contrastive focus patterns found in Lima Spanish, or the aforementioned variation in the Cuzco group, remain present in other sentential positions as well.

In terms of the phonological representations, O'Rourke (2005) employs the asterisk (*) to indicate phonetic alignment with the stressed syllable rather than association. According to her, this is a more "transparent" way of representing the rising pitch accents (2005:109). It must be noted here that O'Rourke discusses possible phonological representations of rising accents only with respect to broad focus declaratives in Lima Spanish and Cuzco Spanish, and not for contrastive focus declaratives (p. 135). O'Rourke suggests the pitch accents, L*H and L*H*, for prenuclear

accents, and L*H* for nuclear accents.⁹ A comprehensive proposal for pitch accent representations in Peruvian Spanish, however, was not put forth.

2.3.2.2 *García (2011)*

In García (2011), I examined the intonational patterns of Peruvian Amazonian Spanish (PAS), as spoken in Pucallpa, Peru. For comparative purposes, I also examined Lima Spanish. Specifically, I analyzed three different types of declarative sentences: broad, narrow, and contrastive focus declaratives. I must note here that the findings I will describe now were based on a visual examination of F0 contours, and neither measurements nor statistical analyses were taken or performed.

For cases of PAS broad focus declaratives, I found that F0 peaks tend to align within the stressed syllable in prenuclear positions, and claimed that this pattern is the most preferred F0 behavior. A similar pattern is found in nuclear accents, but F0 peaks occur much earlier in nuclear position than in prenuclear positions. Data from Lima Spanish, on the other hand, show that the F0 peak is displaced to the post-stressed syllable, confirming the pattern already observed by O'Rourke (2005), and other Spanish varieties as well (Beckman et al. 2002, among others). To represent these two patterns, I followed the labeling of Face & Prieto (2007) and used the pitch accent, L+H*]σ, to indicate that, in PAS, the High tone is the head of the pitch accent, and that phonetically

⁹ O'Rourke (2005) does not use the symbol + to unite the tones in the bitonal pitch accent. An explanation for this decision is offered in her dissertation (p. 105). In the present dissertation, I maintain her nomenclature in order to remain faithful to her original proposal.

the F0 peak occurs within the stressed syllable. For Lima Spanish, I used the pitch accent L+H* to represent the F0 peak displacement to the post-stressed syllable in prenuclear accents of broad focus declaratives.

For cases of narrow focus in PAS, three main characteristics were identified: (1) F0 peaks are realized within the stressed syllable, but relatively earlier than in broad focus prenuclear accents; (2) F0 peaks are narrower than those F0 peaks found in broad focus declaratives; and, (3) after the F0 peak, the F0 starts descending before the end of the stressed syllable. When trying to represent these F0 patterns, I realized that a similar phonological representation would not be sufficient because, as in the case of PAS broad focus declaratives, in narrow focused words both the F0 rise and the F0 peak were located during the stressed syllable. Additionally, broad and narrow focus declaratives convey different meanings. Hence, I proposed a tritonal pitch accent for narrow focus, L+H*]σ+L. This tritonal pitch accent crucially indicates that the F0 peak is realized within the stressed syllable, but the F0 contours starts descending within the same stressed syllable. Gabriel et al. (2010) have also proposed this tritonal unit for cases of narrow and contrastive focus, and emphatic reading, in Argentine Spanish. In Lima Spanish, on the other hand, the position of the F0 within the stressed syllable is a key prosodic cue to mark narrow focus. In fact, F0 peaks occur within the stressed syllable, similar to PAS broad focus patterns. For that reason, in Lima Spanish, I used L+H*]σ as the phonological representation of narrow focused words.

Finally, PAS contrastive focus declaratives behaves similarly to narrow focus in the sense that the F0 peak is realized relatively earlier than in broad focus declaratives.

The F0 peak is also narrower. Additionally, the F0 starts descending before the end of the stressed syllable, and the F0 fall is fairly completed before the end of the stressed syllable. Yet, the main difference between narrow and contrastive focus was that, in the latter, the F0 peak of the focalized word was the highest in the entire utterance. As in the case of narrow focused words, I used the tritonal pitch accent L+H*]σ+L to phonologically account for this pattern. For Lima Spanish, the F0 peak of the word under contrastive focus is also the highest in the utterance but the F0 peak is still realized near the end of the stressed syllable. Hence, I used the same pitch accent as I did for narrow focused words, L+H*]σ. Table 3 below summarizes the rising pitch accents I proposed for Peruvian Spanish (PAS and Lima Spanish), following the phonological representations of Face & Prieto (2007).

Sentence Type	Rising Pitch Accents	
	PAS	Lima Spanish
Broad Focus	L+H*]σ	L+H*
Narrow/Contrastive Focus	L+H*]σ+L	L+H*]σ

Table 3: Rising pitch accents proposed for PAS and Lima Spanish in García (2011), following Face & Prieto's (2007) representations.

García (2011) is the first study to examine the intonational patterns of Peruvian Amazonian Spanish. Although only declaratives were examined, this work provides us with a general depiction of PAS intonation. First, it shows that F0 peaks occur commonly during the stressed syllable across the different types of declaratives. In narrow and contrastive focus, however, the F0 peak is narrower than in broad focus declaratives, and

it starts descending before the end of the stressed syllable. Based primarily on these observations, a tritonal pitch accent was proposed to phonologically account for this contrast in meaning (i.e. broad vs. narrow/contrastive).

With regard to prenuclear accents of broad focus declaratives, PAS exhibits a similar tonal alignment pattern to that reported in other Spanish varieties such as Argentine Spanish (Barjam 2004, Rodríguez, 2007, Colantoni & Gurlekian 2004, Colantoni 2011), Basque Spanish (Elordieta 2003), Cuzco Spanish (O'Rourke 2004, 2005), and Yucatán Spanish (Michnowicz & Barnes 2013). More precisely, PAS as well as these other varieties show that F0 peaks are realized within the stressed syllable. It has been suggested that this F0 behavior in prenuclear accents of broad focus declaratives is the result of a language contact situation with Italian, Basque, Quechua, and Maya, respectively. In García (2011), I did not make any claims about language contact.

2.3.2.3 Discussion of PAS Rising Accents

Given previous studies on Spanish intonation and more recently on Peruvian Amazonian Spanish (PAS), one of the goals of this dissertation is to reflect on what is the most accurate representation for the rising pitch accents in PAS. In this section, we evaluate two proposals for representing the intonational patterns of PAS. First, we will assess the tritonal pitch accent proposal posited by García (2011), both focusing on its advantages and limitations. I will then discuss two alternative proposals to this tritonal pitch accent. In short, the first of these alternatives suggests the presence of an intermediate phrase boundary (Nibert 2000, Hualde 2002), and the second uses phonetic factors (García

2014) in order to account for the aforementioned PAS intonational patterns. In doing so, these alternatives obviate the need for a tritonal representation.

As detailed above (§2.3.2.2), F0 peaks in PAS are reached within the temporal boundaries of the stressed syllable, across sentence positions, and in all focus types: broad, narrow, and contrastive focus. This F0 behavior represented a challenge for the Sp_ToBI labelling system (Estebas-Vilaplana & Prieto 2008) in my early work on PAS (García 2011). Recall that, in the latest Sp_ToBI version, only one rising pitch accent represents the alignment of the F0 peak with the stressed syllable—namely, L+H*. Generally, this pitch accent is used across Spanish varieties to convey narrow/contrastive focus (cf. Willis 2003). Yet, in PAS, the same F0 pattern (i.e. F0 peak realized within the stressed syllable) was not only found in broad focus declaratives, but also in narrow and contrastive focused words. Technically, in PAS, one phonological representation could be conveying three different pragmatic meanings.

For this reason, in García (2011), I used a tritonal pitch accent, L+H*]σ+L to represent cases of narrow and contrastive focused words, and thus distinguish them from those of broad focus declaratives, which I represent with the bitonal pitch accent, L+H*]σ. The tritonal pitch accent was used mainly to indicate that in narrow and contrastive focused words, the F0 contour reaches its peak within the stressed syllable, and the F0 peak starts descending immediately after, often well before the end of the stressed syllable. Contrary to L+H*]σ, whose F0 peak is reached in the stressed syllable, and often it does not start descending until the end of the stressed syllable. Moreover, the fall may occur during the post-stressed syllable. We must note here that Gabriel et al.

(2010) used this phonological representation to describe a similar intonational pattern found in Argentine Spanish for narrow/contrastive focused words, and to mark emphasis. As Gabriel et al. put it, this tritonal pitch accent contains “the Low (L) tonal targets besides a H* target in order to account for the fact that the contour rises and falls within the limits of the metrically strong syllable” (208). This is exactly what I found in PAS narrow and contrastive focused words.

Now, there are advantages and shortcomings regarding this tritonal representation. One of the advantages is its typological strength. First, it can signal the distinction that we find in both PAS and Argentine Spanish between different pragmatic meanings, i.e. broad and narrow/contrastive focus. Face (2014) questions the validity of adding this tritonal pitch accent to the Sp_ToBI repertoire based on the fact that only one Spanish variety (i.e. Argentine Spanish) employs it. García (2011), however, shows that the pattern observed in Argentine Spanish is also found in PAS, providing further supporting evidence for the tritonal pitch accent. A second typological advantage for this tritonal pitch accent is the presence of a tritonal boundary tone in the Sp_ToBI system, for cases of exhortative questions in Peninsular Spanish, after a nuclear accent (Estebas-Vilaplana & Prieto 2008). Surprisingly though, in Prieto & Roseano (2010), no tritonal boundary tones were actually reported (cf. Prieto 2014, for tritonal boundary tones in Catalan).

One major problem of this tritonal pitch accent, however, originates from a theoretical standpoint. As discussed earlier in this chapter (§2.1), in the AM framework, only monotonal and bitonal pitch accents exist. It is important to note here that the

inclusion of tritonal pitch accents in the tonal inventory has already been evaluated for other languages (Gili Fivela 2002 for Pisa Italian; Ferreira 2008 for Brazilian Portuguese; Kügler 2014 for Swabian German). In those studies, the issue has centered on how to explain complex tonal patterns found in those languages without relying exclusively on a tritonal representation. For example, Gili Fivela (2002) proposes a Low leading tone as a stable phonetic feature [L+] for Pisa Italian. Thus, for a broad focus declarative pitch accent, the notation can be represented as [L+]H*, while for contrastive focused elements, the representation can be [L+]H*+L. Similarly, examining a High phrase-initial tone in Brazilian Portuguese, Ferreira (2008) opts to describe it as High phrase accent, H-L+H*, rather than using a tritonal pitch accent representation, H+L*+H. One of her arguments is that, in her Brazilian Portuguese data, the high initial tone is not contrastive; it does not convey different meanings. Kügler (2014), on the other hand, argues in favor of a Low phrase tone (i.e. intermediate phrase boundary tone) after the High tone in a bitonal rising pitch accent to explain a rise-fall movement in Swabian German. Overall, these studies manifest the tendency to avoid tonal overgeneration in the AM framework, such as the case of the tritonal pitch accent.

Returning to Spanish, however, an analogous situation occurred with boundary tones. In early AM studies, boundary tones were described as monotonal: High (H%) or Low (%) (Pierrehumbert 1980, Pierrehumbert & Beckman 1988, Ladd 1996). However, recent ToBI systems have incorporated complex boundary tones in order to capture the various F0 patterns at the end of phrases across languages (see Jun 2005, 2014). In Spanish, for example, McGory & Díaz-Campos (2002) were among the first scholars to

propose a bitonal boundary tone, LH%, for at least some varieties of Spanish.

Furthermore, the latest Sp_ToBI proposal now incorporates several bitonal boundary tones as part of the Spanish intonation inventory (Estebas-Vilaplana & Prieto 2008, Prieto & Roseano 2010). This example illustrates that the principles of the AM theory can be revised in order to account for phonological distinctiveness across languages, or among varieties of the same language, as new patterns are identified. Consequently, one may expect that tritonal pitch accent representations may be incorporated into the framework if it is driven by new findings in data analysis.

A second area of discussion surrounding representations is the current state of Sp_ToBI, highlighted recently by Face (2014). That is, how much in it is phonological and how much in it is simply a phonetic description of the F0 contours. Face maintains that Sp_ToBI is a system of phonological analysis of intonation. Yet, in his view, recent studies have taken a more phonetic route when describing the intonational patterns of several Spanish varieties. Relevant to this discussion, and based on PAS production data, a distinction between broad focus vs. narrow/contrastive focus exists, and the phonological representation should be able to capture it. In other words, positing simply L+H* for all pitch accents in PAS would fail to capture a meaningful distinction in this variety. A final point of concern regarding tritonal pitch accents is what the L's actually represent in the tritonal pitch accent, L+H*]σ+L. In Spanish intonation thus far, the L tone in rising pitch accents represents a F0 valley before the F0 rise. But in this tritonal pitch accent, the second L seems to represent a quite different behavior. Namely, a F0 downward movement immediately after the F0 peak, but within the stressed syllable. If

further pursued, this distinction need to be explicitly stated in the description of the tritonal pitch accent representation.

Here, I want to consider an alternative proposal to the tritonal pitch accent, as suggested by García (2014). This alternative proposal takes into account phonetic factors in order to explain the observed PAS intonational patterns. Under this approach, the two rising pitch accents already proposed for Spanish, $L+>H^*$ and $L+H^*$ (Estebas-Vilaplana & Prieto 2008), would be sufficient to capture PAS distinct intonation patterns. Thus, instead of suggesting that PAS behaves differently from other varieties, it may be assumed that in Spanish F_0 peaks in all prenuclear accents occur after the stressed syllable (as Hualde 2002 has formerly suggested), but other phonetic factors may prompt the location of the F_0 peak within the temporal boundaries of the stressed syllable in PAS broad focus declaratives. Hence, the $L+>H^*$ pitch accent may be used for PAS prenuclear accents of broad focus declaratives, while $L+H^*$ may suffice for PAS narrow/contrastive focused words. In García (2014), I examined broad focus declaratives and showed that PAS stressed vowels are phonetically longer than those in Lima Spanish. Based on these results, I suggested that these phonetically long vowels enable the F_0 peaks to be realized within the stressed syllable by granting them significant time for their realization. In that study, I posited that other factors (i.e. phonetically long vowels in PAS) condition the location of the F_0 peak, and that PAS may not necessarily have distinct intonational patterns. The experimental part of the present dissertation will allow us to further test this proposal, and yield new perspectives on the most appropriate representations of PAS rising accents.

2.3.3 Intonation in Spontaneous Data

Another goal of this dissertation is to examine tonal alignment in PAS spontaneous data. This section will help situate the present study within the larger scope of intonational studies examining spontaneous speech. Research on intonation has dealt primarily with two types of speech data: laboratory and spontaneous. Laboratory data refers to the type of speech elicited in an experimental setting, using scripted sentences, paragraphs, or dialogues read by participants. Spontaneous data refers to the type of speech elicited in casual settings, usually through conversations between the researcher and the participant(s), or monologues from the participants on a certain topic, without reading directly from any scripted material. In this section, I will first describe some of the advantages and limitations of each type of speech data, focusing particularly on those studies examining intonation. I will then briefly describe the various types of eliciting techniques within each type of speech, since these two types of speech occur on a spectrum, and many subtypes of laboratory and spontaneous speech data are found in between (Face 2003). Lastly, I will provide a non-exhaustive list of previous studies that examine intonation in these two styles of speech.

One advantage of eliciting laboratory data is that researchers can control the segmental composition of the target words and/or sentences. In intonational studies, for instance, researchers may decide to only include sonorant consonants in the target sentences as a way to avoid any disruptions in the F0, and consequently obtain a complete intonational contour in the spectrogram. This method facilitates the acoustic analysis of intonation since all tonal events (i.e. F0 minima and F0 maxima) can be easily

identified. In spontaneous data, however, the lack of control over segmental composition represents a challenge in the analysis because participants use a wide range of segments in their speech, not only sonorant consonants. Similarly, when eliciting laboratory data, several factors such as syllable structure or number of syllables in a word can be easily manipulated yielding a comparable set of data across speakers. This is not the case with spontaneous data. In short, laboratory data allows the researcher to systematically compare identical productions in large numbers of utterances.

The main advantage of using spontaneous data is the possibility of exploring linguistic phenomena in a naturalistic setting. In fact, it is generally assumed that the use of spontaneous data may provide a closer approximation to every day conversations. In more spontaneous contexts, participants tend to be less conscious about their productions, and therefore they can reach a more natural way of speaking. An additional advantage of spontaneous data techniques is that researchers do not need to worry about different literacy levels among speakers (Himmelman & Ladd 2008). A participant with a low reading level may have more difficulties in a reading task than in a task where no scripted materials are employed.

One major limitation of eliciting spontaneous data, however, is the low number of comparable instances for a particular linguistic phenomenon. Generally, the number is very low (in comparison to a reading task), such that robust conclusions cannot be made based only on spontaneous data. In recent years, however, researchers have explored ways to use laboratory techniques which would simultaneously grasp the spontaneity of

speech. In intonational studies, the result has been the implementation of semi-spontaneous, or less-controlled, techniques, to which I turn now.

One common way to obtain semi-spontaneous speech is the use of task-oriented techniques such as the Map Task (Anderson et al. 1991). In such task, two participants each have a map (only one of them with a route drawn on it), and they both engage in a conversation through which the participant with the route guides the other participant to draw a similar route in the other map. While both maps contain conspicuous landmarks, their locations and their names can change in order to increase the difficulty of the task. Thus, the task requires both participants to engage in a conversation rather than having one participant complete the entire task by only giving the instructions. In general, this type of tasks allows for a ‘naturalistic’ production of various types of sentences such as declaratives, questions, commands, etc., while controlling for a similar segmental material (i.e. landmark names). Map tasks, for example, are used by Grice & Savino (2003) who examine interrogatives in Bari Italian.

A second task-oriented activity consists of asking participants to retell a popular story using only pictures (used by Farrar et al. 1999). Contrary to reading a text, and very similar to the Map Task, participants will ideally pay more attention to the actual task than to the form they orally produce. Therefore, participants become less conscious about their speech. Similarly, in a game dialogue technique (used by Krahmer & Swerts 2001), participants engage in a coordination task, where various geometrical shapes and colors are part of the task materials. The interactive dialogues among participants deciding on the right shapes and colors, for example, help elicit different types of contrast accents.

In addition to task-oriented techniques, researchers utilize other types of semi-spontaneous techniques. One such technique is the “Guided Questionnaire” (used for example in the intonational analysis of various Spanish varieties in Prieto & Roseano 2010). In this task, participants are presented with a hypothetical situation, and they need to react orally to the given situation. Each hypothetical situation prompts a specific pragmatic meaning. Crucially, participants are not given any scripted text. The words used in the questionnaire can be modified and adapted according to a particular language variety, in order to avoid misunderstanding among speakers. It is important to note that the “Guided Questionnaire” is primarily based on the pragmatic meanings of the phrases. In turn, sentences produced by the speakers can vary considerably, not only segmentally but also syntactically. Different types of sentences can be obtained from this questionnaire: declaratives, interrogatives, exclamatives, commands, requests, etc.

Moving away from semi-spontaneous speech data, several studies have employed reading tasks where participants are prompted verbally by a previous question asked by the investigator (for their implementation in Spanish varieties see Face 2001a, 2002, O’Rourke 2005, García 2011, among others). The difference between these reading tasks and those tasks where participants simply read from a list of sentences (Prieto et al. 1996, Prieto 1998) is the preceding prompting question. Crucially, these prompting questions indicate the pragmatic meaning of the answer (i.e. a broad focus declarative or a contrastive focus declarative). They also simulate a conversation rather than a simple reading task. These prompting questions may be previously recorded and played during the interview (Face 2001b, 2002), or the researcher may ask them directly (de la Mota

1997, Willis 2003, García 2011). In sum, the previous discussion shows that the distinction between laboratory speech data and spontaneous speech data is not categorical. Rather, recent studies have favored a compromise between the two speech types, where even naturalistic speech can still be controlled at some level.

Several scholars have recognized differences in production with respect to the use of these two types of speech data styles. Hirschberg (2000), for instance, examines declaratives and interrogatives in American English, and finds that the presence of a nuclear tone is more frequent in laboratory speech than in spontaneous speech. Grice et al. (1997) find that, in Bari Italian yes-no questions, fewer final F0 rises are found in spontaneous speech (13%), and many more F0 rises are found in read speech data (78%). In Spanish, Face (2003) examines broad focus declaratives in two types of speech data: laboratory and spontaneous. The latter was extracted from a corpus. Face finds that 30% of the words in the corpus analyzed contain a deaccented stressed syllable (i.e. syllable without a pitch accent), contrary to the assumption that in Spanish every stressed syllable bears a pitch accent. Face also notes that, in spontaneous speech, 25% of the F0 peaks analyzed occur within the boundaries of the stressed syllable. These findings again differ from the F0 peak displacement to the post-stressed syllables commonly found in Spanish broad focus declaratives (Prieto et al. 1996, Sosa 1999, Hualde 2002, Face 2001a, Beckman et al. 2002, among others). Similarly, Face finds that downstep is not always present in his spontaneous data, although downstep is reportedly very common in both types of speech. Lastly, Face finds that the final lowering of the F0 is not usually found in

spontaneous speech declaratives. According to Face, when final lowering occurs, it is accompanied by a F0 rise on the last word of the phrase.

Willis (2003), examining the intonational patterns of Dominican Spanish, finds that one of the three rising accents in Spanish (specifically, the *Early Low – Early High*) was found in his spontaneous data, conveying contrastive focus, but was not present in his laboratory data. Henriksen (2009) shows that the production of wh-questions in Peninsular Spanish varies according to the type of speech data analyzed. Namely, while in a reading task the final F0 rise is the most preferred pattern, in a less-controlled task, participants favor the nuclear circumflex contour (i.e. rise-fall F0 movement during the stressed syllable of the last content word, followed by a low F0 until the end of the phrase). Based on these findings, Henriksen concludes with the suggestion of examining different sentence types across “multiple task type conditions” (2009:66). While the previous studies show consistent differences in the production of intonational patterns between various eliciting techniques, Lickley et al. (2005) claim that both laboratory and spontaneous speech data are equally useful when studying intonation. In fact, in their examination of Dutch falling-rising questions, they find that the same patterns found in the reading task were also present in the spontaneous task. These findings led them to support read speech data as a valid tool to examine intonation.

The previous discussion has pointed out at least two considerations regarding intonational studies and different speech styles. First, these studies highlight the recent tendency among researchers of intonation to complement laboratory speech data with semi-spontaneous speech data. Instead of asking participants to simply read sentences

(often without a context), much effort has been given to create task-oriented techniques, e.g. guided questionnaires, or at least to simulate a conversation by using prompting questions before participants produce their sentences. Second, there is evidence that findings based only on laboratory speech may not necessarily reflect those patterns used by speakers in a more spontaneous setting (cf. Lickley et al. 2005). Therefore, examining intonation in both speech styles can provide us with a more representative description of intonation. This dissertation aims to continue that line of research by exploring PAS laboratory as well as more spontaneous speech data.

2.4 Tonal Alignment

The goal of this section is to review two models of tonal alignment across languages. As discussed in section §2.3.2.2, one of the main intonational features that distinguishes Peruvian Amazonian Spanish from other varieties of Spanish is the alignment of the F0 peaks with the stressed syllable in prenuclear accents of broad focus declaratives. The experimental data of this dissertation aims to explore whether this alignment in PAS is conditioned by segmental factors, or rather tonal events in PAS ‘anchor’ to specific locations in the segmental string.

Tonal alignment in this dissertation is understood as “the temporal implementation of fundamental frequency (F0) movements with respect to the segmental string” (Prieto 2011:1185). Essentially, tonal alignment describes how main events in the intonational contour, Low tones (i.e. F0 minima) and High tones (i.e. F0 maxima), are related in timing to the segmental composition of the sentences. Two hypotheses have

been put forth in the literature to model tonal alignment. The first hypothesis suggests that tonal events (L and H) are ‘anchored’ to specific landmarks in the segmental string, and the F0 rise time (i.e. distance from L to H) can vary according to the location of those tonal events. According to this hypothesis, tones have a target and, thus, tones are reached in specified locations in the segmental string. In this dissertation, I will refer to this first model as the *Segmental Anchoring Hypothesis* (SAH). This term was first coined by Ladd et al. (1999), but I will use it here to explain this phenomenon as described in studies both before and after that date.

As an alternative hypothesis, it has been argued that the rise time of a pitch accent is temporally fixed. In turn, the alignment of the tonal events can potentially change depending on various factors, for example syllable structure, segmental duration, speech rate, presence of prosodic boundaries, etc. Under this view, the location of tonal events is more flexible since they do not ‘anchor’ to specific segments or to a specific location in the segmental string. Contrary to SAH, in this second hypothesis there are no tonal targets. Studies that support this hypothesis refer to it as the ‘Invariance Hypothesis’, ‘Invariant Rise Hypothesis’, ‘Fixed Rise-time’, or the ‘Durational Account’. What all of these terms emphasize is that tonal events do not seem to ‘anchor’ to a particular segment. In this dissertation, I will refer to this second hypothesis as the *non-Segmental Anchoring Hypothesis*.

Some early studies on tonal alignment have shown support for SAH. Bruce (1977) finds that Accent I and Accent II in Swedish are distinguished by their tonal alignment. Generally, both accents are characterized by a F0 fall (i.e. H to L, in a tonal

sequence), but the main distinction resides in the location of the High tone. In Accent I, the High tone occurs before the stressed vowel, whereas in Accent II, the High tone occurs during the stressed vowel. Crucially, Bruce's results were consistent across sentences and through repetitions of all participants. These findings led Bruce to favor the level-based approach to intonation instead of the configuration-based approach given that "reaching a certain pitch level at a particular point in time is the important thing, not the movement (rise or fall) itself" (1977:132). This level-based approach was later assumed by the Autosegmental-Metrical (AM) framework for intonational phonology (Pierrehumbert 1980, Ladd 1996/2008). Bruce's work on Swedish words makes two main contributions. First, it shows that tonal alignment is a determining factor when making categorical distinctions in a language (i.e. Accent I vs. Accent II). Second, and similar to the predictions of SAH, Bruce observes that tones (High tone in this case) are 'anchored' to specific landmarks in the segmental string.

Contrary to the early work of Bruce (1977), studies on American English find variation in tonal alignment. Steele (1986), for example, explores nuclear accents and finds that F0 peak delay (in her study, described as the distance from the F0 peak to the beginning of the stressed vowel) is affected by speech rate and the number of post-stressed syllables. Silverman & Pierrehumbert (1990), examining prenuclear accents in American English also, find that F0 peaks align with the following unstressed syllable, but this alignment varies according to speech rate and the presence of prosodic boundaries. These works in part contradict SAH in the sense that speech rate and

prosodic proximity affect tonal alignment. These effects override an ‘anchoring’ condition.

Several studies arguing for either SAH or the non-Segmental Anchoring Hypothesis have emerged in the last two decades. Languages that have been shown to favor SAH include Modern Greek (Arvaniti et al. 1998), Mandarin Chinese (Xu 1988), Southern British English (Ladd et al. 1999), and Tokyo Japanese (Ishihara 2003). Those languages favoring the non-Segmental Anchoring Hypothesis include Southern British English (Wichmann & House 1999), Paris French (Welby & Loevenbruck 2005), and Peninsular Spanish (Prieto & Torreira 2007).

To further entangle this issue, other studies show mixed results regarding these two competing hypotheses. Caspers & van Heuven (1983) explore Dutch, and find that the beginning of the rise (i.e. Low tone) is more stable than the end of the rise (i.e. High tone). In fact, Caspers & van Heuven’s study is among the first ones that describe the onset of the F0 rise as a stable ‘anchoring’ landmark. Examining Mexican Spanish, Prieto et al. (1995) find similar results as Caspers & van Heuven. Mainly, the beginning of the rise aligns slightly before the onset of the stressed syllable, whereas the location of the F0 peak is more variable. Arvaniti & Garding (2007) find more stability at the beginning of the F0 rise with respect to the segmental string than at the end of the F0 rise. In summary, these studies highlight a less rigid Segmental Anchoring Hypothesis, where only one element in the pitch accent shows a consistent alignment with a specific segmental landmark.

2.4.1 Segmental Anchoring Hypothesis

The first proposal for the *Segmental Anchoring Hypothesis* was presented by Arvaniti et al. (1998). These authors are the first ones to articulate the notion of segmental anchoring. Earlier studies in Modern Greek prenuclear accents showed that while the F0 rise began constantly at the onset of the stressed syllable, the F0 peak was more variable (Arvaniti & Ladd 1995). Based on this early observation, Arvaniti et al. aimed to explore the variation in F0 peak location. Surprisingly, Arvaniti et al. find that the F0 peak tends to also align consistently with the first posttonic vowel. Therefore, the authors argue that in prenuclear accents in Modern Greek, both tonal events (i.e. L and H) anchor to specific targets in the segmental string. Namely, the beginning of the rise occurs at the onset of the stressed syllable, while the F0 peak occurs within the first posttonic vowel. Furthermore, Arvaniti et al. show that the tones in a pitch accent behave independently from each other, and the distance between these two tones is not fixed.

In order to explore prenuclear accents in Modern Greek, Arvaniti et al. (1998) carry out three experiments. In their first one, the authors explore the location of the F0 peak with regard to segmental duration. All target words were proparoxytone. The stressed syllable of the target words was followed by three unstressed syllables. As a way to vary syllable duration, unstressed syllables following the target syllable were combinations of short and long syllables. For the short syllables, single consonant onsets and short vowels were used. For the long syllables, complex consonant onsets and low and mid vowels were used. In this study, F0 peak location was measured in relation to the

onset of the first postonic vowel. Results in this first experiment show that regardless of syllable duration, the F0 peak is consistently aligned with the first postonic vowel.

In the second experiment, the authors examined whether both tones, L and H, were positioned at a fixed-distance from each other. In order to do so, they measured the distance (in time) between the two tones as well as their difference in Hertz (Hz). Similar to their first experiment, they used proparoxytone words, and they varied syllable duration by inserting short and long syllables after the target syllables. Additionally, they modified the number of unstressed syllables (from 2 to 5) after the stressed syllable of the target words. In short, the authors found no correlation between the distance and the difference in Hz between the two tones. This finding led them to conclude that the two tones behave independently from each other. Consequently, they argued, the distance between the two tones is not fixed.

In the third experiment, the authors wanted to explore if position of the accent in the word affects F0 peak alignment. Unlike the first two experiments, which included words with antepenultimate stress, in this third experiment oxytone and paroxytone words were also used. Moreover, the number of unstressed syllables between the target syllables ranged from 0 to 2. In general, F0 peak location was not affected by the position of the accent, but the authors found much variation among speakers. For some speakers, the position of the accent was a significant factor, while for other speakers the number of unstressed syllables among target syllables played a significant role. Arvaniti et al. explain the variation in experiment 3 by acknowledging a shorter number of sentences for

this experiment, and fewer numbers of speakers when compared to the first two experiments.

Based on Arvaniti et al.'s (1998) findings, several conclusions regarding SAH can be drawn. First, in SAH, tonal targets are primary. The tones in the F0 contour will attempt to reach their targets regardless of segmental information (e.g. syllable duration, number of syllables after the stressed syllable). Additionally, the trajectory between the two tones depends greatly on the location of the tonal events. Hence, the slope and duration of a pitch movement are not temporally fixed. These descriptions are in line with Bruce's (1977) observation on Swedish, where tonal targets, rather than the actual pitch movement, are the significant elements when distinguishing among Accent I and Accent II. Lastly, SAH suggests that the two tones are independently aligned with the segmental string.

SAH is also prevalent in tonal languages. Xu (1998) investigates rising tones in Mandarin Chinese, and finds that, regardless of syllable structure (i.e. CV and CVC) and speech rate (i.e. normal, slow, and fast), F0 contours align consistently with the associated syllable. Furthermore, he posits that the beginning of the rise (i.e. F0 valley) occurs near the middle of the syllable, while the end of the rise (i.e. F0 peak) occurs near the end of the syllable.

Similar to Arvaniti et al. (1998), Xu (1998) finds stability in both tonal events. Contrary to Arvaniti et al., however, Xu finds that these two tonal events occur within the syllable. Recall that in Arvaniti et al., the end of the rise aligns with the first postaccentual vowel. Based on his observations, Xu argues for the syllable as the

principal domain for tonal alignment in Mandarin Chinese. Furthermore, for Xu, pitch movements form a single phonological unit. Evidence for this comes from the fact that when syllable duration increases, the entire F0 contour moves proportionally into “the later portion of the syllable without systematic changes in the slope of the rise” (Xu 1998:201), presumably working as a pitch movement altogether. These findings diverge from the predictions of SAH. According to SAH, the duration and the slope of the rise are predicted to not remain constant since the position of the two tonal targets determines both the duration and the slope of the rise. Thus, instead of being part of a coordinated unit, the two targets are understood as functioning independently from each other. Overall, Xu maintains that there are two tonal targets in the pitch accent, but argues in favor of a “single dynamic target”, instead of two static tonal targets (1998:201). As a tonal language, Mandarin Chinese is inherently different from the languages discussed thus far, and this could be the reason why Xu’s findings seem to suggest a different interpretation of SAH as discussed above (also pointed out by Ladd et al. 1999). Nonetheless, it is noteworthy that even in different types of languages, there is evidence for SAH.

Ladd et al. (1999) examine prenuclear F0 rises in Southern British English, and find additional evidence for SAH. The first goal of this study is to explore whether or not F0 rise time (i.e. distance in time between the L and H) and F0 excursion (i.e. distance in Hz between L and H) are affected by speech rate (i.e. normal, fast, and slow). Results show that F0 rise time is conditioned by speech rate. That is, as speech rate increases, rise time decreases. Ladd et al. find no effect of speech rate on F0 excursions. In a second

experiment, the authors explore if tonal events in the F0 contour anchor to specific landmarks in the segmental string. Overall, Ladd et al. find that both tonal events are anchored to specific landmarks in the segmental string. Whereas the beginning of the rise occurs at the onset of the stressed syllable, the end of the rise occurs within the onset consonant of the post-stressed syllable. Ladd et al.'s results confirm early observations on segmental anchoring made by Arvaniti et al. (1998) and Xu (1998). Unlike Xu, Ladd et al. find that only the beginning of the rise makes reference to the stressed syllable as a possible segmental 'anchor'. Similar to Arvaniti et al., however, Ladd et al. find that the end of the rise occurs outside the boundaries of the stressed syllable.

In summary, the studies described above provide evidence in favor of the Segmental Anchoring Hypothesis. More precisely, they show that tonal events are 'anchored' to well-defined targets in the segmental string, irrespective of segmental composition, speech rate, or segmental duration. Moreover, the duration and slope of the F0 movements tend to vary because they depend on the exact position of the tonal events (cf. Xu 1998). It is important to highlight that across these studies the indirect manipulation of segmental composition (i.e. syllable structure) has become a crucial factor when testing SAH. This observation will be taken into account in the design of the methodology for this dissertation. In the following section (§2.4.2), I will discuss the non-Segmental Anchoring Hypothesis, and its predictions.

2.4.2 Non-Segmental Anchoring Hypothesis

Contrary to SAH, the non-Segmental Anchoring Hypothesis predicts that tonal events do not ‘anchor’ to specific landmarks in the segmental string. Under this hypothesis, F0 rises exhibit an invariant duration. Hence, the actual phonetic alignment of tonal events is dependent on, for instance, the composition of the segmental string (e.g. syllable structure), close proximity to a prosodic boundary, discourse structure, speech rate, etc.

Examining nuclear accents in American English, Steele (1986) finds that F0 peak delay shortens as the number of post-stressed syllables decreases. That is, a F0 peak is retracted to the left much more when it is positioned closer to the end of the phrase. Similarly, Silverman & Pierrehumbert (1990) identify effects of upcoming prosodic events on F0 peak alignment both in prenuclear and nuclear accents. Namely, F0 peaks align much earlier right before right-hand prosodic contexts (i.e. stress, word boundary, end of the phrase).

In addition to segmental and prosodic effects, discourse structure can also condition F0 peak alignment. In their study of Southern British English, Wichmann & House (1999) placed their target words in various locations: sentence initial, paragraph initial, and sentence final. Results show that, among all possible locations surveyed in the study, in sentence final position F0 peaks align significantly earlier in the stressed syllable. Moreover, F0 peaks in sentence initial position align earlier than in paragraph initial position. This study replicates early findings reported in Steele (1986) and Silverman & Pierrehumbert (1980) by showing a considerable influence of prosodic boundaries in the phonetic alignment of F0 peaks.

Welby & Loevenbruck (2005) examine tonal alignment in the French late rise in order to directly test SAH. Welby & Loevenbruck asked their participants to read a series of paragraphs in two different speech rates: normal and fast. Results show a high degree of inter-speaker variability with regard to rise time, F0 excursion, and F0 slope. In fact, according to the authors, their findings cannot provide support for SAH. No specific ‘anchor’ point was identified for the beginning of the rise (i.e. Low tone). A target for the end of the rise (i.e. High tone) was not found either. These results led the authors to postulate a less rigid version of SAH; namely, *segmental anchorage*, a temporal region within which tones can anchor (Welby & Loevenbruck 2005, 2006). For the F0 peak of the French late rise, the ‘anchorage’ ranges from the end of the vowel of the last full syllable to the end of the accentual phrase. This proposal, however, raises the question of whether or not ‘anchorage’ can also be extended to Low tones. Welby & Loevenbruck report that they did not propose a segmental anchorage for the beginning of the French late rise (i.e. Low tone) because no clear region was suggested in their data.

Overall, these studies show that SAH may not account for all cases of tonal alignment, particularly in those instances where prosodic pressure is exerted. In other cases, the position of a particular word in the discourse and speech rate may also condition the exact location of tonal events, particularly in reading tasks. Lastly, a less rigid description of SAH (i.e. segmental anchorage) has also been proposed to account mainly for inter-speaker variability with regard to tonal alignment.

Focusing on Spanish, Prieto & Torreira (2007) is the first attempt to examine SAH in Spanish, taking into account syllable structure (i.e. CV vs. CVC) and speech rate

(i.e. normal, fast, and slow). The authors conducted two experiments and collected data from three Peninsular Spanish speakers. The first experiment aimed to explore the effects of syllable structure and segmental composition on F0 peak alignment. The second experiment examined the combined effects of syllable structure and speech rate.

Regarding the test sentences, these were carefully elicited to obtain an alignment of the F0 peak with the stressed syllable. In doing so, sentences contained two prosodic phrases, and each one of them contained two pitch accents. Only in the first position of the first prosodic phrase, speakers were producing the F0 peak within the stressed syllable. Even though in this Spanish variety, F0 peak displacement to the post-stressed syllable is more common in prenuclear accents, this crucial detail allowed them to obtain “less variability in alignment” (2007:475), and expressly assess SAH.

In the first experiment, sentences contained both target words with antepenultimate and penultimate stressed patterns, and they also included open (i.e. CV) and closed (i.e. CVC) stressed syllables. In their analysis, F0 peak location was measured as the distance (in ms) from the F0 peak to the end of the stressed syllable, and to the end of the stressed vowel. Results showed that in closed syllables, the F0 peaks occur much later than in open syllables; namely, in the first mid part of the coda. In open syllables, the F0 peak is reached at the end of the stressed vowel. In the second experiment, sentences only contained words with antepenultimate stress in an effort to control for stress position. Moreover, in this second task, participants were asked to read the sentences in three different speech rates: normal, fast, and slow. Results first showed that speakers produce the sentences at different rates successfully. Furthermore, the authors

indicated that speech rate has an effect in the F0 peak timing across speakers. That is, as speech rate increases, F0 peaks are located later in the syllable. In sum, Prieto & Torreira argue that F0 peaks in Peninsular Spanish are not ‘anchored’ to specific segmental landmarks, i.e. the end of the stressed vowel or the end of the stressed syllable, contrary to the predictions of SAH, but rather syllable structure and speech rate condition the location of the F0 peaks.

Some comments are due in relation to Prieto & Torreira’s (2007) methodology and findings. First, only one sentence position was examined (i.e. the initial position of the first intonational phrase). If this proposal is meant to be held, other prenuclear accents particularly those in non-final positions will need to be further explored. Second, and as acknowledged by the authors, the alignment of F0 peak with the stressed syllable in prenuclear positions of declaratives is at best atypical for Peninsular Spanish (Hualde 2002, Face 2001a, Beckman et al. 2002). Thus, we could hypothesize that this variation in the F0 peak alignment (i.e. alignment with the vowel in CV syllables, and with the coda in CVC syllables) in Prieto & Torreira may be partially due to the reported F0 peak displacement in Peninsular Spanish prenuclear accents of broad focus declaratives.

2.4.3 Tonal Alignment and PAS

The status of the Segmental Anchoring Hypothesis in Spanish is still unclear since the study of Prieto & Torreira (2007), although very insightful, has some shortcomings. My aim in the experimental part of this dissertation is to further explore tonal alignment in Spanish, and specifically to test the predictions of SAH in Peruvian Amazonian Spanish.

To my knowledge, no study has examined PAS tonal alignment in relation to SAH, or with regard to segmental information.

Unlike Peninsular Spanish, whose broad focus intonational patterns are characterized by the F0 peak displaced to the post-stressed syllable, PAS is one of few Spanish varieties whose F0 peaks align with the stressed syllable in prenuclear accents of broad focus declaratives (see §2.3.2.2). Thus, an examination of PAS would allow us to explore tonal alignment in several positions in the sentence, not only in the first prenuclear accent as investigated by Prieto & Torreira (2007).

Moreover, PAS is not only distinguished by its intonational patterns. Recent research has shown that PAS stressed vowels are phonetically long (Koops & Vallejos 2014, García 2014). In fact, I examined vowel length in PAS, as spoken in Pucallpa, Peru, and compared it to Lima Spanish. Specifically, I explored vowel length in broad focus declaratives in four contexts: stress (unstressed vs. stressed) and position in the sentence (non-final vs. final). Results showed that PAS stressed vowels measure an average of 77ms in non-final position, and an average of 116ms in final position. In Lima Spanish, on the other hand, stressed vowels measure an average of 56ms in non-final position, and an average of 68ms in final position. Of particular interest here is that PAS stressed vowels, even in non-final position, are much longer than Lima Spanish stressed vowels, in final position. As discussed earlier (§2.3.2.3), in García (2014) I hypothesized that these phonetically long vowels in PAS trigger F0 peaks to be realized within the stressed syllable. An examination of PAS would allow us not only to explore tonal alignment in various prenuclear accents, but also test whether segmental duration have a

direct effect on PAS tonal alignment. Given that in PAS there are phonetically longer segments (i.e. vowels), it is possible to indirectly manipulate segmental length by, for example, adding more words to the sentence (Navarro Tomás 1916, Lehiste 1970). Thus, by indirectly varying segmental duration, we could test if even when segments vary in length, we still observe F0 peaks occurring within the stressed syllable. More broadly, the examination of PAS tonal alignment will add to the discussion of SAH among other Spanish varieties.

2.5 Research Questions

This dissertation addresses the following research questions:

1. What is the effect of segmental information on tonal alignment in Peruvian Amazonian Spanish (PAS) rising accents? Does evidence from PAS provide support for the *Segmental Anchoring Hypothesis* or for the *non-Segmental Anchoring Hypothesis*?

- Are there any differences on tonal alignment between broad, narrow, and contrastive focus declaratives?

2. In more theoretical grounds, what is the most accurate phonological representation for PAS rising accents in the Sp_ToBI system?

- Does additional evidence from the experimental data of this dissertation support the current proposal (García 2011)?

3. How is tonal alignment in PAS declaratives realized in spontaneous data?

- Are there any differences in PAS intonational patterns between laboratory and spontaneous data?

Chapter 3: Methodology

In this chapter, I present the methodology used to acoustically examine tonal alignment in Peruvian Amazonian Spanish (PAS) declaratives, as spoken in the city of Pucallpa, Peru. The analysis in this dissertation is based on production data of PAS monolingual speakers, obtained from laboratory speech (i.e. a reading task) as well as from spontaneous speech (i.e. interviews). Overall, the present study contributes to the current growing body of experimental works on PAS, which aims to supplement early impressionistic descriptions posited for this variety. This chapter is organized as follows. First, I will first present the region where I conducted the study (§3.1) and provide a sociolinguistic background of the participants (§3.2). I continue with a description of the materials used in each interview (§3.3), and the recording procedure followed in each session (§3.4). I then explain the data analysis (§3.5), which includes the acoustic analysis performed (§3.5.1) and the variables (§3.5.2). Finally, in §3.6, I lay out the initial hypotheses of the present study.

3.1. Region of Study

The data collection was conducted in the city of Pucallpa, the capital of the Department of Ucayali. Pucallpa is located in the central region of Peruvian Amazonia, near the banks of the Ucayali River. As of 2015, its population was approximately 211, 651 people

(INEI).¹⁰ Pucallpa is the second most populated city in Peruvian Amazonia, behind the city of Iquitos, which is located in the Department of Loreto. Figure 6 below shows a map of Peru, where I have circled the city of Pucallpa.



Figure 6: Map of Peru¹¹.

Spanish is not the only language spoken in the Amazonian region of Peru. In fact, there are approximately 39 indigenous languages in Peruvian Amazonia, distributed in 17 linguistic families (Solís Fonseca 2003). Found also in the Ucayali region, the Shipibo-Konibo language, part of the Panoan linguistic family, is spoken by approximately

¹⁰ Population figures were obtained from INEI (*Instituto Nacional de Estadística e Informática*). Accessed on April, 2016.

<http://proyectos.inei.gob.pe/web/biblioineipub/bancopub/Est/Lib1020/Libro.pdf>.

¹¹ Image taken from: <http://www.lib.utexas.edu/maps/peru.html>. Accessed on April, 2016.

26,000 speakers (Solís Fonseca 2009). While it is important to acknowledge the presence of various Amazonian languages in Peruvian Amazonia, many speakers in this region are monolingual speakers of Amazonian Spanish, particularly in major urban areas (Solís Fonseca 2003, 2009).

3.2 Participants

The analysis in this dissertation is based on production data from 13 monolingual speakers of PAS. Their ages range from 18 to 30 ($M = 20.77$, $SD = 3.27$). There were seven male speakers and six female speakers. All 13 participants were born and raised in Pucallpa, and they all reported that their parents were also monolinguals, and had lived in Pucallpa for more than 19 years. All participants were university students at the time of the interview (May 2014). Table 4 below presents additional information about each participant.

Speaker Code	Gender	Age
PAS01	M	30
PAS02	F	20
PAS03	M	18
PAS04	F	22
PAS05	M	21
PAS06	M	18
PAS07	F	18
PAS08	M	22
PAS09	M	19
PAS10	F	21
PAS11	M	18
PAS12	F	20
PAS13	F	23

Table 4: Participants' background information.

I originally interviewed a total of 40 speakers in the city of Pucallpa. However, only 20 speakers completed all the tasks in the study (described in §3.3). In several instances, informants started the interview but realized that they were unable to complete it due to other responsibilities (e.g. classes, exams, study meetings). If this was the case, I did not insist. Other participants did not feel comfortable with the reading task, or were conscious of the interview setting, which made it difficult to continue with the interview.

Out of these 20 speakers who completed all tasks, I excluded seven of them due to other factors. Some speakers were producing the sentences in two different intonational phrases, often making pauses within the sentence. Other speakers were constantly producing the unintended pragmatic meaning; in other words, I prompted a broad focus declarative, but the speaker uttered a narrow/contrastive focus response. Lastly, some speakers used careful, unnatural speech throughout the interview.

There are two primary difficulties that I face while conducting linguistic fieldwork in Pucallpa. First, some people are reluctant to participate in these interviews. This is an issue I have faced on my multiple trips to the region. It is my impression that I am viewed by many as an outsider, because I am not a speaker of this variety, but I come to Pucallpa to study it. This is clear from some comments I have heard on many of my visits to the region, such as “What are you doing with my recordings?”, “Are you trying to mock my speech?” However, once I find one person who wants to participate, and then realizes that I am there because I am genuinely interested in this Spanish variety, it becomes much easier to find additional speakers who are willing to be interviewed. These first few participants help me connect with other speakers who also agree to participate.

Once someone agrees to be interviewed, a second obstacle that I face involves natural speech. Many participants in the interview setting become highly aware that they are being recorded, and their speech patterns change considerably. Often, I will have just finished walking through campus with the participants, or spending time with them and their friends, and the participants are speaking with typical Amazonian Spanish characteristics. As soon as the interview begins, however, they change their speech patterns.

These two obstacles that I often face while collecting data in Pucallpa could indicate that PAS speakers are self-conscious of their speech, or aware of stigmas associated with their Spanish variety or region. In fact, stereotypes about the Amazonian region, and specifically about Peruvian Amazonian Spanish, are present in the media (Jara Yupanqui 2012). It is possible that these speakers are hesitant to participate, and often modify their speech patterns when being interviewed by someone who is not from the region. When I have collected data in Lima, Peru, on the other hand, these have not been issues for me. Exploring the possible effects of stereotypes in the behavior of PAS speakers before, and during, my interviews go beyond the scope of this dissertation. Yet, I note it here because it may explain the difference between the number of interviews that I conducted and the actual number of participants included in the analysis.

3.3 Materials

3.3.1 Reading Task Materials

All 13 participants completed the reading task, which consisted of three parts. The first part elicited broad focus declaratives; the second, narrow focus declaratives; and the third, contrastive focus declaratives. As discussed earlier, broad focus declaratives refer to cases where the entire sentence is new information, and no portion of the sentence is particularly emphasized. These sentences are generally prompted by questions such as: *¿Qué pasó?* ('What happened?'), *¿Qué pasaba?* ('What was happening?'), or *¿Qué pasa?* ('What is happening?'). Narrow focus declaratives refer to cases where only one constituent in the sentence is emphasized. In this type of sentences, for example, one of the interlocutors is looking for new information about a certain constituent in the sentence. Narrow focus declaratives are generally prompted by questions such as: *¿Qué donaba Lorena?* ('What was Lorena donating?'). In contrastive focus declaratives, one word is not only emphasized but also contrasted with previous information. Questions prompting contrastive focus generally contain erroneous information in order for the participants to mark the contrast. Thus, a prompting question for the target sentence, *Lorena donaba la corona* ('Lorena was donating the crown') is: *¿Lorena perdía la corona?* ('Was Lorena losing the crown?'). In their responses, participants need to correct the inexact information. The verb here (*donaba*) bears contrastive focus. In sum, in this reading task, all participants would have repeated one sentence *Lorena donaba la corona* three times: one with broad focus, one with narrow focus, and one with contrastive focus.

The basic set up of the reading task was the following. Participants were presented with mini-dialogues printed on a half-A4 size sheet of paper, which contained the written target sentence (i.e. background information), the prompting question, and the target sentence again. I told the participants that each piece of paper represented a separate context, and that in each context we were part of a conversation. Crucially, participants were asked to provide me with information that I did not have or know. First, I asked participants to read silently the first sentence as a way to obtain background information. I then read the second line (i.e. the question). Finally, participants answered me aloud by reading the third line. Figure 7 below shows a sample of a mini-dialogue presented to the participants.

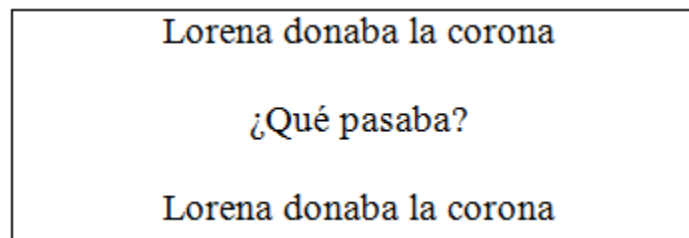


Figure 7: Sample of one mini-dialogue.

Before the beginning of the reading task, participants were given three practice mini-dialogues that did not have the target stimuli. These practice mini-dialogues allowed participants to get used to the task itself. I did not start with the experimental materials until it was clear that the participants completely understood the procedure of the reading task. Sets were presented in a random order, but the whole set was presented in its entirety. Within each set too sentences were presented in random order.

Overall, target sentences in the reading task were designed to examine the effects of two factors in PAS tonal alignment: segmental duration and syllable structure. Research on segmental length has shown that the addition of prosodic words in a sentence usually results in differences in the duration of the segments (Navarro Tomás 1916:398, Lehiste 1970:40). Thus, by varying the number of prosodic words in a sentence, the segmental duration can be indirectly manipulated. This manipulation will allow us to examine whether changes in segmental duration affect tonal alignment in PAS. This means that even though the factor that overtly changes is number of words, the effect that is being explored is changes in segmental duration, and how these changes influence tonal alignment. Second, target sentences include open (CV) and closed (CVC) stressed syllables. By varying the composition of the stressed syllable, it is possible to examine whether the presence of a coda conditions tonal alignment in PAS.

Each of the three parts of the reading task contained six sets of stimuli, each set containing four sentences, for a total of 24 sentences in each part. The target sentences within each set varied in the number of content words they contain. Hence, each set contained a 2-, 3-, 4-, 5-word sentence keeping constant the lexical items. The syntactic structure of the target sentences with two content words was Verb-Object; with three content words, Subject-Verb-Object; with four content words, Subject-Verb-Object-Complement (e.g. Prepositional Phrase); and, with five content words, Complex Subject-Verb-Object-Complement, where the complex subject contained two content words. Example (1) shows a sample set. All content words in each sentence are underlined. The complete list of sets can be found in Appendix A.

- | | | |
|-----|---|-----------------------|
| (1) | a. <u>Donaba</u> la <u>corona</u>
'(She) was donating the crown' | (2Wd, VO) |
| | b. <u>Lorena</u> <u>donaba</u> la <u>corona</u>
'Lorena was donating the crown' | (3Wd, SVO) |
| | c. <u>Lorena</u> <u>donaba</u> la <u>corona</u> con <u>manera</u>
'Lorena was donating the crown with style' | (4Wd, SVOComp) |
| | d. La <u>señora</u> <u>Lorena</u> <u>donaba</u> la <u>corona</u> con <u>manera</u>
'Mrs. Lorena was donating the crown with style' | (5Wd, ComplexSVOComp) |

Furthermore, three sets had CV stressed syllables for each content word in the sentence, and three sets had CVC stressed syllables.¹² Example (1) above is a case of a set with CV stressed syllables. In narrow and contrastive focus declaratives, the focused word was positioned either in verb or in object position. All content words were trisyllabic and had penultimate stress. Finally, in order to avoid disruptions in the F0 contour and to make sure all tonal events were identifiable, only voiced consonants were used in the stressed syllable. Most vowels used in the stressed syllables were non-high (/a, e, o/).

¹² Originally, I created eight sets, each set containing four sentences each. The first interview (which included 32 sentences) took longer than expected, so I then reduced my stimuli to six sets of four sentences each, to make the tasks more manageable for the participants. The rest of the speakers produced 24 sentences for each reading task.

3.3.2 Interview Materials

In addition to the reading task, I elicited spontaneous speech from PAS participants through an interview task. For this task, I asked participants to tell me about a certain topic for about one or two minutes. These topics included: the city of Pucallpa, their university experience, places to visit in Pucallpa, and typical food of the region. Given the nature of the topics, and the novelty of the responses for someone who is not from the Amazonian region, most sentences were considered broad focus declaratives. In certain occasions, I asked prompting questions during the interviews in order to elicit other types of focus (i.e. narrow and contrastive).

For the analysis of the interview data, I included declarative sentences of only six of the 13 participants. Of the remaining seven participants, I did not find any workable sentences from four of them. From the remaining three, I did not record any spontaneous data. As discussed earlier (§2.3.3), some limitations of working with spontaneous speech include the variability of the sentences produced by the participants, the presence of pauses and hesitations, and the small number of workable sentences obtained per participant. Nonetheless, the main criteria to select sentences for the analysis was that they contained a main verb (a criterion also used by Face 2000), and also that the sentences formed a single unit (i.e. without pauses or hesitations). Following these criteria, the interview task yielded a total of 21 declarative sentences.

3.4 Procedure

The recordings took place in various quiet rooms at the *Universidad Nacional de Ucayali* (UNU) in Pucallpa. Each recording session lasted approximately between 30 and 40 minutes. In terms of the recruitment, I found additional participants through previous participants (i.e. friends and/or classmates of people I had already interviewed). Their participation in this study was voluntary, and no compensation of any form was provided.

Once in the recording room, I verbally described the two different tasks to the participants. I then continued to explain the procedures and the recording equipment. I let them know that only their voice was going to be recorded, and that the recordings obtained from them would remain anonymous and used only for academic purposes. I also informed them that they could stop and leave at any point during the recording session without any penalty. After all this explanation, they were asked again if they were still willing to participate.

There was a short break between each part of the reading task, and the interview, to let the participant rest. After the two tasks were completed, participants were able to ask any questions they had about my project and the research. I answered these questions but kept my responses general because of the way I was recruiting participants. Specifically, I did not want earlier participants to tell later ones what my research questions were. All participants were recorded using a Zoom H4 portable digital recorder, and an external Shure WH30 condenser headset microphone with XLR connectors. The recordings were saved as WAV files (44.100 Hz, 16 bit). The data was later examined and acoustically analyzed using *Praat* (Boersma & Weenink 2016).

3.5 Data Analysis

In the reading task, the total number of sentences were 960 (24 sentences x 3 sections of the reading task = 72 sentences per participant (for 12 of the 13 participants)) + (32 sentences x 3 sections of the reading task = 96 sentences for one participant). In total, there were 240 sentences with 2 content words, 240 sentences with 3 content words, 240 sentences with 4 content words, and 240 sentences with 5 content words. Since the number of content words in a sentence is similar to the number of pitch accents, there were 1120 potential pitch accents in each part of the reading task, for a total of 3360 potential pitch accents (1120 pitch accents x 3 parts of the reading task). Table 5 below shows a breakdown of potential pitch accents in the reading task.

Broad Focus	Pitch accents in 2-word sentences	N = 160 (6 sentences * 2 words*12 participants) + (8 sentences * 2 words * 1 participant)
	Pitch accents in 3-word sentences	N = 240
	Pitch accents in 4 word sentences	N = 320
	Pitch accents in 5-word sentences	N = 400
Narrow Focus	Pitch accents in 2-word sentences	N = 160
	Pitch accents in 3-word sentences	N = 240
	Pitch accents in 4 word sentences	N = 320
	Pitch accents in 5-word sentences	N = 400
Contrastive Focus	Pitch accents in 2-word sentences	N = 160
	Pitch accents in 3-word sentences	N = 240
	Pitch accents in 4 word sentences	N = 320
	Pitch accents in 5-word sentences	N = 400
Total	Potential Pitch accents	N = 3360

Table 5: Distribution of the number of pitch accents in the reading task.

Among the 960 sentences in total, I excluded those sentences that were uttered in an unnatural way, had the wrong focus type, or were divided into two intonational phrases. When an entire sentence was excluded from the analysis, this meant the loss of multiple pitch accent tokens. Whereas in a 2-word sentence, two pitch accents were excluded, in a 5-word sentence, five pitch accents were excluded. Individual pitch accents were also excluded from the analysis for other reasons, mainly for unreadable F0 behavior. After these exclusions, the analysis yielded a total of 623 broad focus pitch accents (in 196 sentences), 354 narrow focus pitch accents (in 121 sentences), and 779 contrastive focus pitch accents (229 sentences). Therefore, my actual analysis includes a total of 1756 pitch accents, across the three types of sentences. For the interview task, a total of 21 pitch accents from 20 sentences were included in the analysis (15 broad focus declaratives, 5 narrow focus declaratives, and 1 contrastive focus declarative).

3.5.1 Acoustic Analysis

As the initial step in the data analysis, an acoustic segmentation of all sentences was performed. First, I marked manually the boundaries of the sentences, stressed syllables, and stressed vowels, following a visual inspection of the spectrograms and the waveforms. I also played the audio several times in order to confirm these segmentations. Generally, the boundaries of each segment were easily identified. The duration measurements (in milliseconds – ms) of the sentences, stressed syllables, and stressed vowels, as well as their beginning and end times were extracted using *Praat* scripts.

I then identified two landmarks in the F0 contour. First, I marked the F0 peak (i.e. F0 maxima) of each pitch accent. I highlighted the region where the F0 peak occurred, and then used the *Praat* option, *Move cursor to maximum pitch*, to identify the location of the F0 peak. I then marked the F0 valley of the pitch accents, which was measured as the start of the F0 rise. The F0 valley was marked manually after a close inspection of the F0 contour. The occurring time values (in ms) and the tonal height (in Hertz – Hz) of these two landmarks (i.e. F0 peak and F0 valley) were extracted using the *Praat* option, *Pitch listing*. Figure 8 below shows a sample of the acoustic segmentation in the sentence, *Belinda demanda la milonga* ‘Belinda requests the milonga’. As shown in Figure 8, each content word (e.g. *demanda*), each stressed syllable (e.g. *man*), and each stressed vowel (e.g. *a*) were manually segmented. The two landmarks in the F0 contour, F0 valley and F0 peak, in each pitch accent, were also identified using the labels L and H, respectively. Note that the F0 valley is identified here as the start of the F0 rise, not necessarily as the lowest preceding F0 minima. The reason for this decision is that across sentences the start of the F0 rise was always identifiable, whereas the lowest preceding F0 minima often were not. The same segmentation procedure was performed for all content words in all sentences, as well as for all the sentences in the interview task.

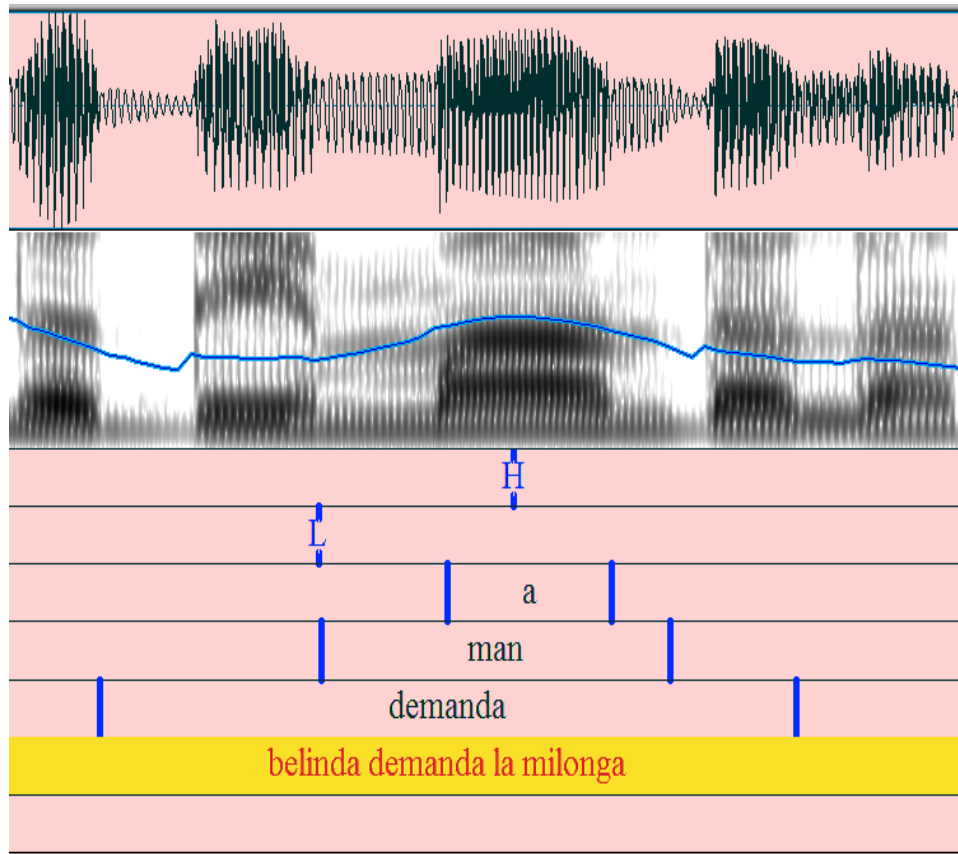


Figure 8: Sample sentence production of speaker PAS01.

I used this acoustic analysis to derive the following dependent variables:
segmental duration, tonal alignment, F0 rise time, and tonal height. In the next section (§3.5.2), I will first describe the dependent variables (§3.5.2.1), and then will follow with the independent variables (§3.5.2.2).

3.5.2 Variables

3.5.2.1 The Dependent Variables

The first dependent variable in this study is segmental duration. Recall that the number of words in a sentence generally help vary the duration of the stressed syllables and stressed vowels, therefore, allowing us to examine if segmental duration has an effect on tonal alignment. This first dependent variable will provide us with two measurements: duration of the stressed syllable and the duration of the stressed vowel (both in ms). Segmental duration is considered a continuous variable.

The second dependent variable is tonal alignment. This dependent variable will help identify the location of F0 peaks: in relation to the stressed syllable and the syllabic elements (i.e. categorical variable), and as a percentage into the stressed syllable and the stressed vowel (i.e. continuous variable). The formulas used to determine tonal alignment, in relation to the stressed syllable and in relation to the stressed vowel, are shown in (2) and (3), respectively:

(2) Formula #1 (for syllables):

$$(\text{Time F0 peak} - \text{Time Beginning of Syllable}) / (\text{Syllable duration})$$

(3) Formula #2 (for vowels):

$$(\text{Time F0 peak} - \text{Time Beginning of Vowel}) / (\text{Vowel duration})$$

Let me explain the categorical variables for tonal alignment using the aforementioned formulas. Formula #1 helps us determine if the F0 peaks are located within the stressed syllable, or beyond its boundaries. If the value from Formula #1 falls between 0 and 1, then the F0 peak is located within the stressed syllable. If the value exceeds 1, then the F0 peak is located after the stressed syllable. If the value is less than 0, then the F0 is located before the stressed syllable. Formula #1 and Formula #2 combined help us locate in what syllabic element of the stressed syllable the F0 peak occurs. For CV stressed syllables, there are four positions: before the syllable, the onset, the vowel, and after the syllable. Table 6 below shows the possible locations of the F0 peak in CV stressed syllables.

<i>F0 Peak</i>	*	*	*	*
<i>Location</i>	Before	Onset	Vowel	After
		Stressed Syllable		

Table 6: Distribution of possible locations of the F0 peak in CV stressed syllables.

For CVC stressed syllables, there are five positions for the location of the F0 peak: before the syllable, the onset, the vowel, the coda, and after the syllable. Table 7 below shows the possible locations of the F0 peak in CVC stressed syllables.

<i>F0 Peak</i>	*	*	*	*	*
<i>Location</i>	Before	Onset	Vowel	Coda	After
		Stressed Syllable			

Table 7: Distribution of possible locations of the F0 peak in CVC stressed syllables.

In a CV stressed syllable, for example, a value between 0 and 1 in the two formulas indicates that the F0 peak is located in the stressed vowel. If the value in both formulas exceeds 1, then the F0 peak is located after the stressed syllable. In a CVC stressed syllable, if the value falls between 0 and 1 in Formula #1, but exceeds 1 in Formula #2, then the F0 peak is located in the coda of the stressed syllable. The different outcomes in both types of syllable structures, based on Formula #1 and Formula #2, are illustrated in Table 8.

Type of Syllable	Results of Formula #1 (syllable)	Results of Formula #2 (vowel)	Location of F0 peak
CV	<0	<0	Before syllable
	0-1	<0	Onset
	0-1	0-1	Vowel
	1<	1<	After syllable
CVC	<0	<0	Before syllable
	0-1	<0	Onset
	0-1	0-1	Vowel
	0-1	1<	Coda
	1<	1<	After syllable

Table 8: Predictions of the location of F0 peaks in CV and CVC stressed syllables, based on Formula #1 and Formula #2.

Tonal alignment is also analyzed as two continuous variables that quantify the F0 peak location as a percentage into the stressed syllable and the stressed vowel. To explore F0 peak location as a percentage into the stressed syllable, Formula #1 will be employed. Similarly, for the F0 peak location as a percentage into the stressed vowel, Formula #2 will be employed. For this variable, only those F0 peaks positioned within the stressed syllable and the stressed vowel (i.e. between 0-1) will be considered in the analysis. The

reason for this is that we specifically want to examine, once the F0 peak is located within the stressed syllable or a particular segment, at what percentage the F0 tends to reach its peak. Therefore, negative percentages and those greater than 100% will not be part of the analysis.

In the literature, tonal alignment has been explored generally in two ways. On the one hand, several scholars have measured tonal alignment as the distance (in ms) from a tonal event (e.g. F0 peak) to a particular segmental landmark, such as the end of the stressed syllable or the stressed vowel (Arvaniti et al. 1998, Prieto & Torreira 2007, among others). Other scholars have also measured tonal alignment as a proportional distance, such as a percentage into the syllable rhyme or the stressed syllable (Silverman & Pierrehumbert 1990, Wichmann & House 1999, Schepman et al. 2006, Arvaniti & Garding 2007). Schepman et al. for example find generally comparable results in their study of tonal alignment in Dutch nuclear accents between the two different types of continuous measurements. Arvaniti & Garding also find similar result patterns when examining tonal alignment in English rising accents both as an absolute distance from a particular segmental landmark (i.e. end of the stressed vowel) and as a percentage into the stressed vowel. Overall, it is important to note that in those studies where the two types of measurements were taken no significant differences between these two measurements were reported in the results.

For PAS, two main reasons commend the examination of tonal alignment as a percentage. First, previous work on PAS has suggested a favored alignment of the F0 peak with the stressed syllable. Therefore, the stressed syllable may serve as a reference

unit. Second, this type of measurement also allows us to control for differences in segmental duration or speech rate, i.e. the percentage allows for some degree of normalization among different speakers and rates.

The third dependent variable is F0 rise time. In this dissertation, rise time is understood as the distance (in time) between the F0 minima (i.e. start of the F0 rise) and the F0 maxima in a pitch accent. Rise time values are obtained by using Formula #3:

(4) Formula #3:

$$\text{Rise Time (ms)} = (\text{F0 maxima} - \text{F0 minima})$$

The fourth dependent variable is tonal height of F0 peaks. Specifically, tonal height refers to the F0 maxima value in each pitch accent, and is directly extracted in Hertz (Hz) from the acoustic analysis.

3.5.2.2 The Independent Variables

One of the goals of this dissertation is to examine whether tonal alignment in PAS is influenced by several linguistic factors. These independent linguistic variables are: type of focus, number of words in a sentence, syllable structure, position in the sentence, word duration, and presence of focus (only for cases of narrow and contrastive focus declaratives). In the next paragraphs, I will explain each one of them.

First, there are three types of focus examined in this dissertation: broad, narrow, and contrastive. Every sentence is produced with three different focus types. For instance,

the sentence *Lorena donaba la corona*, is eventually uttered three times: a first time as a broad focus declarative, a second time as a narrow focus declarative, and a third time as a contrastive focus declarative. Second, the number of words in a sentence range from 2- to 5- content words. Thus, in one set, we find a 2- content word sentence, *Donaba la corona*, and a 5- content word sentence, *La señora Lorena donaba la corona con manera*. This variation in number of content words is kept constant across the three different types of focus. Third, the structure of the stressed syllables varies between open (CV) and closed (CVC). That is, while in some target sentences the stressed vowel is the last segment in the syllable (i.e. donaba), in other target sentences, the stressed vowel is followed by a consonant (i.e. demanda). Fourth, position in the sentence can vary according to the number of content words in the sentence. Thus, position in the sentence is coded as initial (IN), medial (M), and final (FN). Medial position can be further divided in three subtypes: first medial (M1), second medial (M2), and third medial (M3). Medial positions, however, are not relevant for all sentences. For example, a 2- content word sentence has only words in initial and final positions (none in medial positions). A 5- content word sentence, on the other hand, has words in initial and final positions, in addition to three in medial position. Fifth, word duration was calculated by dividing sentence duration by the number of content words in that sentence. This was used as a means to account for different speech rates in the data. Within each type of declarative, there was a range of word duration indicating different speech rates. Fast speech corresponds to the shortest word length value, and slow speech corresponds to the longest

word length value, within each type of declarative. This independent variable was only used in the analysis of segmental duration.

Unlike broad focus declaratives, where all pitch accents in the sentences bear broad focus, in narrow and contrastive declaratives only one pitch accent bear focus. Therefore, narrow and contrastive declaratives contain two additional independent variables. In these two types of sentences, the content word under narrow/contrastive focus is coded as 1 whereas the remaining non-focused words are coded as 0. Thus, for instance, in the contrastive focus declarative, *Lorena DONABA la corona*, the word *donaba* is coded as 1, and the words *lorena* and *corona*, as 0 (contrastive focus word is denoted by capitals). Likewise, the word under focus can vary according to their position in the sentence: non-final and final. Thus, in the sentence *Belinda demanda LA MILONGA*, the word under focus is in final position. However, in the sentence *La cobarde Belinda demanda LA MILONGA de Rolando*, the word under focus is in non-final position.

3.6 Hypotheses

In this section, I present my initial hypotheses based on the variables mentioned above.

1. Based on previous research (Navarro Tomás 1916, Lehiste 1970), I expect to find variation in segmental length according to the number of words in a sentence. Specifically, the duration of stressed syllables and stressed vowels will differ depending on whether they appear in a 2- content word sentence or in a 5- content word sentence.

2. I also predict that type of focus, syllable structure, position in the sentence, and word duration will affect segmental duration. Specifically, stressed syllables and stressed vowels in narrow and contrastive focused words will exhibit longer duration than those in broad focus words. Moreover, closed syllables will show longer duration than open syllables. Vowels in closed syllables will show shorter duration than in open syllables. Stressed syllables and stressed vowels located in final position will show greater duration than those located in non-final positions. Finally, in fast speech, segmental duration will be shorter than in slow speech.
3. Regarding tonal alignment, I expect that all F0 peaks in PAS will be located within the temporal boundaries of the stressed syllable, irrespective of focus type, as reported by García (2011).
4. I also predict that, outside sentence-final position, F0 peaks will align with a particular element in the stressed syllable, regardless of segmental information. Namely, the F0 peak will align with the stressed vowel even when the stressed syllable and the stressed vowel vary in duration or even when a coda follows the stressed vowel. Having the stressed vowel as an ‘anchor’ for the F0 peak would provide evidence in favor of SAH.
5. In sentence-final position, however, F0 peaks will align with the first part of the stressed syllable, or even before the beginning of the stressed vowel (i.e. onset). Previous research on tonal alignment has shown that prosodic boundaries push the F0 peaks leftward (Hualde 2002). Thus, given that in PAS F0 peaks are

located within the stressed vowels, as I predict, the result would be the position of the F0 peak before, or at the beginning of, the stressed vowel.

6. I also expect that the location of the F0 peaks among focus types (i.e. broad, narrow, and contrastive) will not be significantly different. That is, F0 peaks (i.e. their location calculated as a percentage) will occur in a similar location across focus types.
7. Regarding F0 rise time, my prediction is that in languages, or language varieties, where tonal targets are primary (as suggested by SAH), F0 rise time will vary since the tonal targets will specify the duration of the F0 rise. If the F0 rise time in PAS is not constant, then PAS would provide support for SAH. If, on the other hand, F0 rise time is fixed, then PAS would favor the non-Segmental Anchoring Hypothesis.
8. In terms of tonal height, the prediction is that the height of the F0 peak of a pitch accent bearing narrow/contrastive focus will be higher than those F0 peaks found non-focused words.

Chapter 4: Results

In this chapter, I present the results of the examination of rising pitch accents in Peruvian Amazonian Spanish (PAS) across broad, narrow, and contrastive focus declaratives. I start with the results of segmental duration (§4.1), focusing on stressed syllables and stressed vowels. I then continue with the results of tonal alignment (§4.2), F0 rise time (§4.3), and tonal height (§4.4), as they pertain directly to my research questions. Finally, I examine PAS spontaneous data (§4.5), with regard to tonal alignment.

4.1 Segmental Duration

Before reporting the results addressing my research questions on tonal alignment, it is important to examine syllable and vowel duration. As discussed in §3.3.1, one way to examine tonal alignment is through the manipulation of segmental length in order to observe how changes in segmental duration may or may not affect tonal alignment. More precisely, I varied the number of words in a sentence with the intention of indirectly manipulating segmental length. Hence, if the number of words in a sentence changes segmental length, then number of words can serve as a proxy for segmental duration. The examination of segmental duration is central to my research questions on tonal alignment because if manipulating the number of words does in fact vary segmental duration, we can see the effects of segmental length on PAS tonal alignment. In the following

subsection (§4.1.1), I first present the results on stressed syllable duration, and then on stressed vowel duration, across the three types of sentences.

4.1.1 Syllable Duration

In this subsection, I present the results of syllable duration across different types of declaratives: broad, narrow, and contrastive focus. Let us start with broad focus declaratives. In order to examine the effects of number of words on syllable duration in the broad focus group, I created a series of linear mixed-effects models in R (R Core Team 2016), using the *lmer* function (Bates et al. 2014), including speaker as a random effect as a way to account for potential differences among individual speakers. Speaker was included as a random effect in all subsequent models. The independent variables were: number of words (2, 3, 4, 5), syllable structure (CV, CVC), position of the word (initial, M1, M2, M3, final), and word duration (slow and fast speech rate). A detailed description of these factors is provided in Chapter 3 (§3.5.2.2). All of these four independent variables were included in the analysis as fixed factors. I also included the following two-way interactions in the analysis: number of words and syllable structure, and number of words and word duration. These two-way interactions were included due to possible interactions between number of words and the other fixed factors. I focus on these ones in particular because they were relevant to my questions of whether number of words affects segmental duration. The two-way interaction between number of words and position of word was excluded due to collinearity effects. No three-way interactions were included in the analysis. I started with a complex model, and each model was evaluated

with an ANOVA in order to obtain the significance value for each factor and interaction. I first removed non-significant two-way interactions individually, starting with those interactions with the highest p-value. I then removed non-significant fixed factors starting with those factors with the highest p-value. For all the statistical analyses in this chapter, I set the significance level at 0.05.

For broad focus declaratives, the best fit model included all fixed factors: number of words $F(1, 614) = 29.94, p < 0.001$; syllable structure $F(1, 610) = 83.63, p < 0.001$; position of the word $F(4, 606) = 179.90, p < 0.001$; and word duration $F(1, 103) = 136.68, p < 0.001$. Figure 9 below illustrates the direction of these effects. We can observe that as the number of words in the sentence increases, stressed syllable duration also increases. Second, CVC stressed syllables are longer than CV stressed syllables. Post-hoc means comparisons using the Tukey HSD test indicate that stressed syllables in final position are longer than those stressed syllables in non-final positions. Among non-final positions, stressed syllables in initial position are significantly longer than those in M2 and M3 positions. Also, stressed syllables in M1 position are significantly longer than those stressed syllables in M2 and M3 positions. As for the effects of word duration, stressed syllables are longer in slow speech rate than in fast speech rate. There was only one significant two-way interaction: number of words and syllable structure $F(1, 611) = 8.78, p < 0.01$. This two-way interaction shows that the difference in syllable duration across number of words is greater in CV syllables than in CVC syllables.

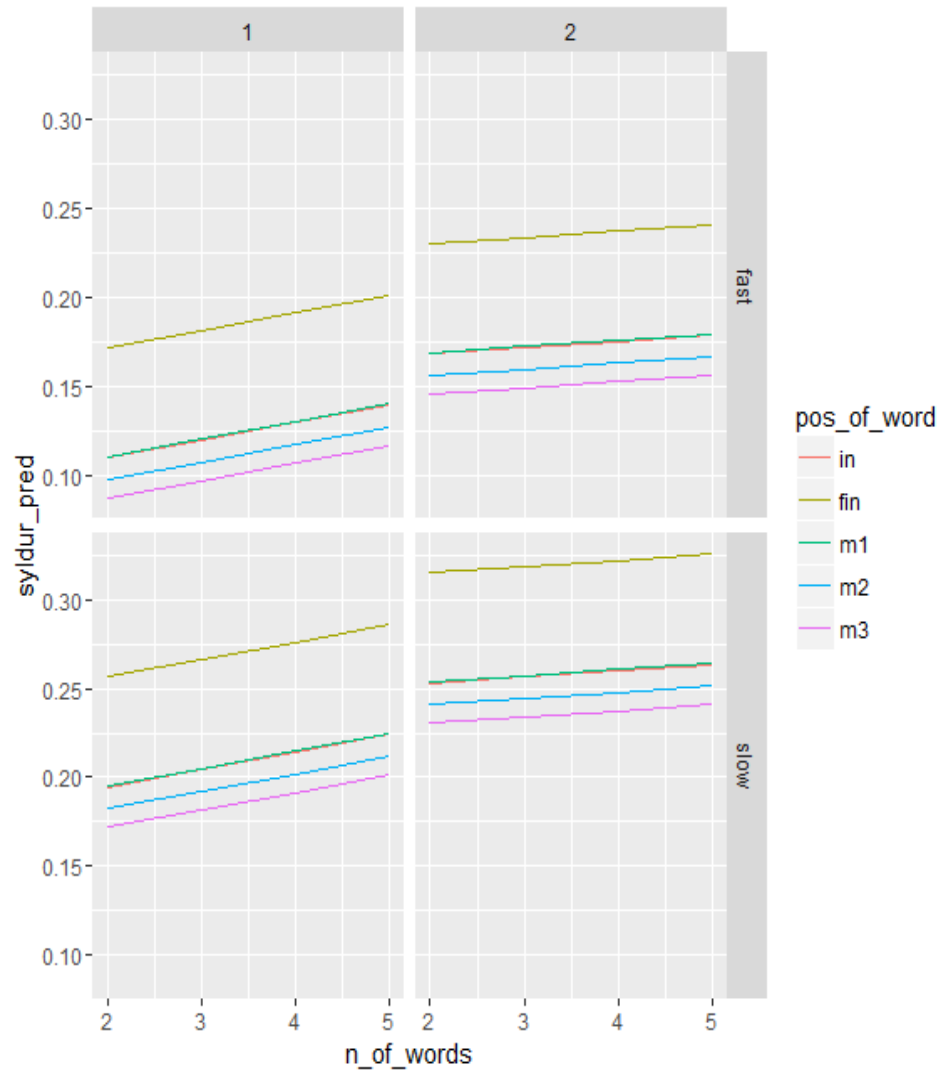


Figure 9: Factors that affect syllable duration in broad focus declaratives. Syllable structure (along the top): (1) = CV, (2) = CVC.

For narrow focus declaratives, I created a series of models starting with the most complex one which included syllable duration as the dependent variable. The independent variables were the same as in the model for broad focus declaratives. However, the independent variable focus was also included to distinguish between focused and non-focused words in the sentence. All of these five independent variables

were included as fixed factors. I also considered the following two-way interactions: number of words and syllable structure, number of words and focus, and number of words and word duration. Again, the two-way interaction between number of words and position of word was not included due to collinearity effects. I followed the same statistical procedure as in the broad focus model.

The best fit model included all the fixed factors: number of words $F(1, 327) = 5.72, p = 0.017$; syllable structure $F(1, 340) = 80.24, p < 0.001$; position of the word $F(4, 333) = 96.24, p < 0.001$; focus $F(1, 333) = 43.31, p < 0.001$; and word duration $F(1, 74) = 76.83, p < 0.001$. Figure 10 below illustrates the directions of these effects. Results show that as the number of words in a sentence increases, so does stressed syllable duration. CVC stressed syllables are significantly longer than CV stressed syllables. Post-hoc means comparisons of position of the word using the Tukey HSD test indicate that narrow focus stressed syllables in final position are significantly longer than those stressed syllables in non-final positions. Among non-final positions, no significant difference in syllable duration was found. Stressed syllables in narrow focused words are significantly longer than those in non-focused words, and, syllable duration is much longer in slow speech rate than in fast speech rate. The only significant two-way interaction is number of words and syllable structure $F(1, 338) = 6.52, p = 0.011$. As in the broad focus group, the difference in duration across number of words is greater in CV stressed syllables than in CVC stressed syllables.

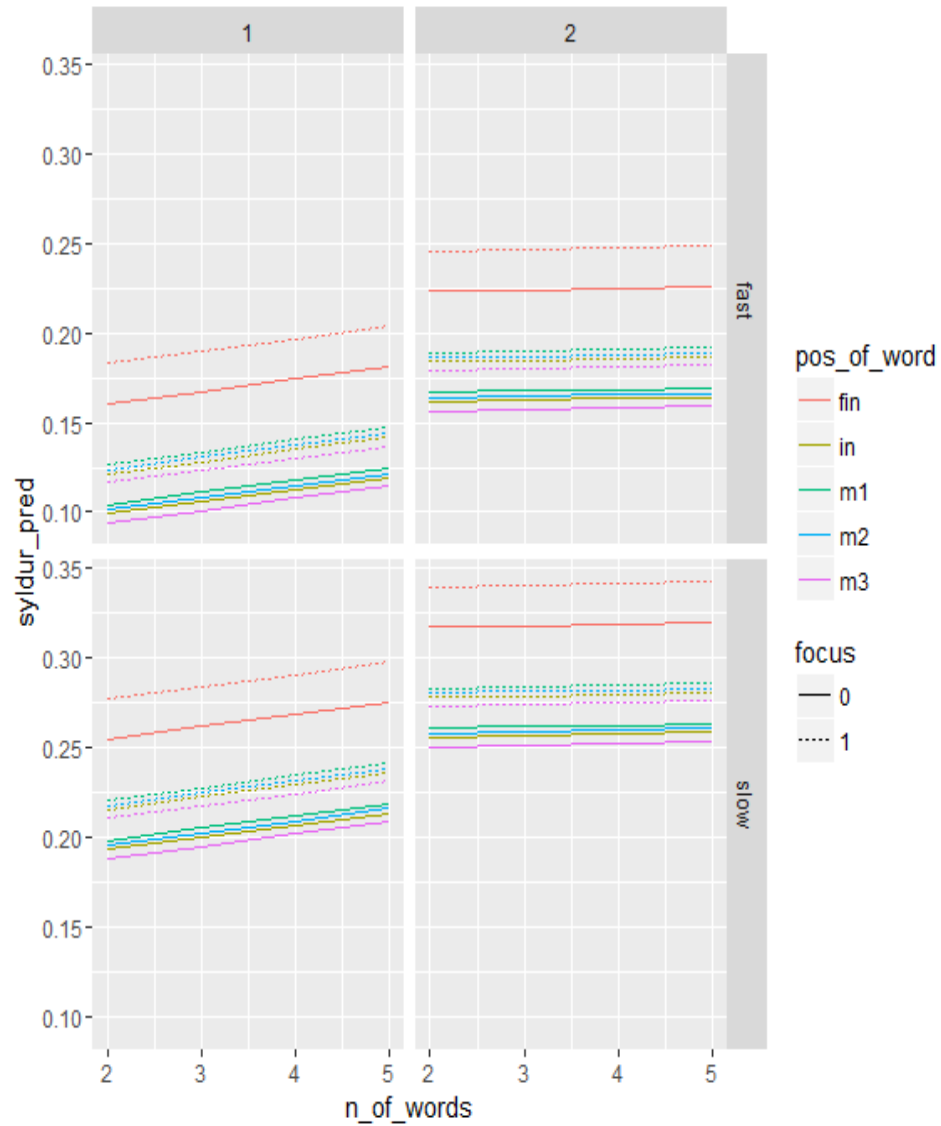


Figure 10: Factors that affect syllable duration in narrow focus declaratives. Syllable structure (along the top): (1) = CV, (2) = CVC. Focus: focused words (1) = dotted lines, non-focused words (0) = solid lines.

Lastly, I ran a similar series of models to analyze syllable duration in contrastive focus declaratives. The independent variables as well as the two-way interactions were the same as the ones used in the model for narrow focus declaratives. As in the previous

analyses, I started with a complex model, and then simplified it using the same procedure stated above.

The best fit model included all of the fixed factors: number of words $F(1, 670) = 25.07, p < 0.001$; syllable structure $F(1, 761) = 77.94, p < 0.001$; position of the word $F(4, 755) = 159.89, p < 0.001$; focus $F(1, 754) = 600.48, p < 0.001$; and word duration $F(1, 52) = 222.50, p < 0.001$. Figure 11 below illustrates the trends found in the best fit model. Similar to the broad and narrow focus groups, stressed syllable duration increases as the number of words in a sentence increases. Syllable duration in CVC stressed syllables is significantly longer than in CV stressed syllables. Post-hoc means comparisons of position of the word using the Tukey HSD test indicate that, in contrastive focus declaratives, all stressed syllables in final position are significantly longer than those stressed syllables in non-final positions. Among non-final positions, stressed syllables in M2 position are significantly longer than in initial, M1 or M3 positions. With respect to focus type, stressed syllables in contrastive focused words are significantly longer than those in non-focused words. In slow speech rate, syllable duration is much longer than in fast speech rate. As with broad and narrow focus declaratives, the only significant two-way interaction is number of words and syllable structure $F(1, 766) = 12.45, p < 0.001$. Namely, the difference in duration across number of words is greater in CV stressed syllables than in CVC stressed syllables.

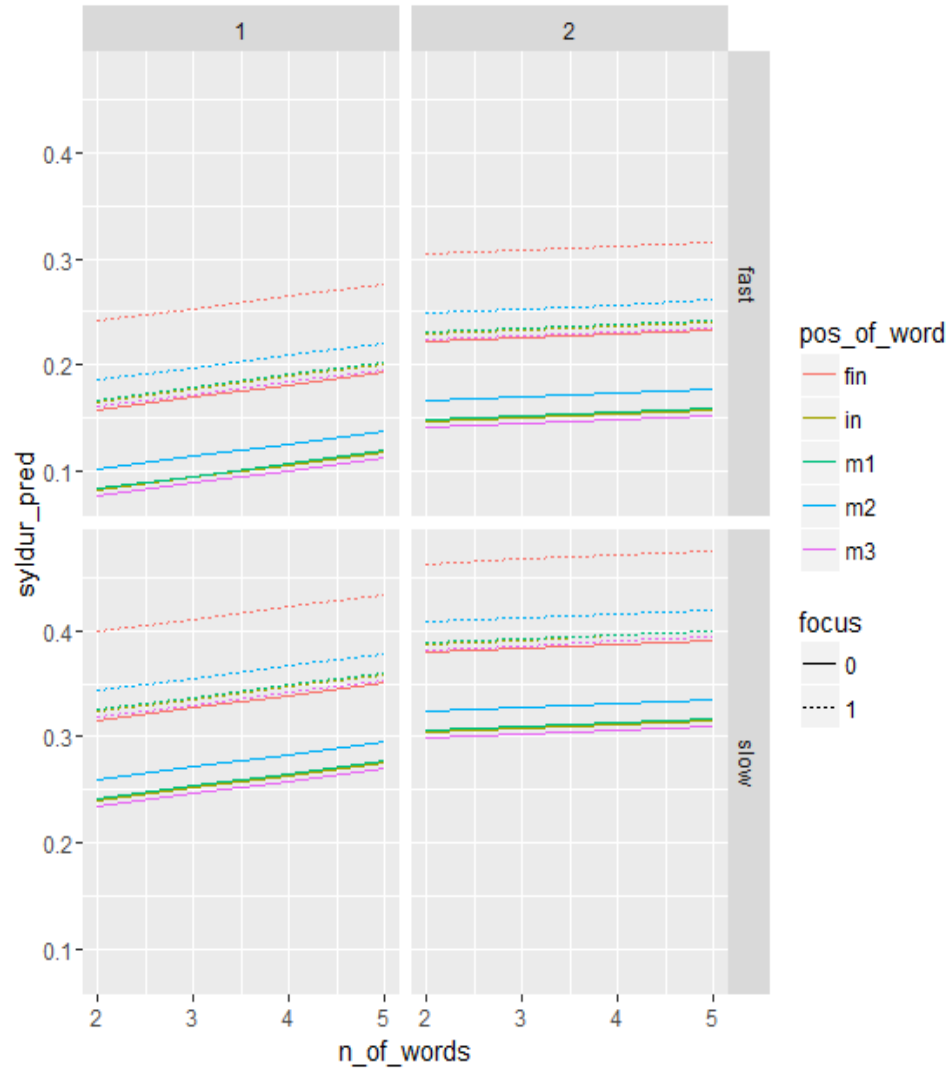


Figure 11: Factors that affect syllable duration in contrastive focus declaratives. Syllable structure (along the top): (1) = CV, (2) = CVC. Focus: focused words (1) = dotted lines, non-focused words (0) = solid lines.

4.1.2 Summary of Syllable Duration

An initial examination of segmental length in PAS shows that, across all the three types of declaratives, the number of words in a sentence affects syllable duration. More precisely, stressed syllables are longer as the number of words in a sentence increases.

These results match my early hypothesis on the manipulation of number of words as a useful proxy of segmental length differences.

In addition to number of words, syllable structure also affects syllable duration. These results are expected since CVC syllables have more segments than CV syllables. Position of the word is also a significant factor on syllable duration. As expected, in final positions, stressed syllables are longer than stressed syllables in non-final position due to final lengthening. It was also predicted that stressed syllables in slow speech rate tend to be longer than those in fast speech rate. Overall, across all types of declaratives, the effects of these three factors are expected, and they suggest that the analysis of syllable duration in PAS is correct. Lastly, for narrow and contrastive declaratives, stressed syllables in focused words exhibit longer duration than those in non-focused words.

4.1.3 Vowel Duration

Overall, subsection §4.1.1 has shown that number of words affects syllable duration across the three types of declaratives. In this subsection, I present the results of vowel duration across broad, narrow, and contrastive focus declaratives. I created a series of linear mixed-effects models in R for each of the three types of declaratives, similar to those used for the examination of syllable duration. In these models, however, the dependent variable was vowel duration rather than syllable duration. I followed the same statistical procedure as I did in the syllable duration models. For broad focus declaratives, the fixed factors were number of words, syllable structure, position of the word, and word

duration. The only two-way interactions included in the analysis were number of words and syllable structure, and number of words and word duration.

The best fit model for the broad focus group included all fixed factors: number of words $F(1, 615) = 12, p < 0.001$; syllable structure $F(1, 591) = 12.58, p < 0.001$; position of the word $F(4, 606) = 184.51, p < 0.001$; and word duration $F(1, 127) = 87.89, p < 0.001$. No two-way interactions were found to be significant. The direction of these effects are illustrated in Figure 12 below. Results show that the duration of the stressed vowels increases as the number of words in a sentence increases. Stressed vowels are significantly longer in CV syllables than in CVC syllables. Tukey's HSD post-hoc means comparisons for position of the word indicate that stressed vowels in final position are longer than those in non-final positions. Among non-final positions, there are only significant differences in duration between initial position and M1, and initial position and M2. Lastly, stressed vowels in slow speech rate are significantly longer than those in fast speech rate.

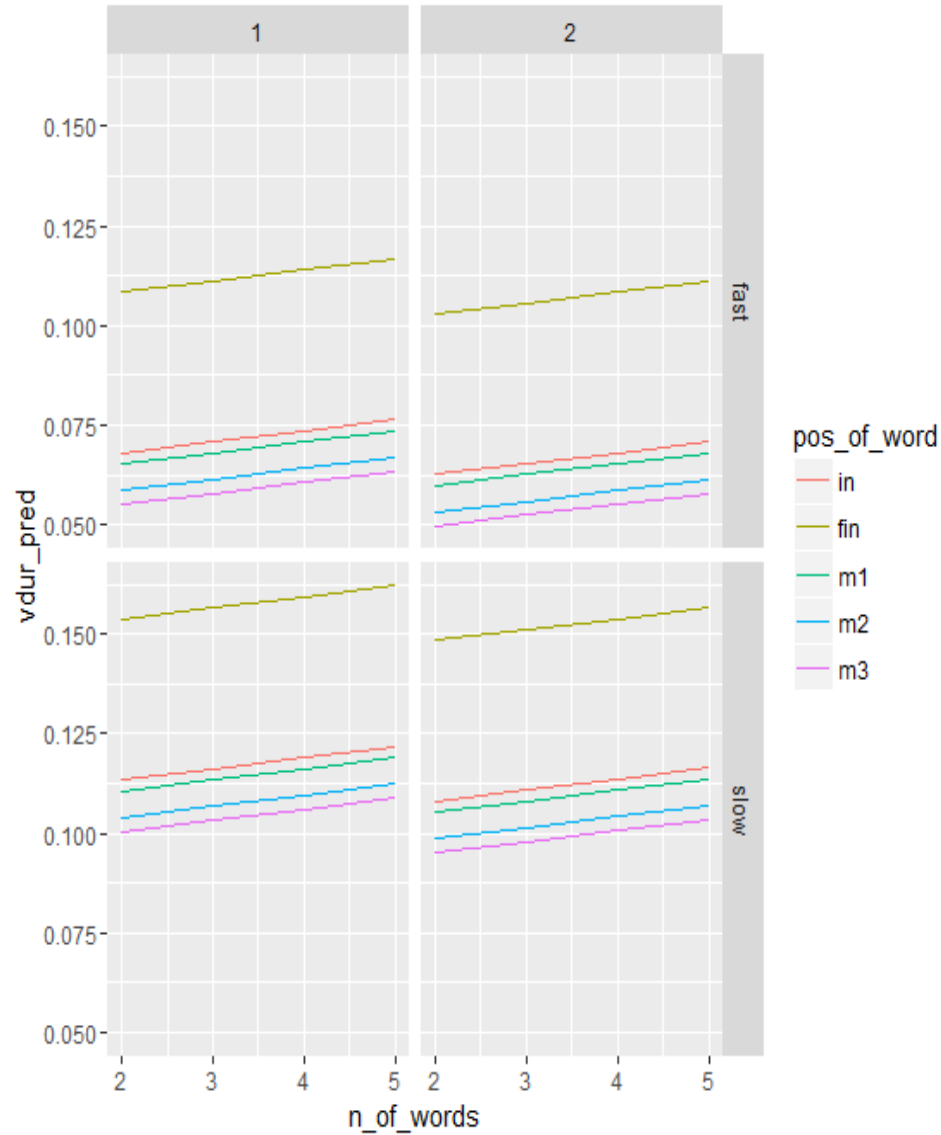


Figure 12: Factors that affect vowel duration in broad focus declaratives. Syllable structure (along the top): (1) = CV, (2) = CVC.

For narrow and contrastive focus declaratives, an additional independent variable was included in the analyses: focus. The same fixed factors and the two-way interactions included in the syllable duration analysis for narrow and contrastive focus declaratives were part of the vowel duration analyses. In narrow focus declaratives, the only

significant fixed factors were syllable structure $F(1, 343) = 7.32, p = 0.007$, position of the word $F(4, 333) = 89.40, p < 0.001$, focus $F(1, 332) = 4.47, p = 0.035$; and word duration $F(1, 86) = 43.48, p < 0.001$. Figure 13 below illustrates the direction of these effects. As in the broad focus group, stressed vowels in CV syllables are longer than those in CVC syllables. Post-hoc means comparisons of position of the word using the Tukey HSD test indicate that stressed vowels in final position are significantly longer than those stressed vowels in non-final positions. No significant differences in vowel duration among non-final position were found, except between initial and M1 position. That is, vowels in M1 position are longer than in initial position. Vowels in focused words are longer than those non-focused words. With respect to word duration, stressed vowels in slow speech rate are longer than those in fast speech rate. Interestingly, number of words is not a significant factor in the duration of stressed vowels. No two-way interactions were found significant.

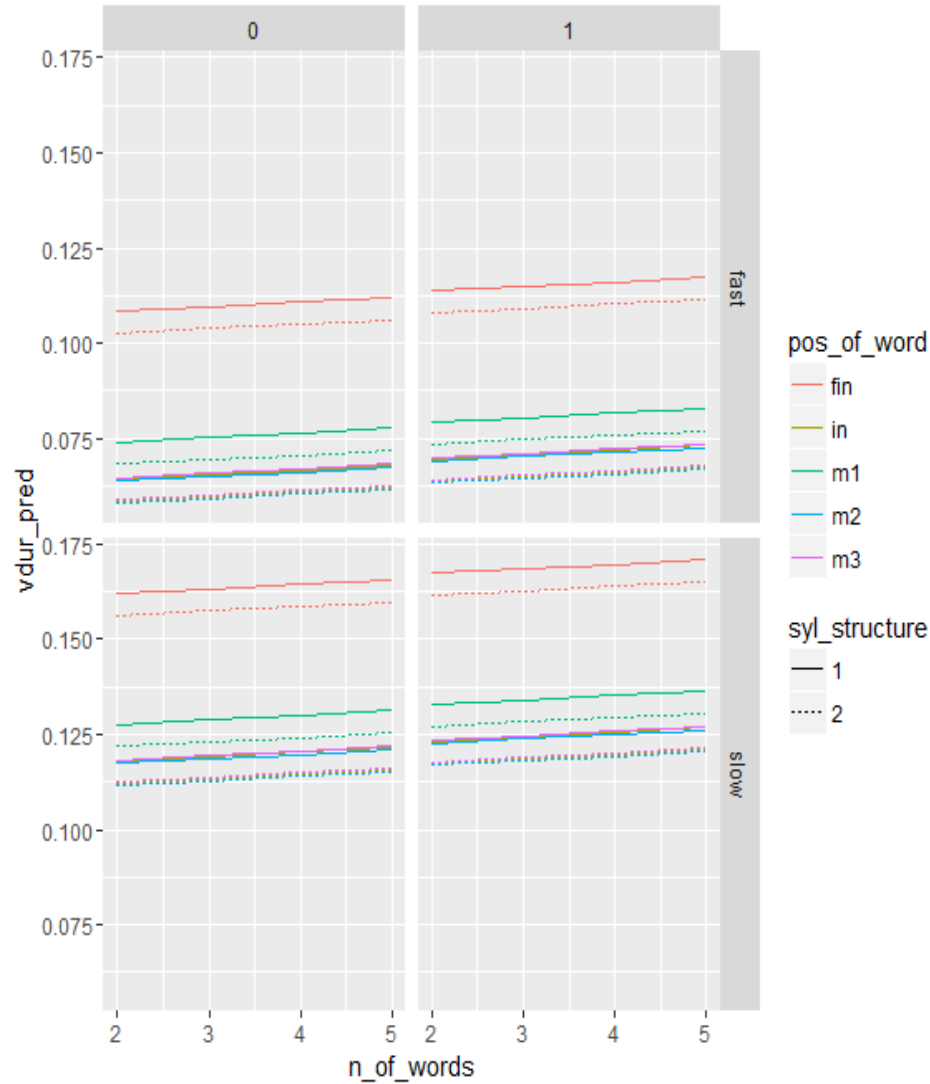


Figure 13: Factors that affect vowel duration in narrow focus declaratives. Focus (along the top): (0) = non-focused words, (1) = focused words. Syllable structure: CV (1) = solid lines, CVC (2) = dotted lines.

In contrastive focus declaratives, the best fit model included all fixed factors:

number of words $F(1, 769) = 12.89, p < 0.001$; syllable structure $F(1, 767) = 20.51, p < 0.001$; position of the word $F(4, 755) = 149.30, p < 0.001$; focus $F(1, 755) = 11.10, p < 0.001$; and word duration $F(1, 411) = 112.03, p < 0.001$. Figure 14 below illustrates the

directions of these effects. Results show that vowel duration increases as the number of words in the sentence increases. Second, stressed vowels in CV syllables are significantly longer than in CVC syllables. Tukey's HSD post-hoc means comparisons for position of the word indicate that stressed vowels in final position are significantly longer than those stressed vowels in non-final positions. No significant differences in vowel duration were found among non-final positions. With regards to focus, stressed vowels in focused words are longer than those in non-focused words. Lastly, vowels in slow speech rate are longer than those in fast speech rate. The only significant two-way interaction found was number of words and focus $F(1, 755) = 6.48, p = 0.011$. Namely, the difference in stressed vowel duration across number of words is greater in focused words than in non-focused words.

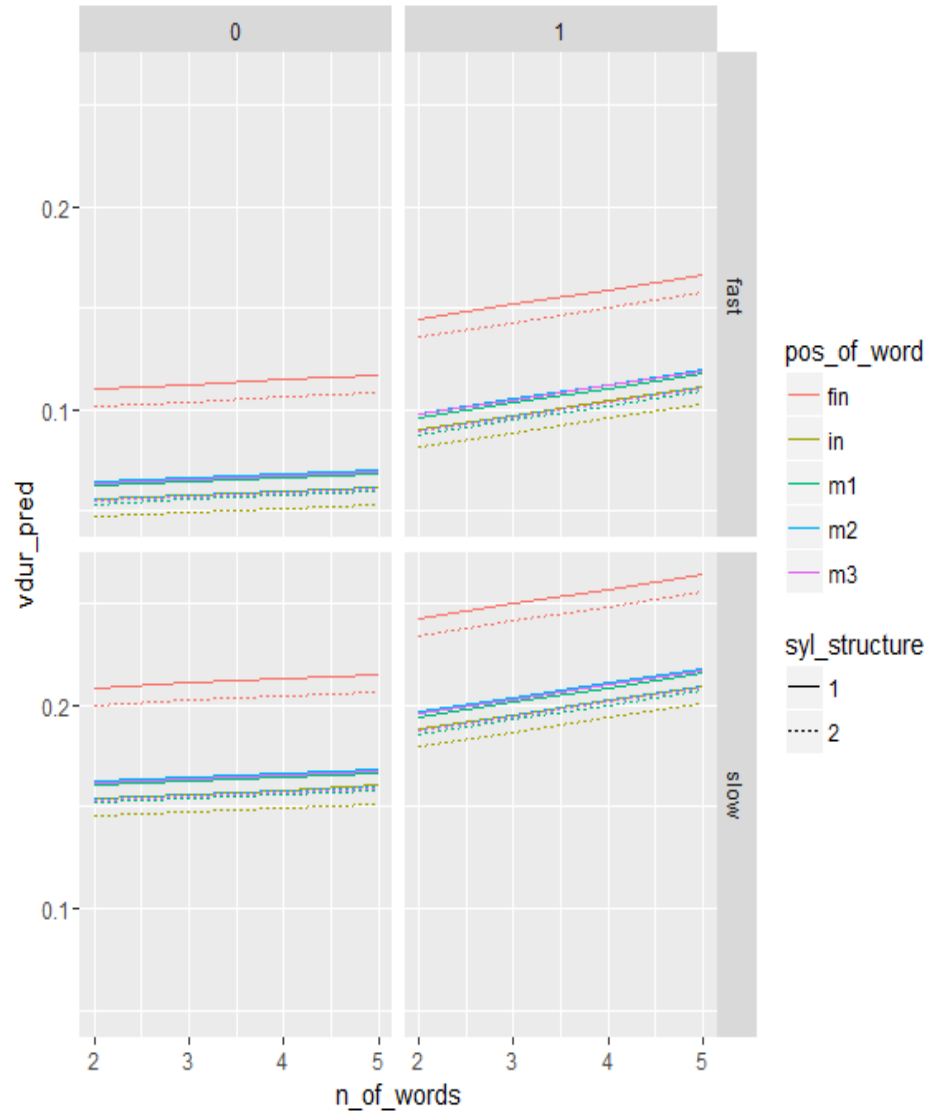


Figure 14: Factors that affect vowel duration in contrastive focus declaratives. Focus (along the top): (0) = non-focused words, (1) = focused words. Syllable structure: CV (1) = solid lines, CVC (2) = dotted lines.

4.1.4 Summary of Vowel Duration

The examination of PAS vowel duration shows that the number of words in a sentence affects stressed vowel duration. More specifically, as the number of words increases, vowel duration increases. This effect is present across all types of sentences, except in narrow focus declaratives where number of words does not reach the significance level. In addition, syllable structure affects vowel duration across the three types of declaratives. Vowels in CV syllables are longer than those in CVC syllables. Third, position of word has an effect on vowel duration. Overall, vowels in final position are longer than those in non-final positions. Only in broad and narrow focus declaratives, there are differences in vowel duration among non-final positions. In slow speech rate, vowels tend to be longer than in fast speech rate. Regarding focus, and particularly in narrow and contrastive focus declaratives, stressed vowels in focused words are longer than those in non-focused words. Lastly, and only in contrastive focus declaratives, there is a two-way interaction between number of words and focus. Specifically, the effect of number of words on vowel duration is more evident in focused words.

The effects of the four previous factors (i.e. syllable structure, position of word, speech rate, and focus) on vowel duration were expected and confirmed by the current PAS data. However, the effect of number of words on vowel length goes against early predictions in the literature. Previous research on segmental length has suggested that increasing the number of words in a sentence prompts shorter segmental duration (Navarro Tomás 1916, Lehiste 1970). Yet, contrary to expectations, increasing the number of words in the sentence does not decrease vowel duration in PAS data but rather

increases it. Nonetheless, the manipulation of number of words does vary vowel duration (by increasing it), across all three types of declaratives, with the exception of stressed vowels in narrow focus declaratives. Thus, the hypothesis that changing the number of words will affect segmental duration is confirmed, and I can further explore my research questions on the effects of segmental length on tonal alignment in PAS.

4.2 Tonal Alignment

In the previous section (§4.1), I examined syllable and vowel duration in PAS. The primary goal was to confirm that the change of number of words in a sentence prompts differences in segmental length in PAS. In this section, I present the results on PAS tonal alignment across the three types of declaratives: broad, narrow, and contrastive focus. Results of the F0 peak location will be first presented with respect to the stressed syllable (as a categorical variable), and then as a percentage into the stressed syllable and the stressed vowel (as a continuous variable).

4.2.1 Location of the F0 Peak with Respect to the Stressed Syllable

One of the first goals here is to examine whether F0 peaks are realized within the stressed syllable or after the stressed syllable. Therefore, in this initial examination, there are three levels: (1) before the stressed syllable, (2) within the stressed syllable, and (3) after the stressed syllable. Additionally, F0 peak location is examined in relation to specific syllabic elements. For CV syllables, for example, there are four levels: (1) before the stressed syllable, (2) in the onset of the stressed syllable, (3) in the vowel of the stressed

syllable, and (4) after the stressed syllable. For CVC syllables, on the other hand, there are five levels: (1) before the stressed syllable, (2) in the onset of the stressed syllable, (3) in the vowel of the stressed syllable, (4) in the coda of the stressed syllable, and (5) after the stressed syllable. In what follows, I will present the results for each type of declaratives. This presentation will help obtain an overall distribution of the location of the F0 peaks (as a categorical variable) across the data.

4.2.1.1 Broad Focus Declaratives

The distribution of F0 peak location in broad focus declaratives is provided below in Table 9. Across all pitch accents included in the analysis (N = 623), in 98.23% of them F0 peaks are realized within the stressed syllable. In 1.77% of the cases, F0 peaks are realized after the stressed syllable. No F0 peak is realized before the stressed syllable. From those F0 peaks that fall after the stressed syllable (N = 11), eight of them occur in initial position, and only one in each medial position.

	Before the stressed syllable	Within the stressed syllable	After the stressed syllable	Total (N)
Number of F0 peaks	0	612	11	623
Percentage	0	98.23%	1.77%	100%

Table 9: F0 peak location in broad focus declaratives.

For CV stressed syllables in the broad focus group (N = 284), in 80.63% of the cases, F0 peaks are realized within the stressed vowel. In 16.2% of the cases, F0 peaks

are realized in the onset, and in 3.17 % of the cases, F0 peaks are realized after the stressed syllable. Table 10 below shows the number of tokens that occurs in each sentential position for CV broad focus declaratives. Within each position, I indicate how many of those tokens occur in the onset, vowel, or after the syllable. For example, in Table 10, there are 91 tokens in initial position, 83 of them are realized in the vowel, 2 of them in the onset, and 6 of them after the stressed syllable.

	Initial (N=91)	M1 (N=58)	M2 (N=33)	M3 (N=11)	Final (N=91)	Total	
						N = 284	Percentage
Onset	2	4	0	0	40	46	16.2%
Vowel	83	53	32	10	51	229	80.63%
After syllable	6	1	1	1	0	9	3.17%

Table 10: F0 peak location in CV stressed syllables in broad focus declaratives.

As a follow-up to the examination of CV stressed syllables, I performed chi-square tests for independence to determine if there was a significant relationship between: F0 peak location and number of words, and F0 peak location and position of the word. For the chi-square tests, number of words had four levels (i.e. 2-, 3-, 4-, 5- words), and position of the word was recoded to contain only two levels (i.e. final and non-final). Position of the word was recoded in this way because, looking at the percentages, we can see that all non-final positions behave very similarly, and collapsing them makes the statistical model simpler. F0 peak location for CV syllables had two levels: onset and

vowel. For all chi-square tests, I only included those F0 peaks that occur within the stressed syllable.

For CV syllables in broad focus declaratives, there is not a significant relationship between F0 peak location and number of words ($\chi^2(3, N = 275) = 6.01, p = 0.111$). There is, however, a significant relationship between F0 peak location and position of the word ($\chi^2(1, N = 275) = 69.50, p < 0.001$). Table 11 below shows the distribution of tokens between F0 peak location and position of the word for CV stressed syllables. Overall, F0 peaks are realized in the vowel of the stressed syllable in both non-final and final positions. Yet, F0 peaks tend to be realized in the onset of the stressed syllable much more frequently in final position.

	Position of the word	
	Non-final	Final
Onset	6 (3%)	40 (44%)
Vowel	178 (97%)	51 (56%)
Total	184	91

Table 11: Distribution of tokens between position of the word and F0 peak location in CV syllables of broad focus declaratives. Chi-square results: $\chi^2(1, N = 275) = 69.50, p < 0.001$.

With regard to CVC stressed syllables ($N = 339$), in 76.7% of the cases, F0 peaks are realized within the stressed vowel, followed by a 13.27% of F0 peaks occurring in the onset. In 9.44% of the cases, F0 peaks are realized in the coda, and in 0.59% of the cases, F0 peaks are realized after the stressed syllable. Table 12 below shows this distribution.

	Initial (N=105)	M1 (N=71)	M2 (N=43)	M3 (N=15)	Final (N=105)	Total	
						N = 339	Percentage
Onset	0	0	3	2	40	45	13.27%
Vowel	97	58	30	10	65	260	76.7%
Coda	6	13	10	3	0	32	9.44%
After syllable	2	0	0	0	0	2	0.59%

Table 12: F0 peak location in CVC stressed syllables in broad focus declaratives.

Chi-square tests for CVC syllables of broad focus declaratives show that there is not a significant relationship between F0 peak location and number of words ($\chi^2(6, N = 337) = 12.21, p = 0.057$). Similar to CV syllables, there is however a significant relationship between F0 peak location and position of the word ($\chi^2(2, N = 337) = 89, p < 0.001$). Table 13 below shows the distribution of tokens between position of the word and F0 peak location in CVC syllables. Generally, F0 peaks are realized in the vowel in both non-final and final positions. However, many F0 peaks tend to be realized in the onset in final position. There are cases of F0 peaks realized in the coda only in non-final position.

	Position of the word	
	Non-final	Final
Onset	5 (2%)	40 (38%)
Vowel	195 (84%)	65 (62%)
Coda	32 (14%)	0
Total	232	105

Table 13: Distribution of tokens between position of the word and F0 peak location in CVC syllables of broad focus declaratives. Chi-square results: $\chi^2(2, N = 337) = 89, p < 0.001$.

4.2.1.2 Narrow Focus Declaratives

In narrow focus declaratives, I examined focused words and non-focused words separately. Table 14 below shows the distribution of F0 peak location. In focused words (N = 121), all F0 peaks occur within the stressed syllable. In non-focused words (N = 233), 98.71% of F0 peaks are realized also within the stressed syllable. In 1.29% of the cases, F0 peaks are realized after the stressed syllable. Among those F0 peaks that occur after the stressed syllable, all of them occur in initial position.

	Within the stressed syllable	After the stressed syllable	Total (N)
Focused words	121 (100%)	0 (0%)	121
Non-focused words	230 (98.71%)	3 (1.29%)	233
Total	351	3	354

Table 14: F0 peak location in narrow focus declaratives.

For narrow focused words (N = 121), in over 95.04% of the cases, F0 peaks are realized within the stressed vowel. In 4.13% of the cases, however, F0 peaks are realized in the onset. The distribution of these 4.13% cases is the following: 2 in CV initial position, 1 in CV M2 position, 1 in CV final position, and 1 in CVC final position. In less than 1% of the cases, F0 peaks are realized in the coda. Table 15 below shows this distribution.

	Initial (N=47)	M1 (N=19)	M2 (N=30)	M3 (N=3)	Final (N=22)	Total	
						N = 121	Percentage
Onset	2	0	1	0	2	5	4.13%
Vowel	45	19	28	3	20	115	95.04%
Coda	0	0	1	0	0	1	0.83%

Table 15: F0 peak location in focused words of narrow focus declaratives.

With respect to the non-focused words (N = 233), F0 peaks are realized within the stressed syllable in over 98% of the cases. Yet, the segment in which the F0 contour reaches its peak is not always the same. Let us start with CV stressed syllables (shown in Table 16 below). In 87.37% of the cases, F0 peaks are realized within the stressed vowel, and in 9.47% of the cases, in the onset. Moreover, F0 peaks are realized after the stressed syllable in 3.16% of the cases, and exclusively in initial position.

	Initial (N=28)	M1 (N=14)	M2 (N=4)	M3 (N=6)	Final (N=43)	Total	
						N = 95	Percentage
Onset	1	1	0	1	6	9	9.47%
Vowel	24	13	4	5	37	83	87.37%
After Syllable	3	0	0	0	0	3	3.16%

Table 16: F0 peak location in CV stressed syllables of non-focused words in narrow focus declaratives.

Similar to the broad focus group, I performed chi-square tests for narrow focus and contrastive focus declaratives. However, I only examined non-focused words. This was due to the fact that the F0 peaks in focused words occur almost exclusively within the vowel (see Table 15 above and Table 21 below). For CV syllables in narrow non-focused words, chi-square tests show that there is not a significant relationship between F0 peak location with either number of words ($\chi^2(3, N = 92) = 3.87, p = 0.27$) or position of the word ($\chi^2(1, N = 92) = 0.83, p = 0.36$).

In CVC stressed syllables, in 81.88% of the cases, F0 peaks are realized within the stressed vowel. In 13.77% of the cases, F0 peaks are realized in the onset, and in less than 5% of the cases, F0 peaks are realized in the coda. This distribution is shown in Table 17.

	Initial (N=46)	M1 (N=26)	M2 (N=4)	M3 (N=9)	Final (N=53)	Total	
						N = 138	Percentage
Onset	1	0	1	0	17	19	13.77%
Vowel	40	25	3	9	36	113	81.88%
Coda	5	1	0	0	0	6	4.35%

Table 17: F0 peak location in CVC stressed syllables of non-focused words in narrow focus declaratives.

Unlike CV stressed syllables, chi-square tests for CVC stressed syllables show that there is there is a relationship between F0 peak location and both number of words ($\chi^2(6, N = 138) = 13.75, p = 0.03$) and position of the word ($\chi^2(2, N = 138) = 26.74, p <$

0.001). Overall, F0 peaks are realized in the stressed vowel, but in 2- and 4- word sentences, several F0 peaks are also realized in the onset. In 4- word sentences, a high number of F0 peaks are realized in the coda. Regarding position of the word, most F0 peak are realized in the stressed vowel, but F0 peaks tend to occur in the onset with higher frequency in final position. F0 peaks occur in the coda only in non-final positions. Table 18 and Table 19 below show the token distribution of CVC stressed syllables of non-focused words in narrow focus declaratives by number of words and by position of the word.

	Number of words			
	2	3	4	5
Onset	8 (28%)	2 (7%)	7 (17%)	2 (5%)
Vowel	20 (69%)	27 (93%)	30 (73%)	36 (92%)
Coda	1 (3%)	0	4 (10 %)	1 (3%)
Total	29	29	41	39

Table 18: Distribution of tokens between number of words and F0 peak location in CVC syllables of narrow non-focused words. Chi-square results: $\chi^2(6, N = 138) = 13.75, p = 0.03$.

	Position of the word	
	Non-final	Final
Onset	2 (2%)	17 (32%)
Vowel	77 (91%)	36 (68%)
Coda	6 (7%)	0
Total	85	53

Table 19: Distribution of tokens between position of the word and F0 peak location in CVC syllables of narrow non-focused words. Chi-square results: $\chi^2(2, N = 138) = 26.74, p < 0.001$.

4.2.1.3 Contrastive Focus Declaratives

Similar to the narrow focus group, contrastive focus declaratives contain both focused and non-focused words, and these are treated separately. Table 20 below shows the distribution of F0 peak location in contrastive focus declaratives. Regarding contrastive focused words (N = 229), all F0 peaks are realized categorically within the stressed syllable. In non-focused words, in 96.55% of the cases, F0 peaks are realized within the stressed syllable. In 3.45% of the cases, F0 peaks are realized after the stressed syllable. The distribution of that 3.45% (N = 19) is the following: 13 of them occur in initial position, four in M1 position, and two in M2 position.

	Within the stressed Syllable	After the stressed syllable	Total (N)
Focused words	229 (100%)	0 (0%)	229
Non-focused words	531 (96.55%)	19 (3.45%)	550
Total	760	19	779

Table 20: F0 peak location in contrastive focus declaratives.

In all contrastive focused words (N = 229), almost all F0 peaks are realized within the stressed vowel. Only in one instance, in a CV stressed syllable located in initial position, the F0 peak is realized in the onset. Table 21 shows this distribution.

	Initial (N=50)	M1 (N=39)	M2 (N=78)	M3 (N=19)	Final (N=43)	Total	
						N = 229	Percentage
Onset	1	0	0	0	0	1	0.44%
Vowel	49	39	78	19	43	228	99.56%

Table 21: F0 peak location in focused words of contrastive focus declaratives.

Among all non-focused words in contrastive focus declaratives (N = 550), in 96.55% of the cases, F0 peaks are realized within the stressed syllable. However, not all of these F0 peaks are realized in the same segment. Let us start with the distribution of CV stressed syllables, shown in Table 22 below. In 88.52% of the cases, F0 peaks are realized in the stressed vowel. In 7.79% of the cases, F0 peaks are realized in the onset. In 3.69% of the cases, F0 peaks are realized after the stressed syllable.

	Initial (N=78)	M1 (N=49)	M2 (N=8)	M3 (N=21)	Final (N=88)	Total	
						N = 244	Percentage
Onset	1	1	0	0	17	19	7.79%
Vowel	70	46	8	21	71	216	88.52%
After Syllable	7	2	0	0	0	9	3.69%

Table 22: F0 peak location in CV stressed syllables of non-focused words in contrastive focus declaratives.

Chi-square tests for CV syllables show that there is not a significant relationship between F0 peak location and number of words ($\chi^2(3, N = 235) = 7.02, p = 0.07$).

However, there is a relationship between F0 peak location and position of the word ($\chi^2(1, N = 235) = 21.53, p < 0.001$). Table 23 below shows the distribution of tokens by F0 peak location and position of the word. Overall, in final position there is a higher percentage of F0 peaks in the onset than in non-final position but still most of them, in both positions, fall within the stressed vowel.

	Position of the word	
	Non-final	Final
Onset	2 (1%)	17 (19%)
Vowel	145 (99%)	71 (81%)
Total	147	88

Table 23: Distribution of tokens between position of the word and F0 peak location in CV syllables of contrastive non-focused words. Chi-square results: $\chi^2(1, N = 235) = 21.53, p < 0.001$.

Figure 24 below shows the distribution of F0 peaks in CVC stressed syllables of contrastive non-focused words. In 80.39% of the cases, F0 peaks are realized within the stressed vowel. In 9.48% of the cases, F0 peaks are realized in the onset, and in 6.86% of the cases, F0 peaks occur in the coda. Lastly, in 3.27% of the cases, F0 peaks are realized after the stressed syllable.

	Initial (N=101)	M1 (N=67)	M2 (N=21)	M3 (N=21)	Final (N=96)	Total	
						N = 306	Percentage
Onset	6	2	0	1	20	29	9.48%
Vowel	77	54	19	20	76	246	80.39%
Coda	12	9	0	0	0	21	6.86%
After Syllable	6	2	2	0	0	10	3.27%

Table 24: F0 peak location in CVC stressed syllables of non-focused words in contrastive focus declaratives.

Chi-square tests for CVC stressed syllables show that there is not a significant relationship between F0 peak location and number of words ($\chi^2(6, N = 296) = 4.78, p = 0.57$). There is, however, a relationship between F0 peak location and position of the word ($\chi^2(2, N = 296) = 28.01, p < 0.001$). Table 25 below shows the distribution of tokens by F0 peak location and position of the word in CVC syllables. Results show that F0 peaks are generally realized in the vowel in both non-final and final position. However, F0 peaks are realized in the onset more frequently in final position than in non-final position. F0 peaks fall within the coda only in non-final position.

	Position of the word	
	Non-final	Final
Onset	9 (5%)	20 (21%)
Vowel	170 (85%)	76 (79%)
Coda	21 (10%)	0
Total	200	96

Table 25: Distribution of tokens between position of the word and F0 peak location in CVC syllables of contrastive non-focused words. Chi-square results: $\chi^2(2, N = 296) = 28.01, p < 0.001$.

4.2.1.4 Summary

In this section, I provide a summary of F0 peak location in PAS as a categorical variable. Overall, and across the three types of declaratives, F0 peaks tend to align with the stressed syllable. In words bearing narrow and contrastive focus, F0 peaks occur categorically within the stressed syllable. Moreover, in broad focus declaratives and non-focused words of narrow and contrastive declaratives, the vast majority of F0 peaks are realized within the stressed syllable. Table 26 below shows the percentage of F0 peaks tokens occurring within the stressed syllable, and after the stressed syllable, across the three types of declaratives.

		Within the stressed syllable	After the stressed syllable
Broad focus		98% (N = 612)	2% (N = 11)
Narrow focus	Focused	100% (N = 121)	0%
	Non-focused	99% (N = 230)	1% (N = 3)
Contrastive focus	Focused	100% (N = 229)	0%
	Non-focused	97% (N = 531)	3% (N = 19)

Table 26: F0 peak location with respect to the stressed syllable across declaratives.

Second, and more interestingly, most F0 peaks in PAS are realized within the stressed vowel across the three types of declaratives, and regardless of segmental information. As shown in Table 27 below, for broad focus declaratives, in around 79% of the cases, F0 peaks are realized within the stressed vowel. In non-focused words of narrow and contrastive focus declaratives, F0 peaks are also realized within the vowel around 84% of the time. Chi-square tests showed that, in cases where F0 peaks are realized in the onset, it is due mostly to their position in the sentence. Specifically, F0 peaks that occur in the onset are particularly located in final position. Last but not least, it is noteworthy that, among the three types of declaratives, broad focus declaratives have more cases of F0 peaks occurring in the coda than narrow and contrastive focus declaratives. Similarly, broad focus declaratives have more cases of F0 peaks in the onset in final positions than narrow and contrastive focus declaratives. These observations suggest that broad focus declaratives present somewhat more variation in the precise location of the F0 peak. This variation, however, can be explained by the fact that in narrow and contrastive focused words, almost all F0 peaks are realized within the stressed vowel, rather than within the coda or within the onset.

	Within the stressed vowel
Broad focus words	79% (N = 489)
Narrow non-focused words	84% (N = 196)
Contrastive non-focused words	84% (N = 462)

Table 27: F0 peak location with respect to the stressed vowel across declaratives.

4.2.2 Location of the F0 peak as a Percentage into the Stressed Syllable

The previous section has examined PAS tonal alignment with respect to the segmental string as a categorical variable. In PAS, not only F0 peaks are realized within the stressed syllable, but also most of them tend to be realized within the stressed vowel, regardless of sentence type, number of words in the sentence, and syllable structure. This section presents the results of tonal alignment as a percentage into the stressed syllable, as a continuous variable. The goal here is to examine if F0 peaks are realized at a specific proportion into the stressed syllable in order to establish the exact location of the F0 peaks with respect to segmental content. I will present the results of broad, narrow, and contrastive focus declaratives individually. For this analysis, I only include those F0 peaks that occur within the stressed syllable (N = 1,723). The reason for this is that across all PAS F0 peaks tokens (N = 1,756), in over 98% of the time F0 peaks are realized within the stressed syllable.

4.2.2.1 Broad Focus Declaratives

For the broad focus group, I created a series of linear mixed-effects models in R, where location of the F0 peak as a percentage into the stressed syllable was the dependent variable. I also included speaker as a random effect. The independent variables were: number of words (2-, 3-, 4-, and 5-), syllable structure (CV and CVC), and position of the word (initial, M1, M2, M3, and final). These independent variables were included in the analysis as fixed factors. In addition, the following two-way interactions were included: number of words and syllable structure, and syllable structure and position of the word. The two-way interaction between number of words and position of the word was excluded due to collinearity effects. I did not include any three-way interactions. As in previous models, I started with a complex model, and then removed non-significant two-way interactions individually, starting with the interactions with the highest p-value. Only then, I removed non-significant fixed factors, starting with those with the highest p-value. As in previous analyses, each model was evaluated with an ANOVA in order to obtain the significance value for each factor and interaction.

The best fit model for the broad focus group ($N = 612$) included only two significant fixed factors: syllable structure $F(1, 599) = 62.78, p < 0.001$; and position of the word $F(4, 595) = 187.60, p < 0.001$. Figure 15 below illustrates the direction of these effects. Though number of words was not significant, I keep it in the figure for comparative purposes. Overall, F0 peak location as a percentage into the stressed syllable is higher in CV syllables than in CVC syllables. Post-hoc means comparisons of position of the word using the Tukey HSD test show that F0 peak location as a percentage is

lower in final position than in non-final position. Specifically, F0 peaks occur earlier in final position than in non-final positions. Crucially, no significant differences were found in F0 peak location as a percentage among non-final positions.

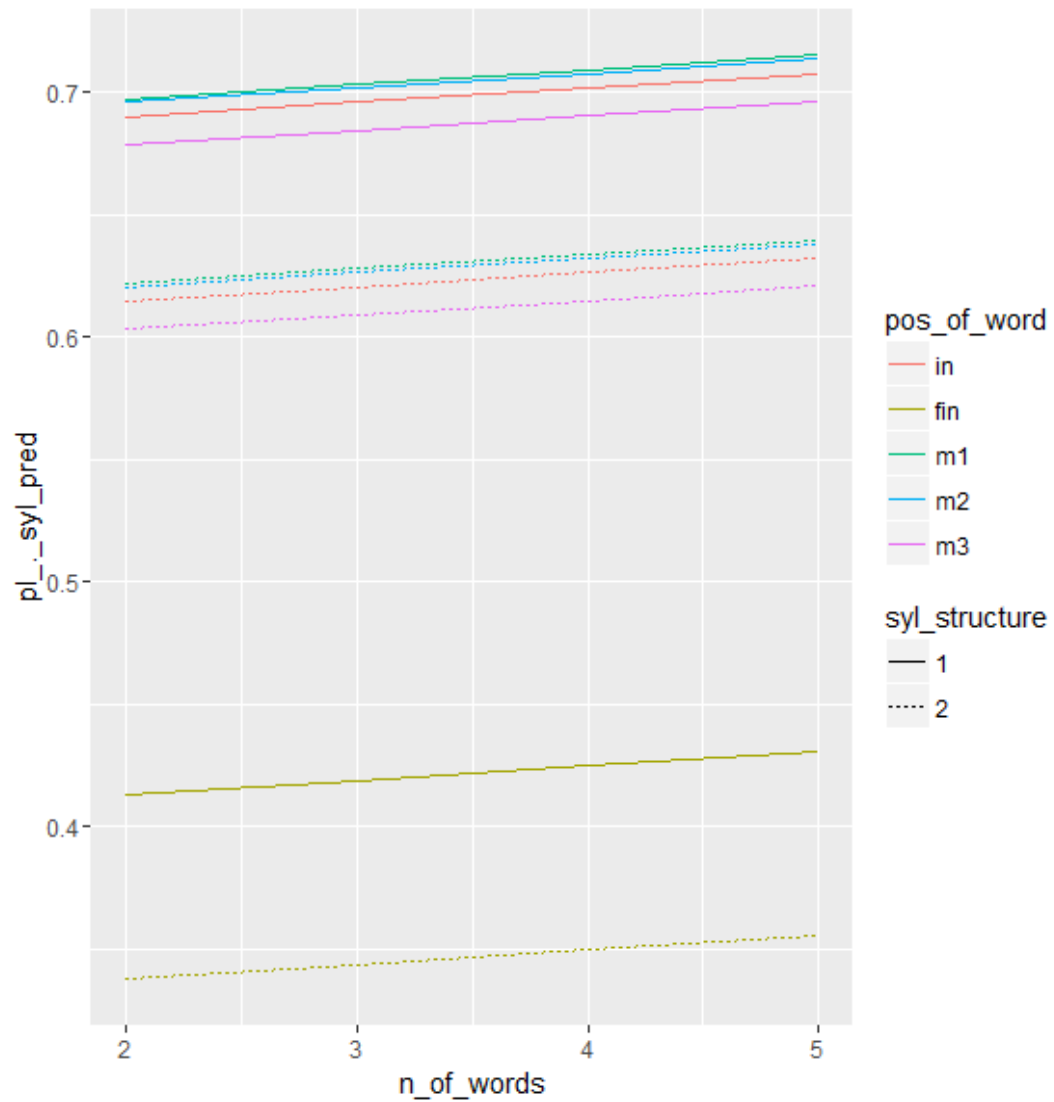


Figure 15: F0 peak location as a percentage into the stressed syllable in broad focus declaratives. Syllable structure: CV (1) = solid lines, CVC (2) = dotted lines.

4.2.2.2 *Narrow Focus Declaratives*

For narrow focus declaratives, as well as for contrastive focus declaratives, an additional fixed factor was added to the analysis: focus. Specifically, this factor indicates whether the word is focused or not. Therefore, the model for these two types of declaratives included four fixed factors: number of words, syllable structure, position of the word, and focus. I also included five two-way interactions: number of words and syllable structure, number of words and focus, syllable structure and position of the word, syllable structure and focus, and position of the word and focus. The two-way interaction between number of words and position of the word was not included due to collinearity effects. Three-way interactions were excluded from the analysis.

In narrow focus declaratives, there were 121 focused words, and 230 non-focused words, yielding a total of 351 tokens. The best fit model included only two fixed factors: syllable structure $F(1, 337) = 69.38, p < 0.001$, and position of the word $F(4, 333) = 66.28, p < 0.001$. Figure 16 below shows the direction of these effects. Though number of words and focus were not significant, I keep them in the figure for comparative purposes. Similar to broad focus declaratives, in the narrow focus group, F0 peak location as a percentage into the syllable is higher in CV stressed syllables than in CVC stressed syllables. Second, Tukey's HSD post-hoc means comparisons for position of the word indicate that F0 peak location has lower percentage in final position than in non-final positions. That is, F0 peaks are realized earlier in final position than in non-final positions. No significant differences were found in F0 peak location as a percentage into the stressed syllable among non-final positions.

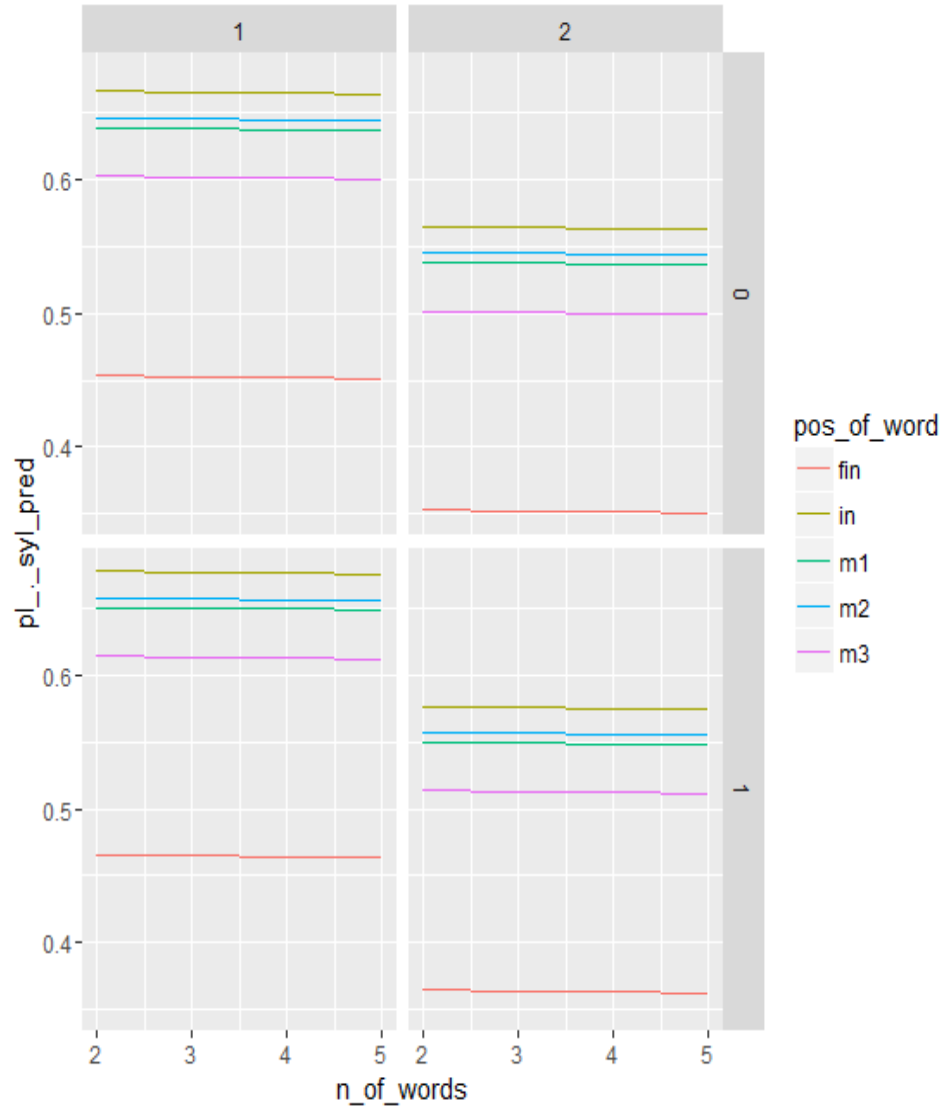


Figure 16: F0 peak location as a percentage into the stressed syllable in narrow focus declaratives. Syllable structure (along the top): (1) = CV, (2) = CVC. Focus (on the right): (0) = non-focused words, (1) = focused words.

4.2.2.3 Contrastive Focus Declaratives

In the contrastive focus group, there were 229 focused words, and 531 non-focused words, for a total of 760 tokens. In this group, three fixed factors were significant:

number of words $F(1, 740) = 6.49, p = 0.011$, syllable structure $F(1, 739) = 126.48, p <$

0.001, and position of the word $F(4, 736) = 56.29, p < 0.001$. Figure 17 below illustrates the direction of these effects. We can observe that as the number of words in a sentence increases, the F0 peak location as a percentage into the stressed syllable decreases.

Second, F0 peak location as a percentage is higher in CV stressed syllables than in CVC stressed syllables. This effect is similar to those found in broad and narrow focus declaratives. Moreover, post-hoc means comparisons of position of word using the Tukey HSD test show that F0 peak location has a lower percentage in final position than in non-final position. In other words, F0 peaks are located earlier in final position than in non-final positions. No significant differences were found among non-final positions. The only significant two-way interaction was position of the word and focus $F(4, 737) = 8.60, p < 0.001$. Specifically, in final position, the percentage of F0 peaks in focused words is higher (i.e. F0 peaks are reached later) than in non-focused words. In non-final position, however, the percentage of F0 peak in non-focused words is higher (i.e. F0 peaks are reached later) than in focused words.

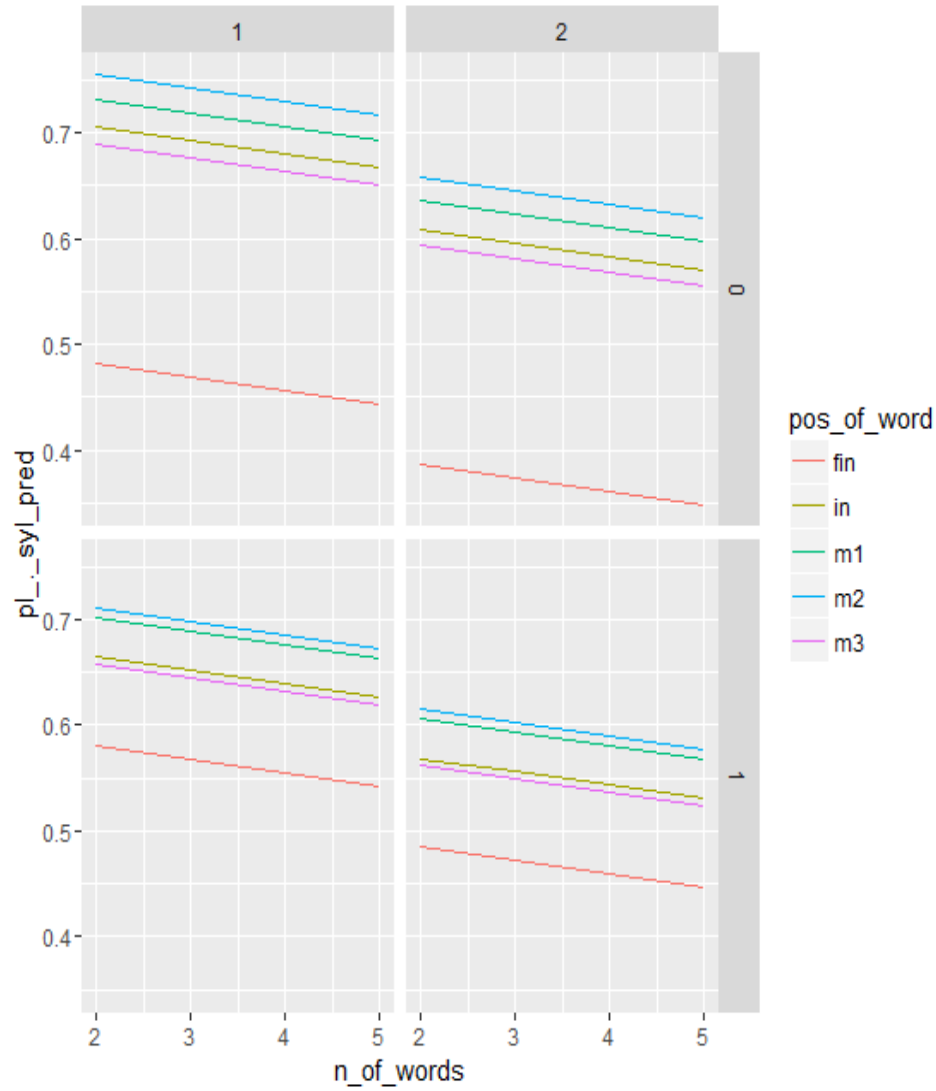


Figure 17: F0 peak location as a percentage into the stressed syllable in contrastive focus declaratives. Syllable structure (along the top): (1) = CV, (2) = CVC. Focus (on the right): (0) = non-focused words, (1) = focused words.

4.2.2.4 Percentage of All Declaratives Taken Together

The previous sections have examined F0 peak location as a percentage into the stressed syllable within each type of declarative. In this section, I report the results of F0 peak location as a percentage into the stressed syllable for all the three types pulled together.

The main objective here is to examine whether there is a significant difference in where the F0 peak is realized depending on the type of focus, i.e. broad vs. narrow vs. contrastive. Thus, a new variable ‘focus type’ was included. This new variable had five levels: broad focus (b), narrow focused (nf), narrow non-focused (nnf), contrastive focused (cf), and contrastive non-focused (cnf). For the sake of clarity, the label ‘narrow/contrastive non-focused’ refer to words in narrow and contrastive focus declaratives that do not bear focus. Non-final position and final position were analyzed separately. This was due to the fact that, as shown in §4.2.2.1, §4.2.2.2, and §4.2.2.3, while there is a significant difference between non-final vs. final positions, no differences were found among non-final positions across the three types of declaratives. In the analysis, I first examine all F0 peaks located in non-final position, and then those F0 peaks located in final position. Figure 18 below shows a boxplot with the F0 peak location as a percentage into the stressed syllable (y-axis) in non-final positions across focus types (x-axis). An initial examination of this plot suggests that, in non-final positions, broad focus words have a higher percentage than any other focus type. This indicates that in non-final positions, F0 peak in broad focus words are located later in the stressed syllable than in any other focus type.

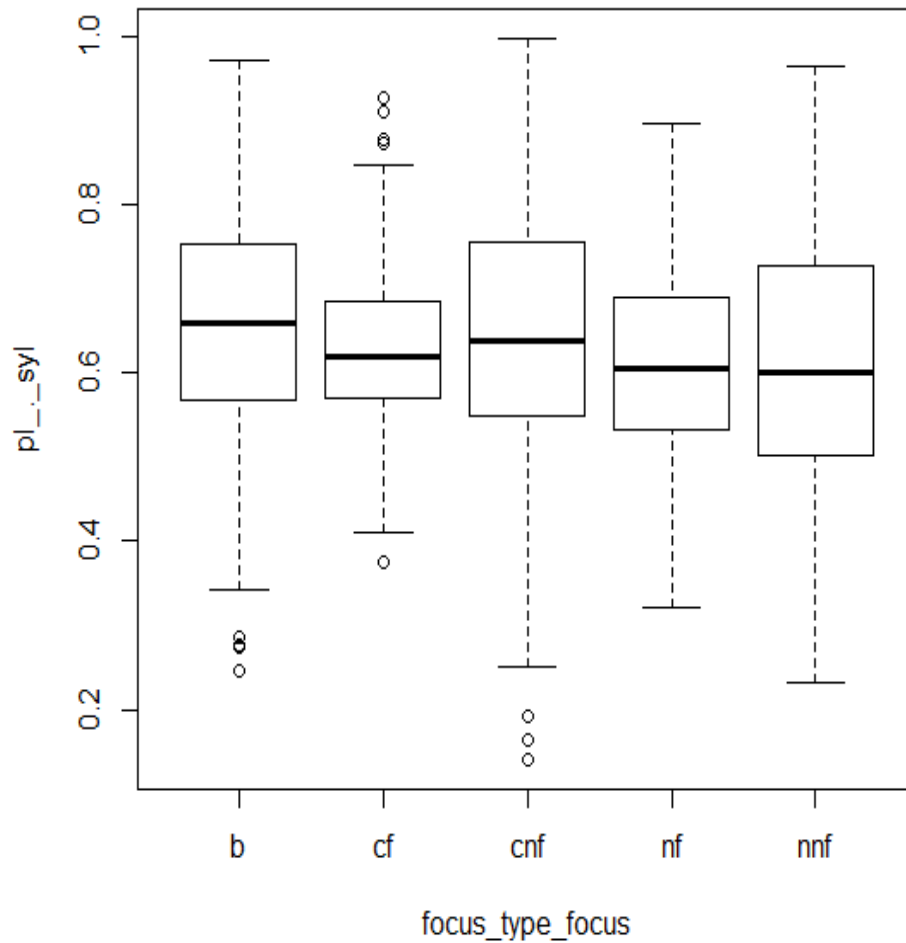


Figure 18: Boxplot showing the distribution of F0 peak location as a percentage into the stressed syllable for all focus types in non-final position. Focus type: b = broad focus, cf = contrastive focused, cnf = contrastive non-focused, nf = narrow focused, and nnf = narrow non-focused.

For the statistical analysis, I created a series of linear mixed-effects models in R, with F0 peak location as a percentage into the syllable as the dependent variable, and speaker as a random effect. The independent variables were number of words (2-, 3-, 4-,

and 5-), syllable structure (CV and CVC), and focus type. Two two-way interactions included in the analysis were: number of words and focus type, and syllable structure and focus type. As with previous analyses in this chapter, I started with a complex model (i.e. three fixed factors and two two-way interactions), and an ANOVA helped me obtain the best fit model by examining the significance level of each factor and interaction. Non-significant two-way interactions were excluded first, followed by non-significant fixed factors.

The best fit model for those F0 peaks in non-final position ($N = 1,182$) resulted in two significant fixed factors: syllable structure $F(1, 1164) = 157.50, p < 0.001$, and focus type $F(4, 1165) = 6.18, p < 0.001$. Figure 19 below illustrates the directions of these effects. I must note here that although number of words was not a significant factor, I keep it in the figure for comparative purposes. Overall, results show that F0 peak location as a percentage into the syllable is higher in CV syllables than in CVC syllables. This result confirms early findings from the analysis of each type of declarative (§4.2.2.1, §4.2.2.2, §4.2.2.3). Tukey's post-hoc means comparisons for focus type indicate differences only between broad focus and narrow focus ($p = 0.005$), and broad focus and contrastive focus ($p = 0.021$). No difference between narrow and contrastive focus ($p = 0.875$) was found. Thus, in the non-final position data, F0 peak location decreases in the following trend: broad focus words > contrastive focused words > narrow focused words, but the difference between contrastive and narrow focused words does not reach significance level.

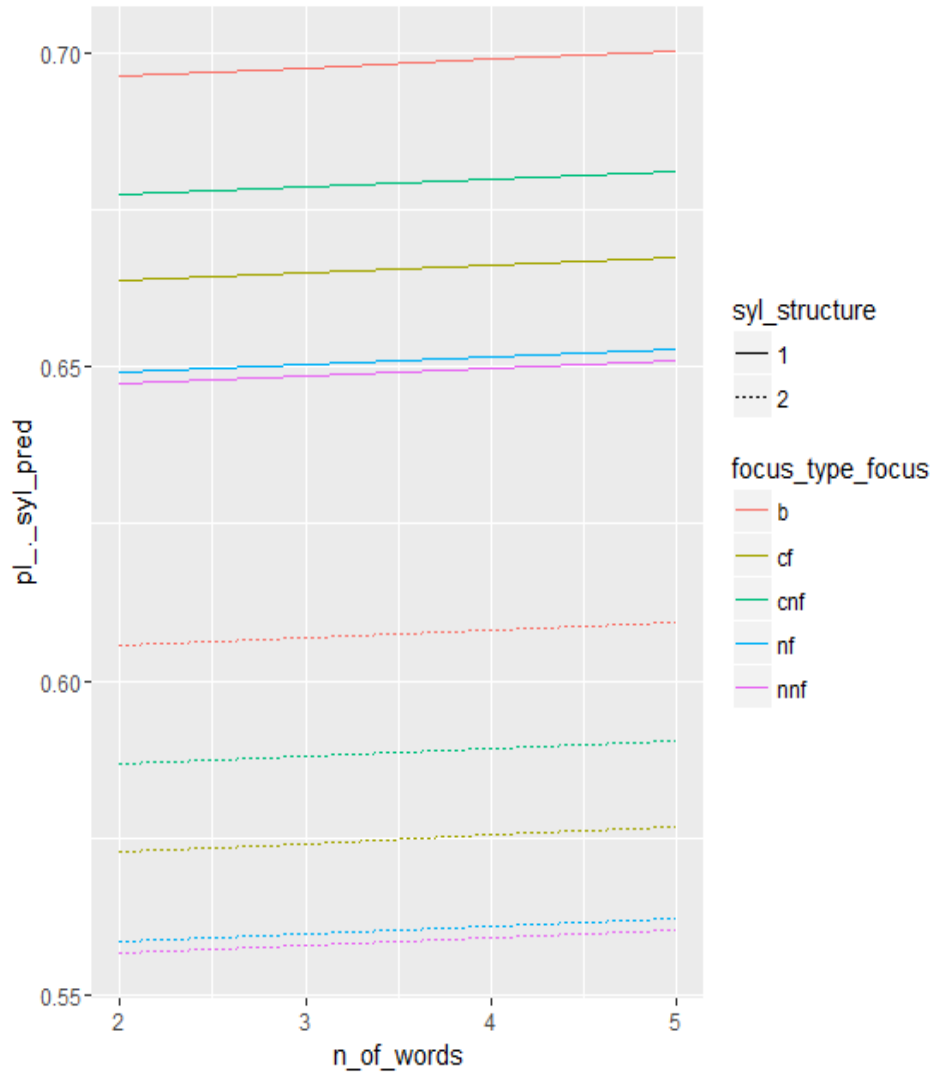


Figure 19: F0 peak location as a percentage into the stressed syllable for all declaratives taken together in non-final position. Syllable structure: CV (1) = solid lines, CVC (2) = dotted lines. Focus type: b = broad focus, cf = contrastive focused, cnf = contrastive non-focused, nf = narrow focused, and nnf = narrow non-focused.

A similar analysis was carried for those F0 peaks located in final position (N = 541). Figure 20 below shows a boxplot with the distribution of F0 peak location as a percentage into the stressed syllable (y-axis) across focus types (x-axis). Unlike the non-final position results, F0 peaks in contrastive focused words in final position have a

higher percentage than the other focus types, which indicates that F0 peaks in contrastive focused words are realized later than in narrow focused and broad focus words.

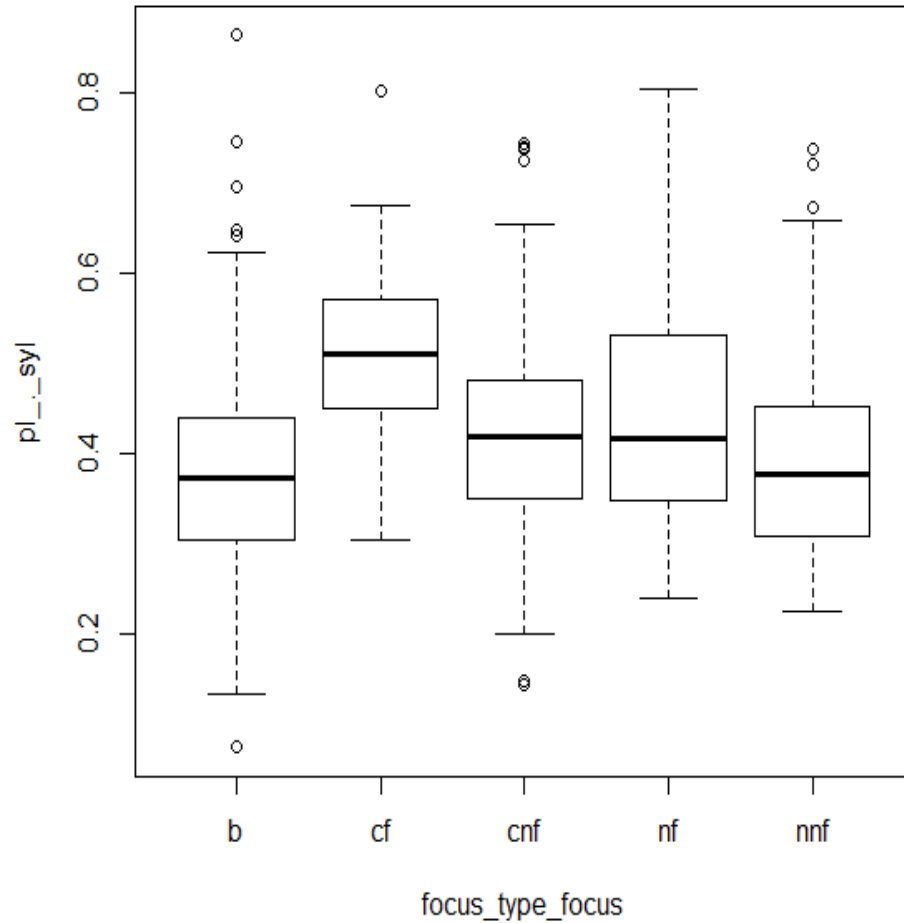


Figure 20: Boxplot showing the distribution of F0 peak location as a percentage into the stressed syllable for all focus types in final position. Focus type: b = broad focus, cf = contrastive focused, cnf = contrastive non-focused, nf = narrow focused, and nnf = narrow non-focused.

The best fit model for those F0 peaks in final position included all three fixed factors: number of words $F(1, 524) = 7.01, p = 0.008$, syllable structure $F(1, 523) = 117.46, p < 0.001$, and focus type $F(4, 524) = 25.24, p < 0.001$. Figure 21 below shows the direction of these effects. Results indicate that as the number of words increases, percentage of F0 peak location decreases. Namely, in final position, F0 peaks are realized much earlier in the syllable with more words added to the sentence. Second, percentage of F0 peak location is higher in CV than in CVC, which indicate that F0 peaks occur later in the syllable in CV than in CVC syllables. Post-hoc means of comparisons of focus type using the Tukey HSD test show differences between broad and narrow focused words ($p = 0.009$), broad and contrastive focused words ($p < 0.001$), and narrow and contrastive focused words ($p = 0.007$). In final position, F0 peak location as a percentage into the syllable is significantly different among the three different focus types, and follows this trend: contrastive focused words > narrow focused words > broad focus words.

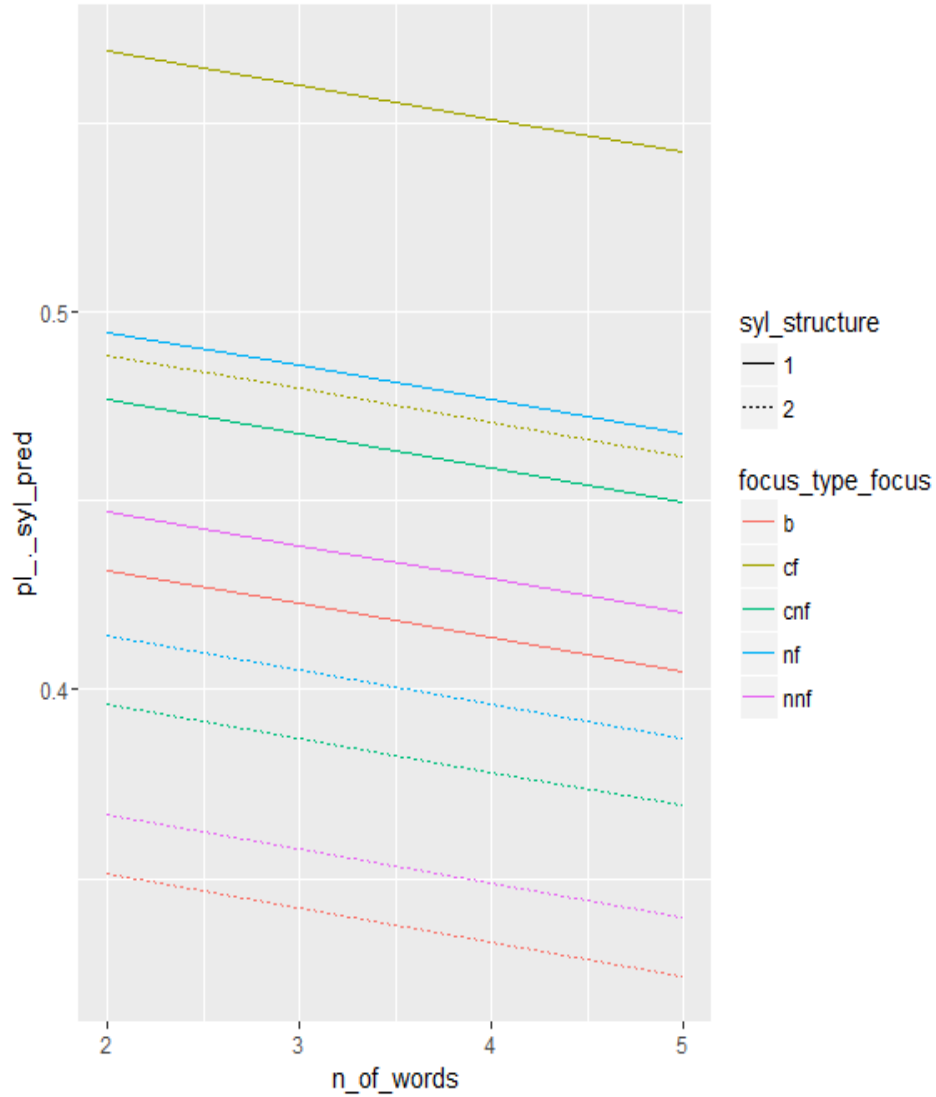


Figure 21: F0 peak location as a percentage into the stressed syllable for all declaratives taken together in final position. Syllable structure: CV (1) = solid lines, CVC (2) = dotted lines. Focus type: b = broad focus, cf = contrastive focused, cnf = contrastive non-focused, nf = narrow focused, and nnf = narrow non-focused.

4.2.2.5 Summary of F0 Peak Location as a Percentage into the Syllable

The previous sections (§4.2.2.1, §4.2.2.2, §4.2.2.3) have presented the results of F0 peak location as a continuous variable across the three types of declaratives. The two

significant factors for all declaratives are: syllable structure and position of the word. Regarding syllable structure, F0 peaks in CVC syllables are realized earlier (at a lower percent into the stressed syllable) than in CV syllables. In other words, even when the presence of a coda increases the length of the syllable (as seen in §4.1.1), F0 peaks seem to be pushed earlier, which may indicate that F0 peaks aim to be realized within the vowel. Second, F0 peaks in final position are reached earlier than those in non-final positions. This is expected since, across Spanish declaratives, F0 peaks in nuclear position tend to occur much earlier than in prenuclear positions (Hualde 2002). Crucially, in PAS, in all prenuclear positions F0 peaks are reached at a comparable distance within the stressed syllable.

Contrastive focus declaratives behave slightly different from narrow focus declaratives. In the contrastive focus group, number of words is a significant factor as sentences with 2- words show a later F0 peak into the syllable than sentences with 5- words. Additionally, there is a significant interaction between position of the word and focus in contrastive focus declaratives. In final position, F0 peaks are realized later in focused words than in non-focused words. However, in non-final position, F0 peaks are realized earlier in focused words than in non-focused words. In order to explain this F0 behavior in contrastive focus declaratives, recall that in broad focus declaratives F0 peaks in final position are realized early in the stressed syllable. Taken these two findings together, they suggest that F0 peaks in contrastive focused words mark focus by delaying its F0 peak realization late in the syllable. In fact, realizing the F0 peak much earlier than in broad focus nuclear accents may push the F0 peak before the onset of the stressed

syllable. As will be argued in Chapter 5, this F0 behavior seems to be unwanted, hence the late F0 peak location in utterance-final contrastive focused words. Overall, F0 peak location in relation to the stressed syllable as a percentage shows similarities across the three types of declaratives in terms of syllable structure and position of the word. In contrastive focus declaratives, however, F0 peaks behave differently than in broad and narrow focus declaratives, particularly in final position.

4.2.3 Location of the F0 Peak as a Percentage into the Stressed Vowel

The previous section (§4.2.2) has provided an examination of F0 peak location as a percentage into the stressed syllable. In this section, I present the results of F0 peak location as a percentage into the vowel across the three types of declaratives. More specifically, I address the question of whether or not there is a particular point within the vowel at which the F0 peak is realized. In order to do so, I only include those F0 peaks that occur within the vowel ($N = 1,490$). Among the total number of F0 peak tokens occurring within the stressed syllable ($N = 1,723$), those F0 peaks that are realized within the vowel constitute over 86% of the data.

Similar to the statistical analysis followed in §4.2.2, I created a series of linear mixed-effects models in R, with F0 peak location as a percentage into the vowel as the dependent variable, and speaker as random effect. The fixed factors as well as the two-way interactions for each type of declarative were the same as the ones included in the analysis of F0 peak location as a percentage into the syllable, detailed in §4.2.2. I started with a complex model, and each model was evaluated with an ANOVA in order to obtain

the significance value for each factor and interaction. Based on these ANOVAs, I arrived at the best fit model for each type of focus by excluding non-significant two-way interactions first, followed by non-significant fixed factors. In the next subsections, I present the results for broad, narrow, and contrastive focus declaratives.

4.2.3.1 Broad Focus Declaratives

The best fit model for the broad focus group ($N = 489$) yielded syllable structure $F(1, 471) = 4, p = 0.046$, and position of the word $F(4, 470) = 57.86, p < 0.001$, as significant factors as well as the two-way interaction between syllable structure and position of the word $F(4, 468) = 2.88, p = 0.023$. Figure 22 below illustrates the direction of these effects. Results show that the percentage into the vowel is higher in CVC syllables than in CV syllables only in initial, M1 and M3 positions. In those positions, F0 peaks in CVC syllables are realized later in the vowel than in CV syllables. In M2 and final position, the percentage into the vowel is similar across the two syllable types. Tukey's post-hoc means comparisons for position of the word indicate that percentage into the stressed vowel in final position is lower than in all non-final positions. In other words, F0 peaks in final position are realized earlier in the vowel than in non-final position. No significant differences were found among non-final positions. With respect to the two-way interaction, only in M2 and final position, F0 peaks in CVC syllables are realized earlier in the vowel than in CV syllables. However, these differences do not reach significance.

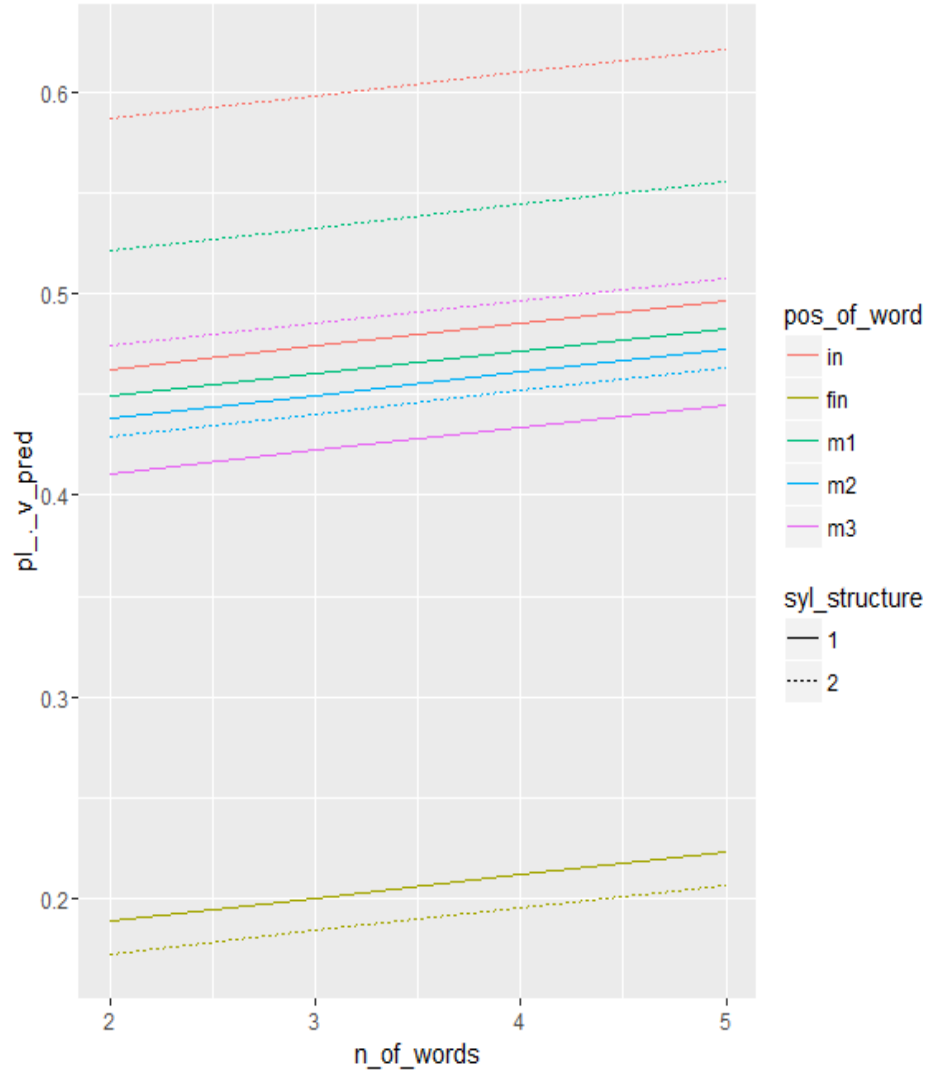


Figure 22: F0 peak location as a percentage into the stressed vowel in broad focus declaratives. Syllable structure: CV (1) = solid lines, CVC (2) = dotted lines.

4.2.3.2 Narrow Focus Declaratives

For the narrow focus group ($N = 311$), the best fit model included the following significant factors: syllable structure $F(1, 296) = 4.65, p = 0.032$, position of the word $F(4, 293) = 23.38, p < 0.001$, and the two-way interaction syllable structure and focus $F(1, 292) = 4.01, p = 0.046$. Figure 23 below shows the direction of these effects.

Overall, in non-focused words, F0 peak location as a percentage into the vowel in CVC and CV is comparable. However, when syllable structure interacts with focus, the percentage into the vowel in CV focused syllables is lower than in CVC focused syllables. That is, in CV focused syllables, F0 peak is realized earlier in the vowel than in CVC focused syllables. Moreover, Tukey's post-hoc means comparisons show that F0 peaks as a percentage into the vowel are reached earlier in final position than in non-final positions. No difference in F0 peak location as a percentage into the vowel was found among non-final positions.

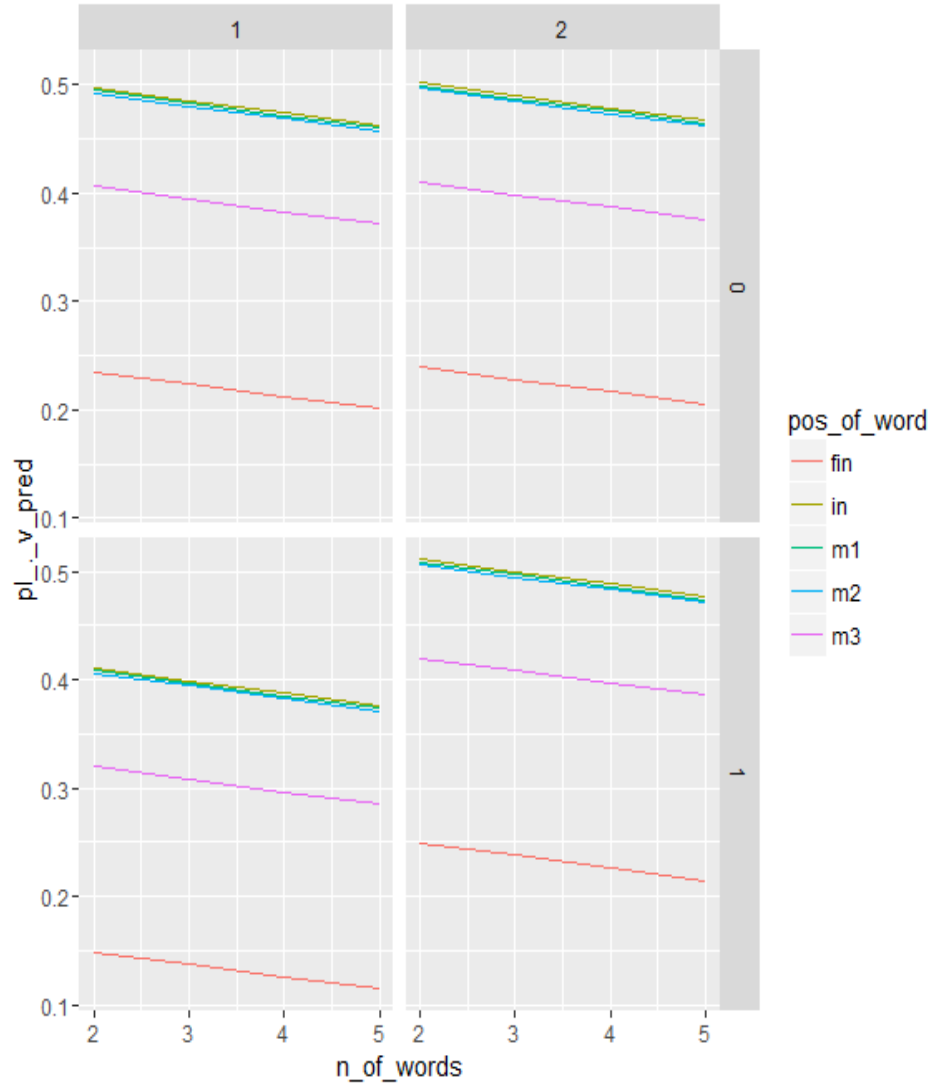


Figure 23: F0 peak location as a percentage into the stressed vowel in narrow focus declaratives. Syllable structure (along the top): (1) = CV, (2) = CVC. Focus (on the right): (0) = non-focused words, (1) = focused words.

4.2.3.3 Contrastive Focus Declaratives

For the contrastive focus group (N = 690), the best fit model included the following significant factors and interactions: number of words $F(1, 672) = 11.68, p < 0.001$, syllable structure $F(1, 671) = 18.18, p < 0.001$, position of the word $F(4, 668) = 32.41, p$

< 0.001 , and the two-way interaction position of the word and focus $F(4, 669) = 3.08, p = 0.016$. Figure 24 below illustrates the direction of these effects. Results show that as the number of words in a sentence increases, the F0 peak as a percentage into the vowel decreases. That is, F0 peaks are realized earlier in the vowel as sentences increase in length. Also, percentage in CVC syllables is higher than in CV syllables, which indicates that F0 peaks in CVC syllables are realized later into the vowel than in CV syllables. Post-hoc means comparisons of position of the word using the Tukey HSD test indicate that the percentage is lower in final position than in all non-final positions. No significant difference was found among all non-final positions, except between initial and M1 position.

With regard to the interaction between position of the word and focus, in final position, F0 peaks in focused words have higher percentage into the vowel than non-focused words. These results indicate that, in contrastive focused words located in final position, F0 peaks are realized later in the stressed vowel than in contrastive non-focused words. Additionally, in non-final position, focused words have lower percentage than non-focused words. That is, in non-final position, F0 peaks in contrastive focused words are realized earlier in the stressed vowel than in contrastive non-focused words.

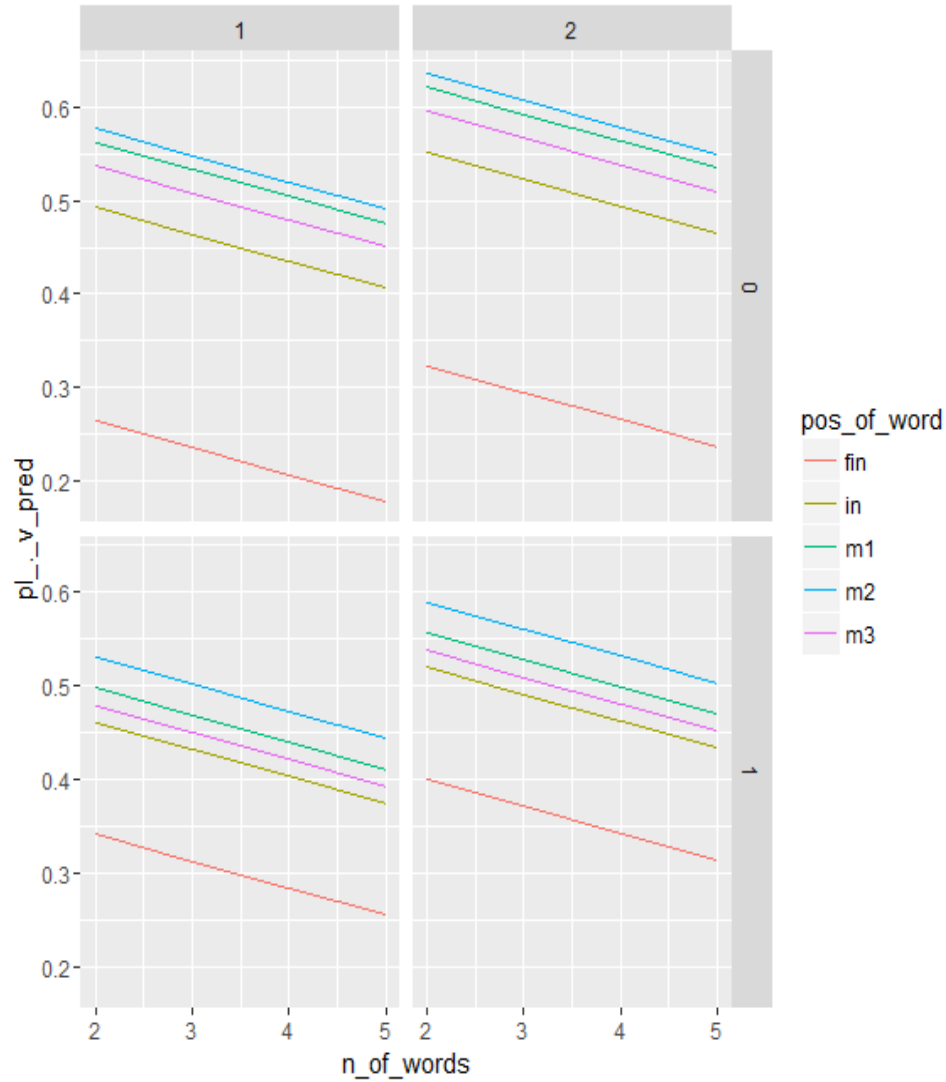


Figure 24: F0 peak location as a percentage into the stressed vowel in contrastive focus declaratives. Syllable structure (along the top): (1) = CV, (2) = CVC. Focus (on the right): (0) = non-focused words, (1) = focused words.

4.2.3.4 Percentage of All Declaratives Taken Together

The previous sections have examined F0 peak location as a percentage into the vowel for each declarative separately. In this section, I expand on this examination by comparing the three types of declaratives altogether: broad, narrow, and contrastive focus. For the

sake of consistency, I follow the same statistical procedure employed in the analysis of F0 peak location as a percentage into the syllable (§4.2.2.4). The only difference is that in the present analysis the dependent variable is F0 peak location as percentage into the vowel. The main goal here is to examine whether or not there is any consistency in the location of F0 peaks with respect to the stressed vowel across focus types. In order to do so, I only examine those F0 peaks that occur within the stressed vowel (N = 1,490). I first present data for those F0 peaks located in non-final positions, followed by those located in final position.

Figure 25 below shows a boxplot with the distribution of F0 peaks as a percentage into the stressed vowel (y-axis) across focus types (x-axis) in non-final positions. An examination of these results suggests that, in broad focus words, F0 peaks are located at a later position when compared to other focus types given that it shows a higher percentage. Similar results were found in the analysis of F0 peak location as a percentage into the syllable (§4.2.2.4).

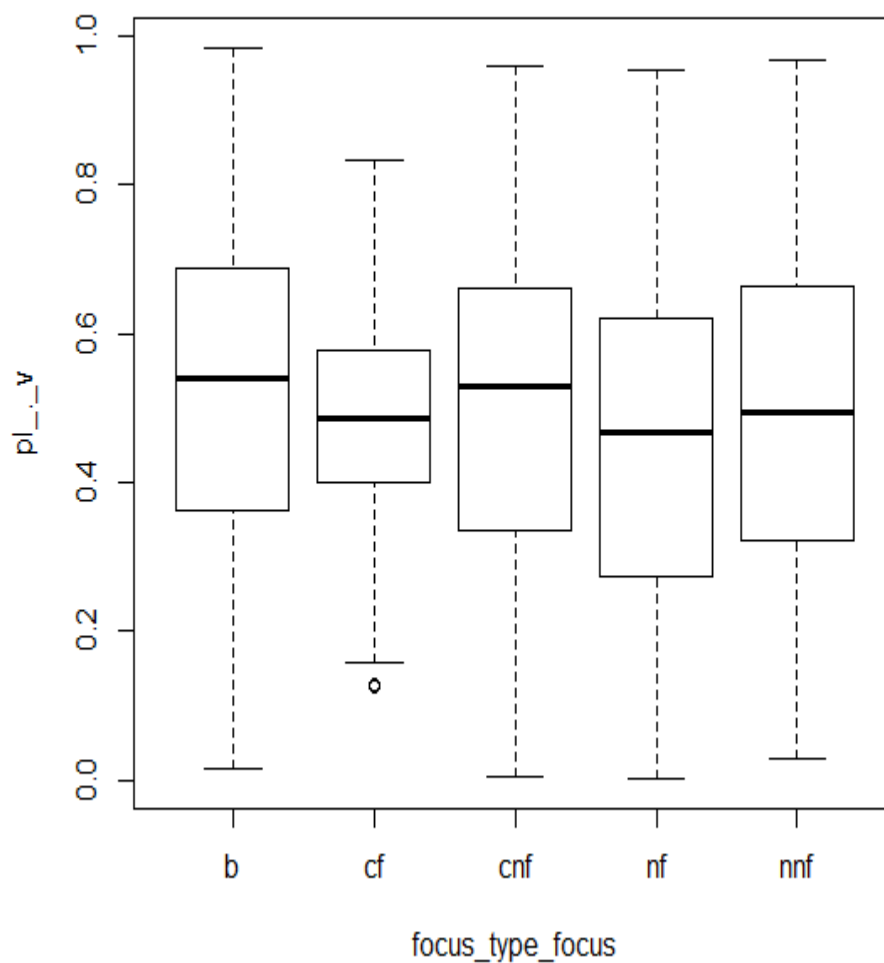


Figure 25: Boxplot showing the distribution of F0 peak location as a percentage into the stressed vowel for all focus types in non-final position. Focus type: b = broad focus, cf = contrastive focused, cnf = contrastive non-focused, nf = narrow focused, and nnf = narrow non-focused.

For those F0 peaks located in non-final positions ($N = 1,182$), the best fit model only included syllable structure as a significant factor: $F(1, 1073) = 38.22, p < 0.001$.

Neither number of words nor focus type were significant factors. Figure 26 below

illustrates this pattern. Results show that percentage into the vowel is higher in CVC syllables than in CV syllables, which indicates that across focus types F0 peaks are realized later in the vowel in CVC syllables than in CV syllables. Post-hoc means comparisons of focus type using the Tukey HSD test indicate that there is not a significant difference between all focus types. Nonetheless, it is important to note that F0 peak location as a percentage into the vowel follows the trend: broad focus words > contrastive focused words > narrow focused words.

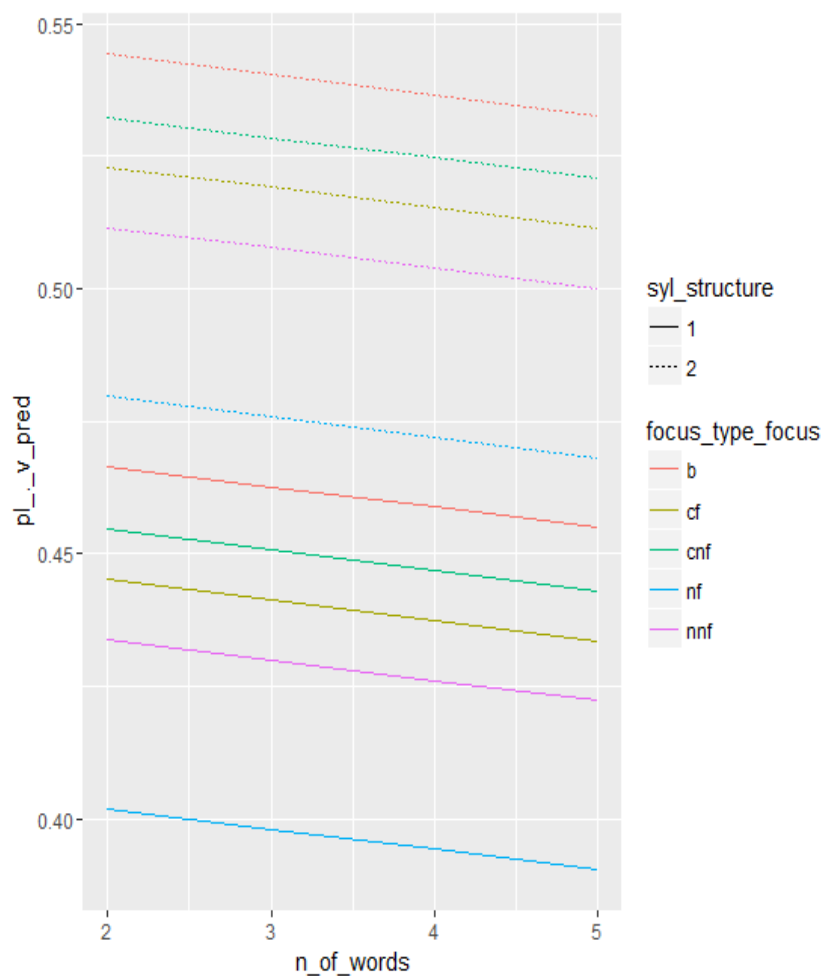


Figure 26: F0 peak location as a percentage into the stressed vowel for all declaratives taken together in non-final position. Syllable structure: CV (1) = solid lines, CVC = (2) dotted lines. Focus type: b = broad focus, cf = contrastive focused, cnf = contrastive non-focused, nf = narrow focused, and nnf = narrow non-focused.

Figure 27 below presents a boxplot with the distribution of F0 peak location as a percentage into the stressed vowel (y-axis) across focus types (x-axis), in final position. We can observe here that F0 peaks in broad focus words are realized earlier than any other focus type given their low percentage. However, F0 peaks in contrastive focused words are realized much later in the vowel than any other focus type.

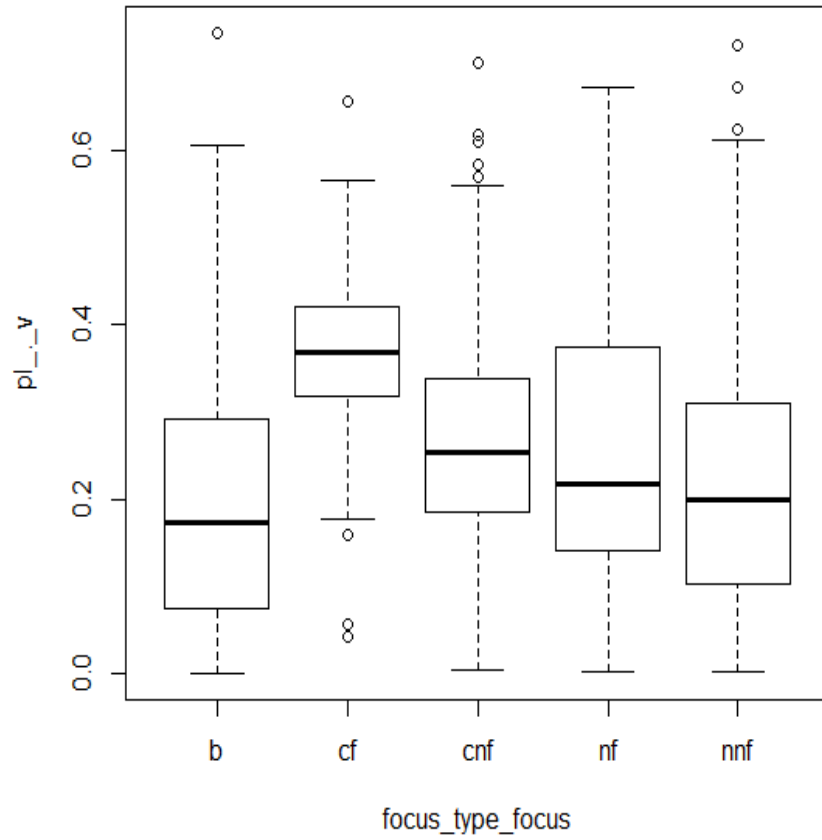


Figure 27: Boxplot showing the distribution of F0 peak location as a percentage into the stressed vowel for all focus types in final position. Focus type: b = broad focus, cf = contrastive focused, cnf = contrastive non-focused, nf = narrow focused, and nnf = narrow non-focused.

For the final position group ($N = 399$), the best fit model included the following two fixed factors: number of words $F(1, 383) = 22.02, p < 0.001$, and focus type, $F(4, 383) = 17.15, p < 0.001$. Syllable structure was not a significant factor. Figure 28 below illustrates the direction of these effects. Similar to the analysis of the F0 peak location as a percentage into the syllable, as the number of words in a sentence increases, percentage

into the vowel decreases. Specifically, F0 peaks are realized earlier in the vowel in long sentences than in short sentences. Post-hoc means comparisons of focus type using Tukey HSD tests indicate the following differences among focus type: broad and contrastive focused words ($p < 0.001$), narrow and contrastive focused words ($p = 0.003$). No significant differences were found between broad and narrow focused words ($p = 0.347$). Overall, in final-position, F0 peak location as a percentage into the vowel follows this trend: contrastive focused words > narrow focused words > broad focus words, but the difference between narrow focused words and broad focus words does not reach statistical significance.

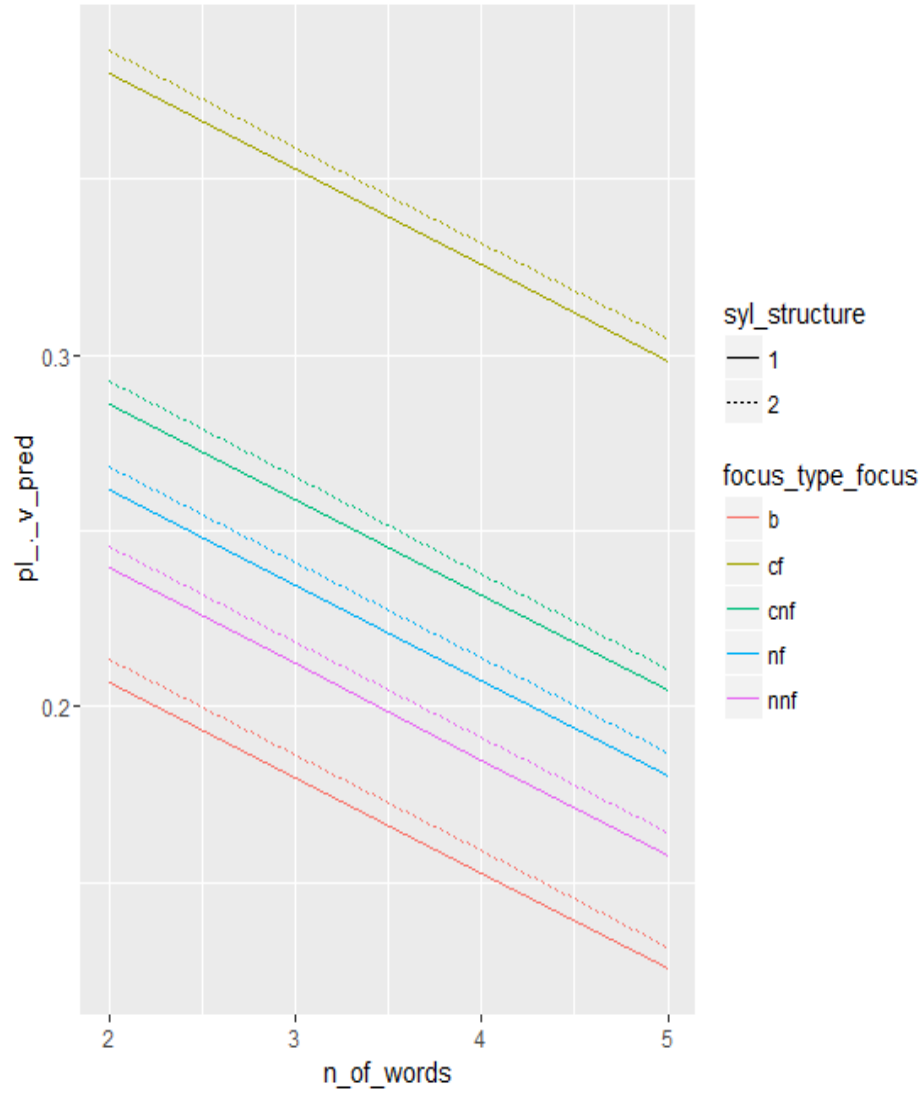


Figure 28: F0 peak location as a percentage into the stressed vowel for all declaratives taken together in final position. Syllable structure: CV (1) = solid lines, CVC (2) = dotted lines. Focus type: b = broad focus, cf = contrastive focused, cnf = contrastive non-focused, nf = narrow focused, and nnf = narrow non-focused.

4.2.3.5 Summary of F0 Peak Location as a Percentage into the Vowel

Across the three types of declaratives, syllable structure and position of the word are significant factors that affect the F0 peak location as a percentage into the stressed vowel.

In broad focus declaratives, significant effects of syllable structure are found only in three sentential position (i.e. initial, M1, M3)—that is, later F0 peaks into the stressed vowel in CVC than in CV syllables. In M2 and final position, no significant differences are reported. In narrow focus declaratives, effects of syllable structure are only found in focused words, with early F0 peaks into the vowel in focused words with CV syllables. In non-focused words, F0 peaks are realized at a comparable location into the vowel across the two different syllable types. Lastly, in contrastive focus declaratives, F0 peaks in the vowels of CVC syllables are realized later than those in CV syllables' vowels. Across the three types of declaratives, in final position, F0 peaks were realized earlier into the vowel than those F0 peaks located in non-final positions. This finding is comparable to what occurs when F0 peaks are examined as a percentage into the syllable.

In the contrastive focus group, there is a two-way interaction between position of the word and focus. Namely, in final position, F0 peaks in contrastive focused words are realized later into the vowel than in non-focused words. On the other hand, in non-final positions, F0 peaks in contrastive focused words are realized earlier into the vowel than those in non-focused words. This is the same pattern that emerged in the examination of F0 peak location as a percentage into the stressed syllable for contrastive focus declaratives.

Finally, when compared all focus types together in non-final positions, no significant differences among focus types are reported. However, in final position, differences emerge between broad focus and contrastive focused words, and between

narrow focused and contrastive focused words. No significant differences are reported between broad focus and narrow focused words.

4.2.4 Summary of Tonal Alignment

In this section, I provide a summary of the findings on PAS tonal alignment. Tonal alignment was first examined as a categorical variable. Overall, among all F0 peaks included in the analysis (N = 1,756), in over 98% of the cases across broad, narrow, and contrastive focus declaratives, F0 peaks are realized within the stressed syllable. In narrow and contrastive focused words, F0 peaks occur categorically within the stressed syllable. In addition, among those F0 peaks that occur within the stressed syllable (N = 1,723), over 81% of them occur within the vowel. If F0 peaks occur in the onset, they are mostly likely located in sentence final position.

Tonal alignment was also examined as a percentage into the stressed syllable and stressed vowel (as a continuous variable). With respect to percentage into the stressed syllables, syllable structure and position of the word are significant factors across all declaratives. Specifically, F0 peaks are realized earlier in CVC syllables than in CV syllables. With regard to position of the word, in final position, F0 peaks are realized earlier than those in non-final positions. Among non-final positions, F0 peaks do not show a significant difference in their location.

There is however a difference between narrow and contrastive focus declaratives. In the latter, number of words is a significant factor. Namely, as number of words in a sentence increases, F0 peaks are realized earlier in the stressed syllable. Additionally, in

final position, F0 peaks in contrastive focused words are realized later than in contrastive non-focused words. Conversely, in non-final positions, F0 peaks in contrastive focused words are realized earlier than in non-focused words.

When examining F0 peak location as a percentage into the stressed syllable across all three declaratives, the following patterns emerged. In non-final positions, F0 peaks in CVC syllables are realized earlier than in CV syllables. Furthermore, F0 peaks in broad focus words are reached later in the syllable than those F0 peaks in narrow or contrastive focused words. F0 peaks in narrow and contrastive focused words occur at a comparable location.

In final position, F0 peaks in CVC syllables are also realized earlier than in CV syllables. Moreover, F0 peaks in narrow and contrastive focused words are realized later than those in broad focus words. Yet, F0 peaks in contrastive focused words are realized later in the stressed syllable than in narrow focused words. Only in final position, F0 peak location among the three focus types is significantly different.

Regarding F0 peak location as a percentage into the stressed vowel, syllable structure and position of the word are two significant factors. Syllable structure has only an effect in certain sentential positions in broad focus declaratives; in narrow focused words; and in contrastive focus declaratives. In those particular cases, F0 peaks are realized later in the stressed vowel of CVC syllables than in CV syllables. In final position, F0 peaks are realized earlier into the vowel than in all non-final positions. No difference among non-final positions were found, except in contrastive focus declaratives. In contrastive focused words, F0 peaks in final position are realized later

into the vowel than in non-focused words. In non-final position, F0 peaks in contrastive focused words are realized earlier into the vowel than in non-focused words.

When examining F0 peak location as a percentage into the stressed vowel in non-final positions, we find no significant differences across all types of declaratives. F0 peaks are realized at a comparable location. Moreover, F0 peaks are realized later into the vowel in CVC syllables than in CV syllables. In final position, however, no significant differences were found with respect to F0 peak location across syllable types. Lastly, F0 peaks realized later in contrastive focused words than in both broad and narrow focused words. Finally, no differences are found between broad and narrow focused words.

4.3 Rise Time

The two previous sections (§4.1 and §4.2) in this chapter have outlined two main findings in PAS: (1) stressed syllable and stressed vowel duration vary as the number of words in a sentence changes, and (2) F0 peaks align consistently within the stressed syllable, and for most of the cases, F0 peaks are realized within the stressed vowel. In this section, I explore F0 rise time across the three types of declaratives.

As detailed in Chapter 3 (§3.5.2.1), F0 rise time refers to the temporal distance between the F0 minima and the F0 maxima in a pitch accent. The main goal in this section is to explore the correlation between F0 rise time and the duration of the stressed syllable and the stressed vowel. In order to do so, several Pearson correlation analyses were performed. If there is indeed a positive correlation between F0 rise time and duration, it would suggest that F0 rise time is not constant. If, on the other hand, there is a

negative correlation between F0 rise time and duration, then this would suggest that the F0 rise time is not constant, but rather as F0 rise time decreases, duration increases. Either a positive or negative correlation is evidence against a fixed rise time. If no correlation is present between F0 rise time and duration, this would indicate that F0 rise time is constant, regardless of syllable and vowel length. It is important to recall here that the non-Segmental Anchoring Hypothesis predicts that the F0 rise time is temporally fixed. Therefore, a positive correlation between F0 rise time and duration may indeed provide supporting evidence for the Segmental Anchoring Hypothesis.

I performed a series of Pearson correlations between F0 rise time and duration for each type of declarative. Separate correlation analyses were run for stressed syllables and stressed vowels. Additionally, I performed separate correlation analyses for F0 peaks located in non-final positions and final position. The reason for this is that previous findings in the present dissertation have suggested significant differences between non-final and final positions, but not among non-final positions (i.e. initial, M1, M2 and M3). For cases of narrow and contrastive focus declaratives, I performed separate analyses for F0 peaks in focused and non-focused words. In the following subsections, I present results for broad focus, narrow focus, and contrastive focus declaratives. For each type of sentence, I report the results for both stressed syllables and stressed vowels, in non-final position, and in final position.

4.3.1 Broad Focus Declaratives

In this subsection, I present the results of Pearson correlations in broad focus declaratives. Let us begin with stressed syllables in non-final positions. There is a positive correlation between F0 rise time and syllable duration in non-final position, $r(413) = 0.25, p < 0.001$. In final positions, there is also a positive correlation, $r(188) = 0.35, p < 0.001$. Similarly, and with respect to stressed vowels in non-final position, there is a positive correlation between F0 rise time and vowel duration, $r(370) = 0.26, p < 0.001$. A positive correlation is also found in final position, $r(113) = 0.21, p = 0.026$. Overall, in PAS broad focus declaratives, a positive correlation between F0 rise time and syllable and vowel duration was found, which indicates that rise time is not fixed. Table 28 below summarizes these results. The significant correlations between F0 rise time and duration are marked with an asterisk.

			<i>r</i>	df	<i>p</i>
Broad Focus	Syllable	Non-final	0.25	413	< 0.001 *
		Final	0.35	188	< 0.001 *
	Vowel	Non-final	0.26	370	< 0.001 *
		Final	0.21	113	0.026 *

Table 28: Results of Pearson correlations between rise time and duration in broad focus declaratives.

4.3.2 Narrow Focus Declaratives

In the narrow focus group, the data was divided between non-focused and focused words. I also distinguished between stressed syllables and stressed vowels, in non-final and in final position. Table 29 below shows the results of Pearson correlations in the narrow

focus data. We can observe various positive correlations across the data, with strong correlations in narrow focused words. Overall, duration of syllable and vowels in focused words have stronger positive correlations with F0 rise time than in non-focused words.

			<i>r</i>	df	<i>p</i>
Non-focused words	Syllable	Non-final	0.09	132	0.309
		Final	0.31	94	0.002 *
	Vowel	Non-final	0.10	121	0.257
		Final	0.21	71	0.075
Focused words	Syllable	Non-final	0.28	97	0.005 *
		Final	0.58	20	0.004 *
	Vowel	Non-final	0.29	93	0.004 *
		Final	0.34	18	0.141

Table 29: Results of Pearson correlations between rise time and duration in narrow focus declaratives.

4.3.3 Contrastive Focus Declaratives

A similar analysis was performed for contrastive focus declaratives. Table 30 below shows the results of Pearson correlations. Significant positive correlations were found between F0 rise time and syllable and vowel duration, both in non-final and final positions. It is important to note that the coefficients tend to be stronger for contrastive focused words as opposed to non-focused words.

			<i>r</i>	<i>df</i>	<i>p</i>
Non-focused words	Syllable	Non-final	0.28	343	< 0.001 *
		Final	0.48	181	< 0.001 *
	Vowel	Non-final	0.25	312	< 0.001 *
		Final	0.45	144	< 0.001 *
Focused words	Syllable	Non-final	0.48	184	< 0.001 *
		Final	0.73	41	< 0.001 *
	Vowel	Non-final	0.39	183	< 0.001 *
		Final	0.40	41	0.008 *

Table 30: Results of Pearson correlations between rise time and duration in contrastive focus declaratives.

4.3.4 Summary

The preceding subsections have shown that overall there is a positive correlation between F0 rise time and duration across different types of declaratives. This correlation is significant in broad and contrastive focus declaratives (for syllables and vowels), but much less so in narrow focus declaratives. Perhaps this weak correlation is due to the small overall number of tokens in narrow focus declaratives. In narrow and contrastive focus declaratives, correlations tend to be stronger in focused words than in non-focused words. On the other hand, in narrow and contrastive non-focused words, correlations are stronger in final position than in non-final position.

Results from these correlations show that, in PAS declaratives, F0 rise time is not constant. Rather, it varies depending on the duration of stressed syllables and vowels. These positive correlations provide evidence against a fixed rise time, as predicted by the non-Segmental Anchoring Hypotheses. Generally, as duration increases, F0 peaks in PAS are realized later in the stressed syllable or the stressed vowel.

4.4 Tonal Height

As described earlier (§2.3.1), most research on the intonation of Spanish rising accents has considered F0 peak location as a determinant factor when distinguishing between pragmatic meanings (cf. Willis 2003). In Lima Spanish or Peninsular Spanish (and several other varieties), for example, broad focus declaratives are generally characterized by a F0 peak located after the stressed syllable (Beckman et al. 2002, O'Rourke 2005, García 2011). However, when marking a different type of focus, such as narrow or contrastive, the F0 peak tends to occur within the temporal boundaries of the stressed syllable.¹³ For varieties such as PAS, this distinction poses a challenge. As reported in the section on PAS tonal alignment (§4.2), F0 peaks occur within the stressed syllable across declaratives: broad, narrow, and contrastive. This means that these types of focus are not differentiated by whether the F0 peak falls within or after the stressed syllable like in other varieties.

Further quantitative analyses in the present dissertation (§4.2.3) have shown a distinction between the exact location of F0 peaks when examined as a percentage into the stressed syllable. More specifically, in non-final positions, F0 peaks in broad focus words are realized later than those in contrastive focused words, and F0 peaks in contrastive focused words much later than those in narrow focused words. However, the only significant difference emerges in F0 peak location between broad focus and contrastive focused words, and between broad focus and narrow focused words. F0 peaks

¹³ The location of F0 peak within the stressed is by no means the only focus strategy reported in the literature (see Face 2002 for a summary of several focus cues).

in narrow focused and contrastive focused words occur relatively at a similar location. The goal of this section is to explore tonal height in order to examine whether F0 peak height is another feature used to distinguish between these three types of declaratives, or rather if F0 peak location and tonal height work mutually to mark different focus distinctions. I must note here that the results about tonal height reported in this section correspond to the data of only 11 speakers. Data values from speakers PAS10 and PAS13 were disregarded because they produced their utterances at a higher pitch range than the other speakers. Therefore, in order to avoid skewed results, their utterances were not part of the analysis. In the following sections, F0 peak height is examined within each declarative group, and later I compare the three declaratives groups altogether.

4.4.1 Broad Focus Declaratives

In this subsection, I present the results of F0 peak tonal height (in Hz) in broad focus declaratives. Figure 29 below shows the distribution of F0 peak height across declaratives of 2-, 3-, 4-, and 5- words, located from left to right respectively. To illustrate, in a 2-word sentence, there is initial (in.2) and final position (fin.2), whereas in a 5-word sentence, there is initial (in.5), first medial (m1.5), second medial (m2.5), third medial (m3.5), and final position (fin.5). A perusal of the data suggests that the highest F0 peaks are found in initial position, across all types sentences. There is also a clear downward trend from initial to final position in F0 peak height within each sentence.

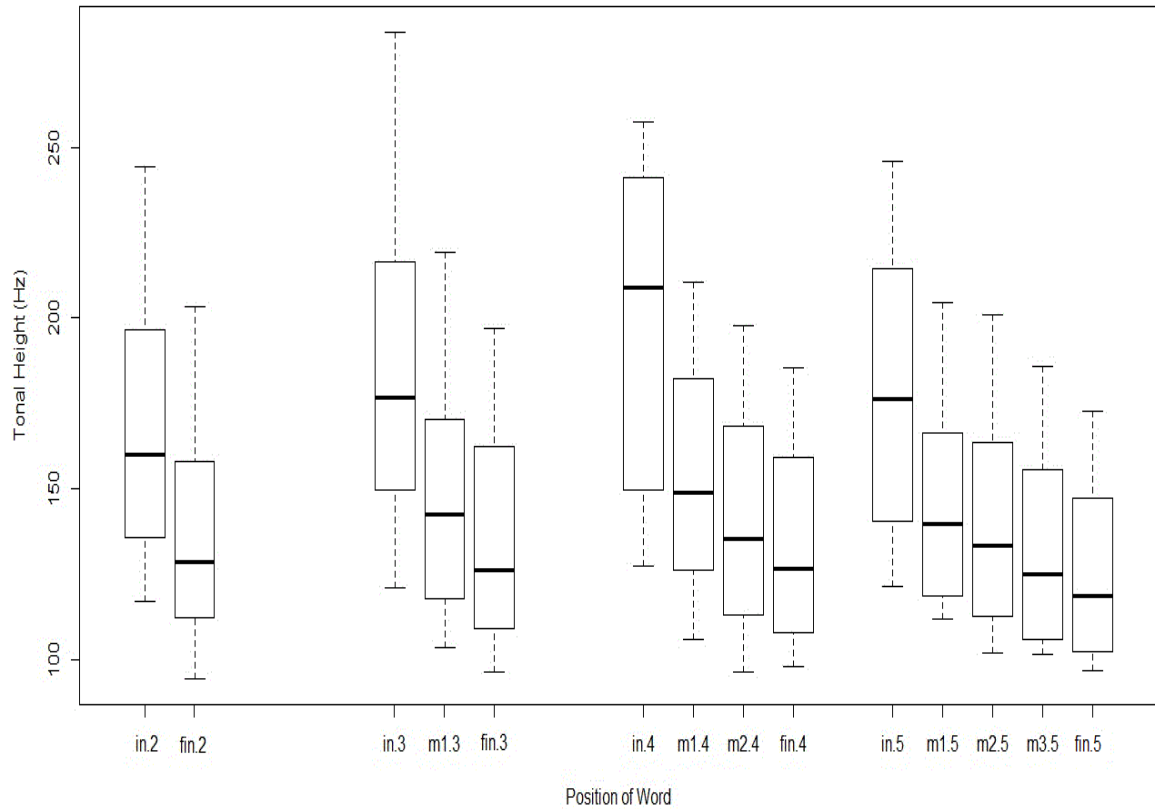


Figure 29: F0 peak tonal height distribution in all broad focus declaratives.

Table 31 below shows the means (SD in parentheses) of F0 peak height in the broad focus group by number of words in a sentence, and by position of the word within a sentence. A sentence with 2 words has only initial and final position, while a sentence with 5 words has initial, final, and three medial positions (i.e. M1, M2, and M3). In Table 31, we can observe that while there is an increase in F0 peak height in initial position as the number of the words in a sentence increases, F0 peak height in final position tend to remain constant, irrespective of the number of words in the sentence. We must note however that final F0 peaks in 5-words sentence are much lower than those in 2-, 3- or 4-word sentences.

	Initial	M1	M2	M3	Final
2-words	166 Hz (34.2)	--	--	--	135 Hz (28.9)
3-words	182 Hz (39.7)	149 Hz (31.1)	--	--	136 Hz (29.7)
4-words	198 Hz (44.1)	156 Hz (31.3)	144 Hz (29)	--	136 Hz (28.6)
5-words	181 Hz (43.2)	144 Hz (28)	139 Hz (28.5)	132 Hz (27.3)	124 Hz (26.7)

Table 31: Means of F0 peak height in broad focus declaratives.

In order to examine the effects of number of words and position of the word on F0 peak height, I created a series of linear mixed-effects models in R, with F0 peak height as the dependent variable, and speaker as a random effect. The best fit model includes number of words $F(3, 577) = 5.27, p = 0.001$, and position of the word $F(4, 577) = 368.16, p < 0.001$, as significant factors of F0 peak height. Tukey's post-hoc means of comparisons for number of words show that only 2-word sentences have significantly lower F0 peaks than both 4-word sentences ($p = 0.001$) and 5-word sentences ($p = 0.003$). Moreover, Tukey's post-hoc means of comparisons for position of the word resulted in the following differences: F0 peaks in initial position are higher than those in M1, M2, M3, or final position; and, F0 peaks in M1 position are higher than those in M2, M3, or final position. All of these relationships had a p-value of < 0.001 .

4.4.2 Narrow Focus Declaratives

In this subsection, the results of F0 peak height in narrow focus declaratives are presented. Here, a distinction was made between words bearing focus (one per sentence), and non-focused words. Figure 30 below shows the distribution of F0 peak height in narrow focus declaratives, with particular emphasis on the F0 peak height difference between focused words (indicated by ‘yes’) and non-focused words (indicated by ‘no’). Figure 30 shows this distribution across position of the word, from initial position (left side of the graph) to final position (right side of the graph). Data show that in narrow focus declaratives, as in the broad focus group, F0 peaks in initial position are the highest across sentences.

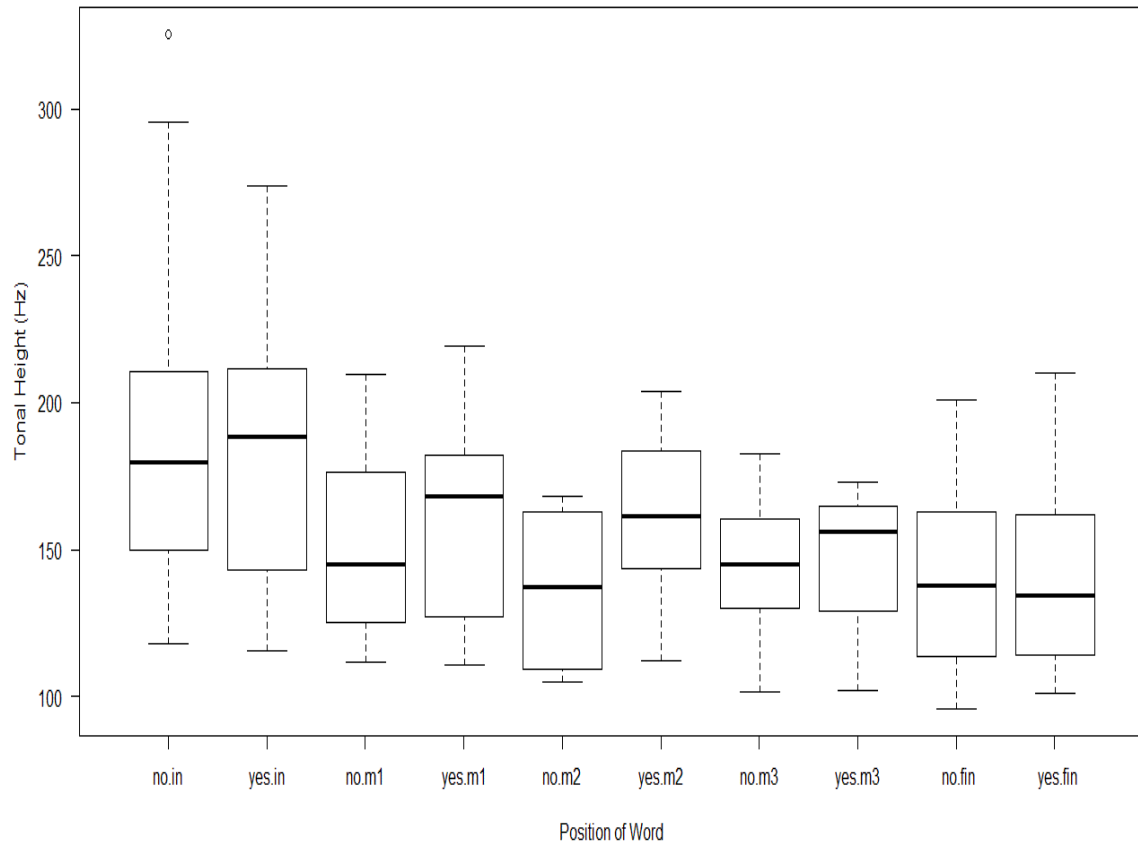


Figure 30: F0 peak tonal height distribution in all narrow focus declaratives. Position of the word: in = initial, m1 = first medial, m2 = second medial, m3 = third medial, fin = final. Focus: yes = focused word, no = non-focused word.

Table 32 below presents the means (SD in parentheses) of F0 peak height (Hz) in narrow focus declaratives across number of words, position of the word, and focus. We can observe that F0 peaks in focused words are higher than those in non-focused words. The only exception appears in final position of a 4- word sentence, where F0 peaks in the focused word are lower in height than those in the non-focused words.

	Initial		M1		M2		M3		Final	
	NF	F	NF	F	NF	F	NF	F	NF	F
2-words	170 (40)	181 (43)	--	--	--	--	--	--	142 (30)	147 (33)
3-words	180 (40)	--	152 (36)	161 (34)	--	--	--	--	142 (30)	146 (35)
4-words	188 (51)	--	151 (29)	--	131 (28)	154 (25)	--	--	135 (26)	125 (27)
5-words	192 (48)	--	153 (30)	--	144 (33)	166 (31)	143 (25)	144 (37)	135 (23)	--

Table 32: Means of F0 peak height (in Hz) in narrow focus declaratives. Focus: NF = non-focused word, F = focused word.

A series of linear mixed-effects models was created in R in order to examine F0 peak height and the effects of focus, number of words, and position of the word. These three independent variables were included as fixed factors in the analysis. Additionally, the following two-way interactions were included: focus and position of the word, and focus and number of words. Similar to previous linear mixed-effects models used in this chapter, I started with a complex model, and then removed first non-significant two-way interactions individually, starting with the interactions with the highest p-value. Only then, I removed non-significant fixed factors, starting with those with the highest p-value. Each model was evaluated with an ANOVA in order to obtain the significance value for each interaction and fixed factor.

The best fit model included focus $F(1, 311) = 7.37, p = 0.007$, position of the word $F(4, 311) = 89.52, p < 0.001$, and the two-way interaction between position of the word and focus $F(4, 311) = 2.58, p = 0.03$. First, results show that overall F0 peaks in

focused words are higher than those in non-focused words (except in 4- word sentences as shown in Table 32). Second, post-hoc means comparisons of position of the word using the Tukey HSD test show that across narrow focus declaratives, F0 peaks in initial position are higher than those located in M1, M2, M3, or final position. Additionally, F0 peaks in M1 position are higher than those in final position. All of these relationships had a p-value of < 0.001 . Only in final position of 4-words sentences, F0 peaks in focused words fail to exceed in height those F0 peaks in non-focused words. Finally, it is important to note that while non-focused and focused F0 peaks in M3 position have comparable tonal height, the F0 peak of the focused word matches in height the previous non-focused F0 peak located in M2 position.

4.4.3 Contrastive Focus Declaratives

In this subsection, I present the results of F0 peak height in contrastive focus declaratives. Figure 31 below shows the distribution of the F0 peak height in contrastive focus declaratives with respect to focus and position of the word. We can observe that all F0 peaks in contrastive focused words are higher than those in non-focused words. Moreover, and different from the narrow focus group, F0 peaks in final position are considerably higher in focused words than in non-focused words.

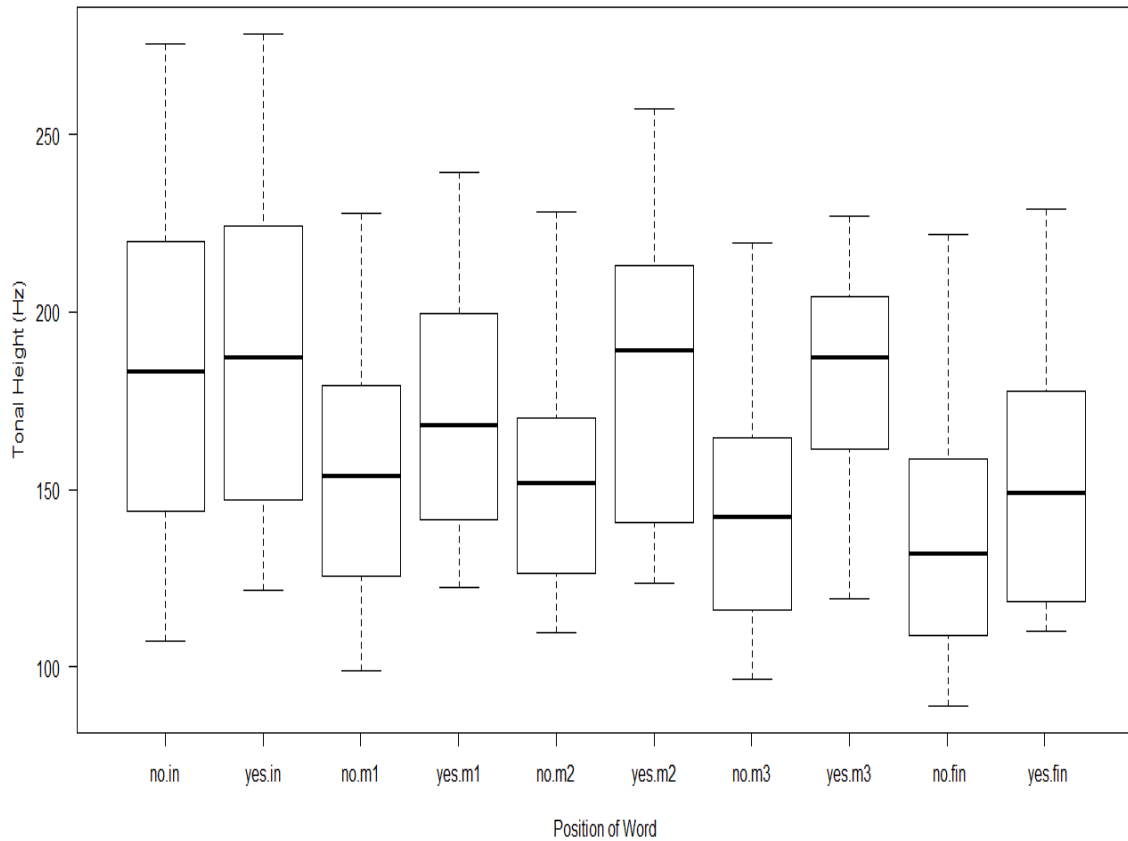


Figure 31: F0 peak tonal height distribution in all contrastive focus declaratives. Position of the word: in = initial, m1 = first medial, m2 = second medial, m3 = third medial, fin = final. Focus: yes = focused word, no = non-focused word.

Table 33 below shows the means (SD in parentheses) of F0 peak height across number of words, position of the word, and focus. It is noteworthy that, in 3-, 4-, and 5-word sentences, F0 peaks in focused words, although higher than previous non-focused words, do not surpass the initial F0 peak in height.

	Initial		M1		M2		M3		Final	
	NF	F	NF	F	NF	F	NF	F	NF	F
2-words	180 (44)	188 (43)	--	--	--	--	--	--	139 (33)	156 (38)
3-words	175 (42)	--	158 (35)	172 (37)	--	--	--	--	131 (30)	158 (36)
4-words	184 (46)	--	152 (34)	--	146 (34)	180 (38)	--	--	136 (32)	145 (38)
5-words	188 (46)	--	154 (32)	--	157 (27)	182 (40)	142 (32)	181 (34)	138 (30)	--

Table 33: Means of F0 peak height (Hz) in contrastive focus declaratives. Focus: NF = non-focused word, F = focused word.

A series of linear mixed-effects models was created in R for contrastive focus declaratives. The same fixed factors as well as two-way interactions used in the narrow focus analysis (§4.4.2) were included in the analysis of contrastive focus declaratives. The best fit model for contrastive focus declaratives included: focus $F(1, 681) = 259.43$, $p < 0.001$, position of the word $F(4, 681) = 143.92$, $p < 0.001$, number of words $F(3, 681) = 4.51$, $p = 0.003$, and the two-way interaction between focus and position of the word $F(4, 681) = 15.98$, $p < 0.001$. Results show that F0 peaks in focused words are largely higher than those in non-focused words. With respect to position of the word, post-hoc means comparisons using Tukey HSD test indicate that in contrastive focus declaratives, F0 peaks in initial positions are higher than all F0 peaks positioned across the sentence. Likewise, F0 peaks in M1 and M2 are much higher than those in M3 position or final position. Regarding number of words, F0 peaks in 2-word sentences are higher than those F0 peaks in 3-word sentences.

4.4.4 Tonal Height for All Declaratives Taken Together

In this subsection, I present the results of F0 peak height across the three types of declaratives. For this analysis, I carry out statistical analyses for each number of words, i.e. separate models were created for sentences according to the number of words they contain (2-, 3-, 4-, and 5-). The reason for this is that as number of words increases in the sentence, not every sentential position will bear narrow or contrastive focus. For example, in a 5-word sentence, words bearing narrow or contrastive focus are never found in initial position, rather they only appear in M2 and M3 positions. On the other hand, in a 2-word sentence, both positions (i.e. initial and final) can potentially bear narrow or contrastive focus. Therefore, by separating the analysis within each number of word group, comparisons such as initial broad focus, initial narrow focus, and initial contrastive focus are possible. Moreover, as it has been reported in the previous subsections (§4.4.1, §4.4.2, §4.4.3), on average F0 peaks in initial position are consistently the highest peaks in the sentences. Thus, if we include all F0 peaks in the analysis, the tonal height value of this initial F0 peak may skew the overall results.

A series of linear mixed-effects models was created in R, with F0 peak height as the dependent variable, and speaker as a random effect. The fixed factors were position of the word and focus type (b = broad focus, nf = narrow focused, nnf = narrow non-focused, cf = contrastive focused, cnf = contrastive non-focused). The only two-way interaction included was position of the word and focus type. The same statistical procedure used in previous linear mixed-effects models was performed.

Let us start with 2-word declaratives. In this group, both initial and final positions can bear narrow and contrastive focus. The best fit model included focus type $F(4, 329) = 19.48, p < 0.001$ and position of the word $F(1, 329) = 351.76, p < 0.001$ as significant factors. Overall, F0 peaks in initial position tend to be higher than in final position. Tukey's post-hoc means comparisons for focus type were performed across the three types of declaratives. F0 peaks in contrastive focused words are higher than those in narrow focused words ($p < 0.001$) as well as than those in broad focus words ($p < 0.001$). F0 peaks in narrow focused words are also higher than those in broad focus words ($p = 0.007$). It is also important to note that F0 peaks in contrastive focused words are significantly higher than those in contrastive non-focused words ($p < 0.001$). The same trend is found between F0 peaks in narrow focused words and narrow non-focused words ($p = 0.044$). Namely, F0 peaks in focused words are higher than those in their non-focused counterparts. Table 34 below shows the F0 peak averages (SD in parentheses) by focus type for 2- word declaratives.

	Initial	Final
Broad Focus	166 Hz (34)	135 Hz (29)
Narrow Focused	181 Hz (43)	147 Hz (33)
Contrastive Focused	188 Hz (43)	156 Hz (38)

Table 34: F0 peak distribution according to focus type for 2-word declaratives.

In 3-word sentences, narrow and contrastive focus words were only found in M1 and final position. The best fit model only included the two fixed factors: position of the word $F(1, 225) = 113.6, p < 0.001$, and focus type, $F(4, 225) = 54.72, p < 0.001$. Overall, across the three types of declaratives, F0 peaks in M1 position are higher than those in final position. However, F0 peaks in contrastive focused words are higher than those in narrow focused words ($p < 0.001$) as well as than in broad focus words ($p < 0.001$). No difference in F0 peak height was found between narrow focused and broad focus words ($p = 0.112$). As in the 2-word sentence group, F0 peaks in contrastive focus word are higher than those in contrastive non-focused words ($p < 0.001$). No significant difference was found between narrow focused words and narrow non-focused words ($p = 0.23$). Table 35 below shows the F0 peak average by focus type in 3-word sentences.

	M1	Final
Broad Focus	149 Hz (31)	136 Hz (30)
Narrow Focused	160 Hz (34)	146 Hz (35)
Contrastive Focused	172 Hz (37)	158 Hz (36)

Table 35: F0 peak distribution according to focus type for 3-word declaratives.

In 4-word sentences, narrow and contrastive focused words were only found in M2 and final position. The best fit model included the two following fixed factors: position of word $F(1, 204) = 64.33, p < 0.001$, and focus type $F(4, 205) = 49.13, p < 0.001$. Overall, F0 peaks in M2 position are higher than those F0 peaks in final position. With respect to focus type, Tukey's post-hoc means comparisons indicate that F0 peaks

in contrastive focused words are significantly higher than those in broad focus words ($p < 0.001$). No difference was found either between contrastive focused words and narrow focused words ($p = 0.305$) or between narrow focused words and broad focus ($p = 0.581$). Furthermore, F0 peaks in contrastive focused words were still significantly higher than those in contrastive non-focused words ($p < 0.001$). No significant differences were found between F0 peaks in narrow focused words and those in narrow non-focused words ($p = 0.497$). Table 36 below shows the F0 peak average by focus type in 4-words declaratives.

	M2	Final
Broad Focus	144 Hz (29)	136 Hz (29)
Narrow Focused	154 Hz (25)	125 Hz (27)
Contrastive Focused	180 Hz (38)	145 Hz (38)

Table 36: F0 peak distribution according to focus type for 4-word declaratives.

There was, however, a significant interaction between position of the word and focus type $F(4, 205) = 6.51, p < 0.001$. Figure 32 below shows the F0 peak height distribution of 4-word declaratives by focus type. We can observe that across focus types, F0 peaks in M2 position are much higher than in final position. Yet, narrow non-focused words follow a different trend. On average, in narrow non-focused words, F0 peaks in final position are slightly higher than those in M2 position. This observation may explain the two-way interaction found in 4-word sentences.

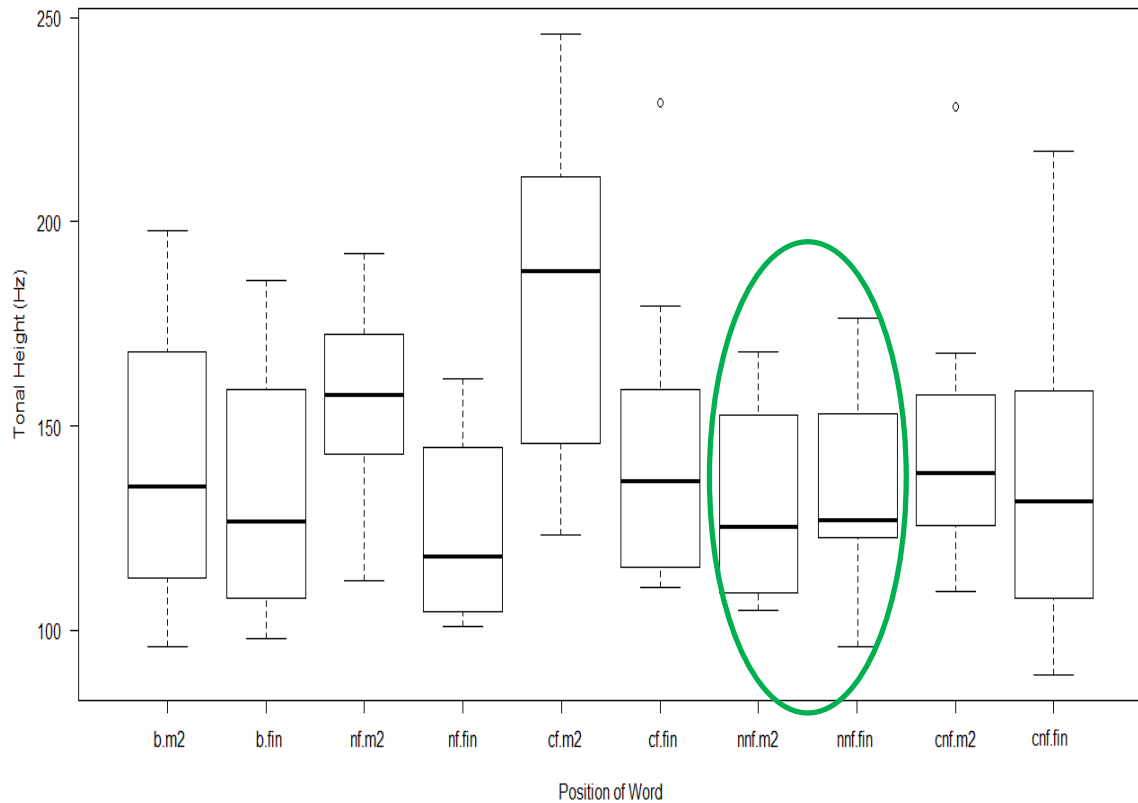


Figure 32: F0 peak height distribution by focus type in 4-word declaratives.

Lastly, in 5-word sentences, the only positions bearing narrow and contrastive focus were M2 and M3. The best fit model included two fixed factors: position of the word $F(1, 184) = 32.36, p < 0.001$, and focus type $F(4, 184) = 94.13, p < 0.001$. Results show that overall F0 peaks in M2 position are higher than those in M3 position. We must note however that, in contrastive focused words, F0 peaks in M2 and M3 are on average equivalent in height. Tukey's post-hoc means comparison show the following results. F0 peaks in contrastive focused words are higher than those in broad focus words ($p < 0.001$) as well as than those in narrow focused words ($p < 0.001$). F0 peaks in narrow focused words are higher than those in broad focus words ($p < 0.001$) as well as than those in

narrow non-focused words ($p = 0.007$). F0 peaks in contrastive focused words are higher than those in contrastive non-focused words ($p < 0.001$). Table 37 below shows the F0 peak average of focus words in 5-word sentences.

	M2	M3
Broad Focus	139 Hz (29)	132 Hz (27)
Narrow Focused	166 Hz (31)	144 Hz (37)
Contrastive Focused	182 Hz (40)	181 Hz (34)

Table 37: F0 peak distribution according to focus type for 5-word declaratives.

4.4.5 Summary of Tonal Height

In this section, I provide a summary of F0 peak height in PAS declaratives. In broad focus declaratives, there is a clear F0 peak downtrend from initial to final position throughout the entire sentence. This pattern is observed in the current data, irrespective of the number of words in a sentence. This downtrend in declaratives is expected and common in other Spanish varieties (Prieto et al. 1996), and PAS data confirm these observations. Across broad declaratives, the initial F0 peak is the highest in the sentence. Moreover, this initial F0 peak tends to increase as the number of words in a sentence increases. It was also shown that F0 peaks in final position tend to maintain its tonal height even when the number of words in a sentence increases. This finding suggests that while the maximum height of the initial F0 peak is subject to vary, there could be a minimum height for the F0 peak in final position.

In narrow focus declaratives, F0 peak height in initial position is the highest across all sentences. Second, F0 peak in focused words are generally higher than those in non-focused words. Interestingly, F0 peaks in M2 and M3 focused positions barely exceed their previous F0 peak in height. At most, the narrow focused F0 peak matches (in height) the previous non-focused F0 peak. In final position, a narrow focus F0 peak is still lower than the previous non-focused F0 peak in the same sentence.

Similar to the broad focus and narrow focus groups, the initial F0 peak in contrastive focus declaratives is the highest across the sentences. In contrastive focus declaratives, however, all F0 peaks in focused words are higher than those in their non-focused counterparts. This is evident across all sentential positions. Unlike narrow focus words, F0 peaks in medial contrastive focus words (i.e. M2 and M3) exceed considerably the previous F0 peak, but they still fail to exceed the initial F0 peak in height. Put differently, if we exclude the initial position in contrastive focus declaratives, F0 peaks in M2 and M3 focused positions are the highest F0 peaks in the sentence. In final position, however, the F0 peak in a contrastive focused word barely matches the previous non-focused F0 peak in height.

A comparison of tonal height across declaratives shows that, in similar locations (i.e. where broad, narrow and contrastive focused words are comparably found), F0 peaks in contrastive focused words are significantly higher than those in broad focus words. This pattern is found across sentences with 2-, 3-, 4-, and 5- words. Also, F0 peaks in contrastive focused words are higher than those in narrow focused words, with the exception of cases 4-word sentences where they are not significantly different. Lastly,

only in 2- and 5-word sentences, F0 peaks in narrow focused words are significantly higher than those in broad focus words. In 3- and 4-words sentences, F0 peaks in narrow focused words and broad focus words are similar in tonal height.

4.5 Spontaneous Data

The previous sections in this chapter have focused on the results related to tonal alignment (§4.2), F0 rise time (§4.3), and tonal height (§4.4) from laboratory data. In order to complement those results, this section offers a qualitative exploration of PAS tonal alignment based on spontaneous data. This examination will focus mainly on the location of the F0 peaks, described both as a categorical and a numerical variable. As explained in Chapter 3 (§3.3.2), PAS spontaneous data come from six speakers, and were elicited as responses to questions about a certain topic for about one or two minutes.

Before describing some of the intonational patterns observed in the spontaneous data, it is important to note a few differences between reading task sentences and the sentences found in the interview data. One of these differences is the unequal number of declaratives types. In the reading task, three comparable sets of sentences were obtained: broad, narrow, and contrastive focus declaratives. In the interview material, however, only 15 broad focus, five narrow focus, and one contrastive focus declaratives were gathered. The number of content words in a sentence was also different across the two tasks. In the reading task, sentences with 2-, 3-, 4-, and 5- content words were elicited. In the interview data, sentences ranged from 1 to 7 content words. While in the reading task all content words were potentially analyzable, in the interview task only one or two

content words per sentence were part of the analysis. This was due mainly to unidentifiable F0 contours and the presence of voiceless segments across the sentences. Voiceless segments result in a break in the F0 contour such that they could not be properly analyzed. Third, the number of syllables in a content word as well as the stress pattern vary across the tasks. In the reading task, all content words contained three syllables, and all content words had penultimate stress. In the interview material, the number of syllables in a word ranged from two to five syllables, and words had stress in the penultimate syllable as well as in the last syllable. Because interview data is inherently different from laboratory data, it is challenging to make direct comparisons. Nevertheless, we can still examine whether the results reported for the reading task hold up in the spontaneous data.

The measurements used in the reading task with respect to tonal alignment were followed in the analysis of the spontaneous data. Namely, F0 peak location was analyzed both as a categorical variable (with respect to the syllable and its elements) and as a continuous variable (as a percentage into the stressed syllable and vowel). Due to the small data set, minimal statistical analyses were performed.

Overall, the spontaneous data consisted of 20 analyzable sentences. From these 20 sentences, a total of 21 pitch accents showed clear F0 contours, and thus were selected for analysis (i.e. 15 broad focus, 5 narrow focus, and 1 contrastive focus). Categorically, all 21 F0 peaks were realized within the stressed syllable. These findings match the results in the reading task where in over 98% of the cases F0 peaks occur within the stressed syllable. The spontaneous data, which occurred in a less controlled setting,

provide further support for the results found in the reading task. Specifically, results from both tasks show that PAS favors the occurrence of F0 peaks within the temporal boundaries of the stressed syllable.

Among the broad focus tokens ($N = 15$), I examined F0 peak location as a percentage into the stressed syllable across syllable types (i.e. CV vs. CVC). Recall that in the reading task, F0 peaks in CV syllables have higher percentage than in CVC syllables. In the spontaneous data, in CV syllables ($N = 8$), the average of F0 peak location as a percentage into the syllable was 52% ($SD = 0.144$), whereas in CVC syllables ($N = 7$), the percentage was 39% ($SD = 0.102$). An independent samples t-test shows that there is a significant difference between syllable types, where F0 peaks in CVC syllables are realized earlier than in CV syllables, $t(13) = 1.88$, $p = 0.041$. Although the number of tokens analyzed here is relatively low when compared to the reading task, PAS spontaneous data seem to support the trend found earlier regarding F0 peak location as percentage into the stressed syllable.

In the reading task, position of the word was also a significant factor in the location of F0 peaks as a percentage into the stressed syllable. Namely, F0 peaks in final position had a lower percentage than those in non-final position. In the spontaneous data, I examined F0 peak location as a percentage into the syllable in both non-final and final positions among broad focus tokens. In non-final position ($N = 8$), F0 peak location averaged around 53% ($SD = 0.139$) into the stressed syllable, whereas in final position ($N = 7$), F0 peak location averaged around 38% ($SD = 0.082$) into the stressed syllable. An independent samples t-test shows a significant difference with regard to position of the

word, $t(13) = -2.54$, $p = 0.012$. Overall, these results reflect those found in the reading tasks where F0 peaks in final position occur earlier than those in non-final positions.

F0 peak location was also examined with respect to the stressed vowel. In all tokens ($N = 21$), with the exception of one, F0 peaks were realized within the vowel. The single token was realized in the onset. Overall, this trend is expected given the results from the reading task where the vast majority of the F0 peaks occur in the stressed vowel. F0 peaks that are realized in the onset generally occur in final position. This is the case of the single token found in the spontaneous data. The findings reported here further support the claim that in PAS the vowel serves as an ‘anchor’ for the F0 peaks. This claim is strengthened by the fact that the tokens analyzed in the spontaneous data include both CV and CVC syllables.

I now examine F0 peak location as a percentage into the stressed vowel across syllable types in broad focus tokens. In the reading task, it was found that at least in certain positions F0 peaks in CVC syllables had a higher percentage than those in CV syllables. Results from the spontaneous data show that in CV syllables ($N = 8$), F0 peaks occur on average at 33% ($SD = 0.149$) into the vowel, while in CVC syllables ($N = 4$), F0 peaks occur on average at 38% ($SD = 0.145$) into the vowel. Although these means are consistent with the results from the reading task (i.e. higher percentages in CVC than in CV syllables), the difference is not significant, $t(9) = -0.54$, $p = 0.30$.

With regard to position of word, F0 peak location as a percentage into the vowel was examined among non-final and final positions in broad focus contexts. In non-final position ($N = 7$), the average F0 peak location into the vowel was 42% ($SD = 0.12$). In

final position ($N = 4$), the average F0 peak location was 22% ($SD = 0.06$). This difference was significant, $t(9) = -3.17$, $p = 0.006$, with F0 peaks occurring earlier into the vowel in final position than in non-final positions.

Figures 33, Figure 34, and Figure 35 below illustrate representative patterns from PAS spontaneous data. Each figure shows a spectrogram of the content word of interest (located in the upper part), the F0 contour (represented by the solid line over the spectrogram), and five tiers. The two upper tiers show the tonal units. The third and fourth tier show the segmental boundaries of the stressed vowel and the stressed syllable, respectively. The fifth tier shows the segmental boundaries of the content word.

Figure 33 shows the word *tenemos* ‘(we) have’ produced by speaker PAS05. This trisyllabic word has penultimate stress, and the stressed syllable *ne* is a CV type syllable. This word is located in an utterance-initial position of a 6-(content) word sentence: *Tenemos un equipo que está jugando en segunda profesional*, ‘We have a team that is playing in the second division league’. In this part of the interview, the speaker was telling me about how much *Pucallpinos* enjoy sports, particularly *fútbol*. In Figure 33, we can observe that the F0 contour begins its rise in the vicinity of the onset of the stressed syllable, continues through it, and reaches its peak (indicated by the H in the tones tier) at around 67% into the stressed syllable, and at around 53% into the stressed vowel. It is important to note that the duration of the stressed syllable was around 83ms, and of the stressed vowel was around 58ms.

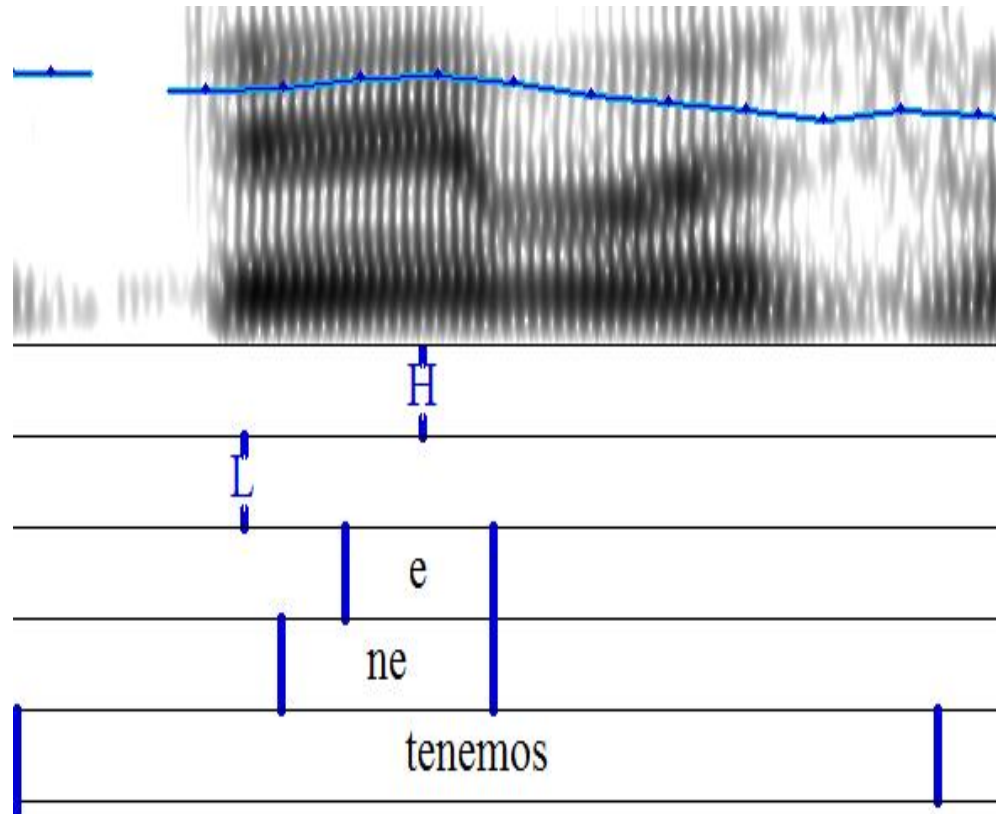


Figure 33. F0 contour of the word *tenemos* ‘(we) have’ located in utterance-initial position. *Tenemos un equipo que está jugando en la segunda profesional* ‘We have a team that is playing in the second division league’. Produced by speaker PAS05.

Figure 34 shows another word from the same sentence produced by the same speaker. The word of interest here is *jugando* ‘playing’. This word has three syllables, and has penultimate stress. Unlike the word *tenemos*, the stressed syllable in *jugando* is a CVC type syllable, and it is located in medial position. We can observe again that the F0 begins to rise just before the start of the stressed syllable, and continues its rise through the stressed syllable. The F0 contour reaches its peak at around 52% into the stressed syllable, and at around 50% into the stressed vowel. As expected, the CVC syllable is longer than the CV stressed syllable (171ms vs. 83ms, respectively). The duration of the

stressed vowels in these particular tokens, however, did not follow the trend observed in the reading task. Here, the stressed vowel is higher in the CVC syllable than in the CV syllable (83ms vs. 58ms).

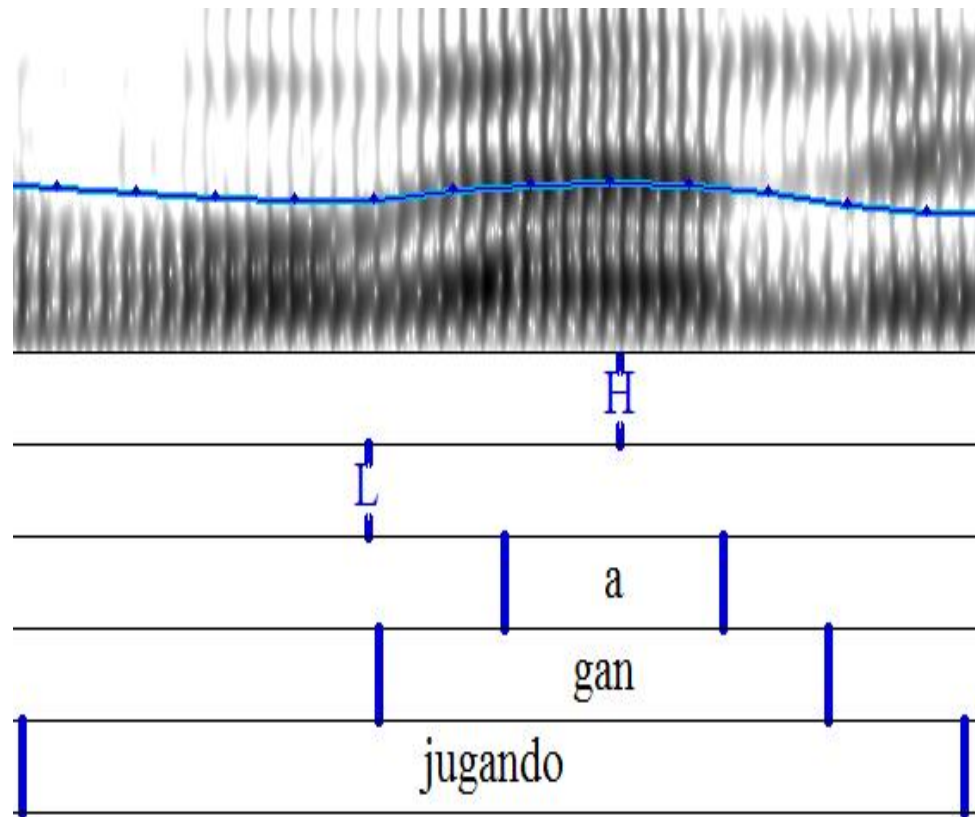


Figure 34: F0 contour of the word *jugando* ‘playing’ located in medial position. *Tenemos un equipo que está jugando en la segunda profesional* ‘We have a team that is playing in the second division league’. Produced by speaker PAS05.

What is important to note here is that, irrespective of segmental information, F0 peaks occur within the stressed syllable, but more specifically, within the stressed vowel. A similar pattern was observed in the reading task analysis. Moreover, F0 peaks in CV syllables are realized later in the syllable than those in CVC, when measured as a

proportion into the stressed syllable. This observation again mirrors the findings obtained in the reading task. Lastly, F0 peaks in the stressed vowel occurs at a comparable location (as a percentage) in the two types of syllables. Unlike in the reading task, however, these percentages into the vowel were comparable, despite different syllable structures.

Figure 35 below shows the F0 contour of the word *Loreto*, in the 2- (content) word sentence, *Pertenece a Loreto*, ‘(It) belongs to Loreto’, produced by speaker PAS01. In this part of the interview, the speaker was telling me about the city of Contamana, in the department of Loreto, Peru, as another place to visit in the Amazonia. The word *Loreto* is trisyllabic, has penultimate stress, and is located in utterance-final position. The stressed syllable *re* is of CV syllable type. In Figure 35, we can observe that the F0 contour begins its rise before the onset of the stressed syllable, and reaches its peak both within the stressed syllable and the stressed vowel. The F0 peak is realized at 40% into the stressed syllable, and at 31% into the stressed vowel. These low percentages are expected since the word *Loreto* is located in utterance-final position, when compared to the words observed in Figure 33 and Figure 34. Furthermore, the stressed syllable has a duration of 173ms whereas the stressed vowel has a duration of 151ms. The long duration of this word (when compared to other non-final pitch accents) is to be expected, given that it is located in utterance-final position.

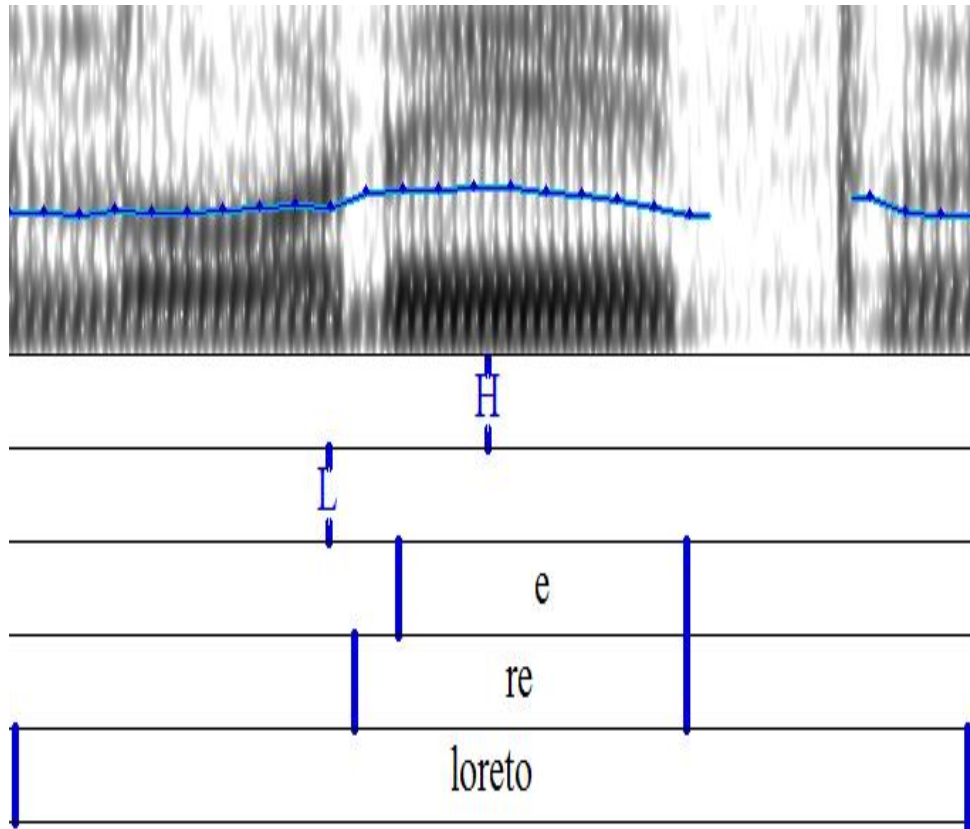


Figure 35: F0 contour of the word *Loreto* located in utterance-final position. *Pertenece a Loreto* ‘(It) belongs to Loreto’. Produced by speaker PAS01.

The examination of PAS spontaneous data presented in this section correspond to the findings reported in the reading task. Specifically, F0 peaks occur within both the stressed syllable and stressed vowel. With respect to segmental length, stressed syllables located in final position are longer than those in non-final positions. Last but not least, F0 peaks located in final position tend to occur earlier in the stressed syllable and the stressed vowel than those found in non-final positions.

Chapter 5: Discussion

In this chapter, I discuss the results presented in Chapter 4 for tonal alignment in PAS rising accents. I then connect them with my main research questions regarding the interaction between intonational events and segmental information, and the phonological representations of PAS rising pitch accents. I start this chapter with an overview of the main findings of this dissertation (§5.1), regarding tonal alignment, F0 rise time, tonal height, and the analysis of spontaneous speech data. I then evaluate the Segmental Anchoring Hypothesis (SAH) based on the results of tonal alignment and F0 rise time (§5.2). In the last section (§5.3), I revisit the current proposal for the phonological representations of PAS rising accents.

5.1 Main Findings

5.1.1 Segmental Duration

One of the central goals of this dissertation was to examine PAS tonal alignment. More specifically, I aimed to explore whether variation in the segmental string (i.e. segmental duration, syllable structure) had an effect on PAS tonal alignment of rising accents. With regard to segmental duration, I used number of words as a proxy of segmental length in order to indirectly modify the duration of stressed syllables and stressed vowels (see §4.1). Results showed that as the number of words in a sentence increases, the duration of

both stressed syllables and stressed vowels increases as well. The only exception occurred in stressed vowels of narrow focus declaratives, where no statistically significant durational differences were found, perhaps due to having a smaller sample size than broad or contrastive focus declaratives. In fact, analyzed tokens in narrow focus declaratives were around half the number of tokens in the other two types.

Overall, the manipulation of number of words in a sentence allowed us to indirectly vary segmental duration in PAS. These results show that my methodological choice of varying segmental length by changing the number of words was justified, as number of words does in fact serve as a proxy for differences in stressed syllable and stressed vowel duration, albeit one exception. It should be noted though that the direction of these durational differences contradict earlier predictions in the literature. Early works on segmental length suggest that the duration of segments decreases as more words are added to the sentence (Navarro Tomás 1916, Lehiste 1970). In the current PAS data, however, larger sentences resulted in longer segmental duration. Although it is left for further research to investigate why this is the case in PAS, the addition of content words did prompt differences in the length of stressed syllables and stressed vowels.

5.1.2 Tonal Alignment

Before diving into the discussion of PAS tonal alignment, I would like to recall that several studies on Spanish intonation have referred to the topic of tonal alignment (regarding F0 peaks) simply as a binary distinction: *does the F0 peak occur after the stressed syllable or within the stressed syllable?* Using this two-way distinction, previous

studies have found that F0 peaks tend to occur after the stressed syllable in prenuclear pitch accents of broad focus declaratives (e.g. Prieto 1996, Sosa 1999, Beckman et al. 2002, among others, cf. Willis 2003). Furthermore, the alignment of the F0 peak within or after the boundaries of the stressed syllable has been shown to signal a difference in meaning, i.e. focus, in some other varieties. For example, in broad focus declaratives of Lima Spanish, F0 peaks in prenuclear positions fall after the stressed syllable. On the other hand, an F0 peak occurring within the stressed syllable marks a different meaning, as this F0 pattern is generally observed when conveying narrow or contrastive focus. My earlier work on PAS has used this binary distinction (i.e. after vs. within the stressed syllable) to examine tonal alignment in this variety (García 2011). In that work, for example, I found that in prenuclear accents of PAS broad focus declaratives most F0 peaks tend to occur within the stressed syllable.

Moving beyond the binary distinction, some other studies have also measured tonal alignment as a continuous variable, and have explored for example how many milliseconds away from a particular segmental landmark tonal events are realized (Prieto et al. 1994, Face 2001a, Face 2002, among others). The use of this continuous measurement has been able to present more nuanced results of tonal alignment. Thus, by examining F0 peak location as a continuous variable, we are able to get a more detailed analysis of tonal alignment. Similarly, this dissertation takes a step further from earlier work in the examination of PAS intonational patterns by looking at where specifically in the stressed syllable F0 peaks occur. Not only do I analyze tonal alignment as a categorical variable (e.g. after vs. within the stressed syllable), but also as a continuous

variable (i.e. percentage into the stressed syllable and stressed vowel). As a result, I am able to obtain a more thorough account of PAS intonational patterns of rising accents, and to explore their theoretical implications for models of tonal alignment. Additionally, this reexamination of PAS rising accents invites us to revisit the current phonological representation of pitch accents in PAS (§5.3).

5.1.2.1 F0 Peak Location in the Stressed Syllable

In this dissertation, I examined three types of declaratives: broad focus, narrow focus, and contrastive focus. Across the three types of declaratives, I used the same sentential material, varying only their pragmatic meaning, which ultimately allowed for direct comparisons between them.

Across the three types of declaratives, and regardless of segmental information, more than 98% of the analyzed F0 peaks are realized within the stressed syllable, including both prenuclear and nuclear accents. Specifically, for broad focus declaratives, 98% of F0 peaks are realized within the stressed syllable; for narrow focus declaratives, 99%; and for contrastive focus declaratives, 98%. The data from this dissertation provides more consistent results than my previous work on PAS (García 2011) since overwhelmingly F0 peaks are realized within the stressed syllable. Furthermore, if we consider only broad focus declaratives, this percentage is higher than those found in other Spanish varieties where F0 peaks also occur within the stressed syllable: between 50% and 80% in Cuzco Spanish (O'Rourke 2004), and 64% in Yucatan Spanish (Michnowicz & Barnes 2013). The percentage reported in this dissertation, however, mirrors the

findings for Buenos Aires Spanish, where between 80-100% of F0 peaks in prenuclear accents in broad focus declaratives are realized within the stressed syllable (Colantoni 2011). We must note here that when comparing percentages of F0 peak locations across varieties, it is important to reflect on the methods used to elicit and analyze the data. For example, in the Cuzco Spanish study, reading tasks were used whereas for Yucatán and Buenos Aires Spanish spontaneous data was used. In addition, there has not been consistency with regard to syllable structure. While in some of these studies only CV syllables were analyzed (O'Rourke 2004, 2005), in others both CV and CVC were analyzed (Michnowicz & Barnes 2013). Moreover, in other studies, syllable type was not even a factor in the analysis (Colantoni 2011). It has been shown, however, that syllable structure may play a role in F0 peak location (Prieto & Torreira 2007). For these reasons, it is challenging to compare directly the results of these studies.

Nonetheless, there seems to be a continuum in the phonetic realization of F0 peaks in broad focus declaratives across previously studied Spanish varieties. On one end of the spectrum, we have those varieties whose F0 peaks occur after the stressed syllable (e.g. Peninsular (Madrid) Spanish, Mexican Spanish, Lima Spanish, among others). Toward the middle, we have those varieties whose F0 peaks occur within the stressed syllable, but not all the time (e.g. Cuzco Spanish, Yucatan Spanish); and, on the other end of the spectrum, there are those where the F0 peaks occur almost categorically within the stressed syllable (e.g. PAS and Buenos Aires Spanish). In those varieties in which F0 peaks occur within the stressed syllable, scholars have suggested contact with other languages as a possible explanation for those patterns (O'Rourke 2005, Colantoni 2011,

Michnowicz & Barnes 2013). As mentioned earlier, the Peruvian Amazon is home to various Amazonian languages, and thus, contact could potentially provide an explanation for the PAS broad focus declarative patterns. However, the question of the effects of Amazonian languages on PAS intonational patterns falls outside of the scope of this dissertation, and this topic remains readily open for future investigations. I will return to this topic later (§6.3).

Continuing with narrow and contrastive focus declaratives, these two groups contain two types of words that carry pitch accents: focused and non-focused words. In narrow and contrastive focus declaratives, those F0 peaks in focused words occur categorically within the stressed syllable. In non-focused words of narrow and contrastive focus declaratives, F0 peaks are realized within the stressed syllable in over 98% and over 96% of the cases, respectively. These results suggest that F0 peaks tend to align with the stressed syllable irrespective of focus type. This F0 behavior in PAS yields a contrast with those Spanish varieties where F0 peaks align with the stressed syllables only in words bearing narrow or contrastive focus (Beckman et al. 2002, Face 2002, cf. Willis 2003).

Based on the results of this dissertation, the contrast between a F0 peak falling in the stressed syllable, or after it, is not used to mark the difference between different types of focus in declaratives. Differences in focus in PAS are not conveyed by the distinction of the F0 peak occurring within or after the stressed syllable. One main piece of supporting evidence for why this distinction is not present in PAS is that, across the three types of declaratives, the vast majority of F0 peaks are realized within the stressed

syllable. However, even though the alignment seems to occur with the stressed syllable, there could be significant differences as to where exactly within this syllable the F0 peaks fall. Thus, with the goal of obtaining a more thorough description of PAS tonal alignment, I also examined in which syllabic element F0 peaks occur. Thus, the inclusion of both open stressed syllables (i.e. CV) and closed stressed syllables (i.e. CVC), in addition to the manipulation of segmental duration in all declaratives, become crucial. Exploring the alignment in this way further allows us to explore the effect of segmental information on F0 peak location in PAS.

Let us start with broad focus declaratives. Among all broad focus tokens, in 80% of the cases F0 peaks occur in the stressed vowel. Of the remaining F0 peaks, some occur in the onset (over 14%), some in the coda (around 5%), and a few others after the stressed syllable (around 0.33%). There is more alignment with the onset in nuclear position than in prenuclear positions, but still most nuclear F0 peaks are aligned with the vowel. Those cases of F0 peak alignment with the onset are explained by considering the sentential position of the word. Indeed, nuclear pitch accents present the highest number of F0 peaks realized in the onset. Building off of Hualde (2002), a possible explanation for this is that those F0 peaks realized in the onset may target the vowel for alignment, but due to their nuclear position, these F0 peaks are pushed leftward due to the presence of a boundary tone (see §2.3.1.1). Therefore, in PAS, these F0 peaks fall in the onset of the stressed syllable. When F0 peaks in final position are removed from the total number of broad focus F0 peaks, the percentage of F0 peaks occurring in the stressed vowel increase

to over 87%. Figure 36 below shows the distribution of F0 peak location in non-final positions of broad focus declaratives.

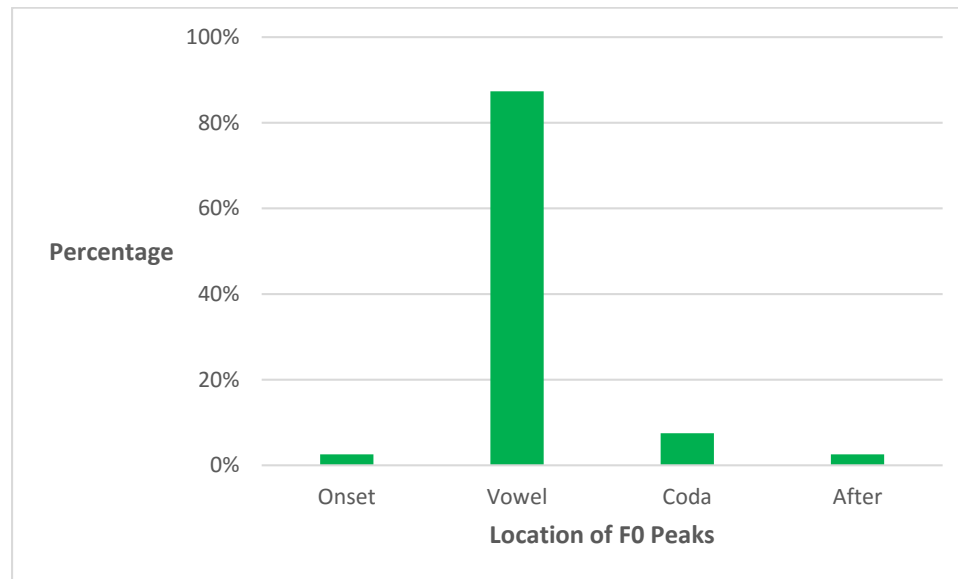


Figure 36: F0 peak location in non-final positions of broad focus declaratives.

Although we can predict those F0 peaks that occur in the onset, F0 peaks occurring in the coda (5% of F0 peaks in the broad focus group) are much harder to explain. It must be noted, however, that those F0 peaks occurring in the coda are found across all sentential positions, making it less predictable. Nonetheless, this way of looking at F0 peak location allows me to present a fine-grained view of tonal alignment in PAS.

Moving beyond broad focus declaratives, narrow and contrastive focus declaratives had two types of words: focused and non-focused. Regarding focused words in narrow focus declaratives, in 95% of the cases, F0 peaks are realized in the stressed

vowel. In non-focused words, the majority of F0 peaks are also realized in the stressed vowel (over 87% in CV syllables, and over 81% in CVC syllables). However, when final positions are excluded, these percentages increase since final positions display a higher number of cases where F0 peaks are realized in the onset. Similarly, in focused words of contrastive focus declaratives, in over 99% of the cases, F0 peaks occur in the stressed vowel. In non-focused words, most F0 peaks occur within the stressed vowel (over 88% in CV syllables, and over 80% in CVC syllables). When final position is excluded, these percentages increase as well. Table 38 below compares the percentages of F0 peak location in stressed vowels of narrow and contrastive non-focused words. These percentages are indicated for all positions (i.e. including both final and non-final position) and only in prenuclear positions. As stated above, final position was excluded because in this position there is a high number of F0 peaks occurring in the onset.

	CV		CVC	
	All positions	Non-final positions	All positions	Non-final Positions
Narrow non-focused words	87% (N=95)	89% (N=52)	82% (N=138)	91% (N=85)
Contrastive non-focused words	89% (N=244)	93% (N=156)	80% (N=306)	81% (N=210)

Table 38: Distribution of F0 peak location in the stressed vowel in narrow and contrastive non-focused words.

As shown in Table 38, percentages of F0 peaks in the stressed vowel increase across syllable types when those F0 peaks located in final positions are excluded. The

greatest difference is seen in CVC syllables of narrow non-focused words, and in CV syllables of contrastive non-focused words. This reanalysis (which excludes final positions) supports the hypothesis that, in PAS, F0 peaks tend to align, not only with the stressed syllable, but more precisely with the stressed vowel. These results make it evident that, for all types of declaratives, there is consistent alignment with a single syllabic element: the vowel. These findings also suggest that, for narrow and contrastive focus declaratives, tonal alignment to a syllabic element cannot be used to distinguish between focused and non-focused words. In both types of words, F0 peaks tend to align with the stressed vowel.

5.1.2.2 F0 Peak Location as a Percentage

F0 peak location in PAS was also examined as a percentage into the stressed syllable and the stressed vowel (i.e. a continuous variable). The goal here is to determine whether there was a specific point within the stressed syllable and/or vowel to which F0 peaks anchor. This variable also allowed me to further analyze the effects of segmental information on F0 peak alignment. I will first discuss the results of F0 peak location as a percentage into the stressed syllable.

Across the three types of declaratives (i.e. broad, narrow, and contrastive focus), syllable structure and position of word had an effect on F0 peak location as a percentage into the stressed syllable. In CV syllables, percentages are much higher than in CVC syllables. In other words, in CV syllables, F0 peaks are realized later in the syllable than in CVC syllables. These findings suggest that, with the presence of a coda, F0 peaks

retract to an earlier location in the stressed syllable, possibly aiming to reach the vowel.

In fact, most F0 peaks occur in the stressed vowel. One possible explanation for this difference in percentage into the syllable based on syllable type could be the fact that CVC has a coda, making it a longer syllable than a CV type. Thus, if F0 peaks seek to align with the vowel, the percentage would need to be lower in a CVC syllable. Otherwise, a high percentage in a CVC syllable may indicate placement of F0 peaks in the coda.

With respect to position of the word, percentage into the syllable is higher in non-final positions than in final position. Specifically, F0 peaks are realized much earlier in the stressed syllable in final position than in non-final position. Lower percentages for final positions, i.e. the fact that F0 peaks are realized earlier, is expected given that in nuclear accents F0 peaks align earlier than in prenuclear accents (Hualde 2002).

Crucially, among non-final positions, no significant differences of percentages were found. In other words, F0 peaks are realized in a comparable location (as a percentage) into the stressed syllable across non-final positions. Differences due to position of the word (final vs. non-final) apply to both CV and CVC stressed syllables.

Regarding narrow focus declaratives, it was found that there is not a significant difference between the percentage into the syllable for focused words and non-focused words. That is, F0 peaks occur at a comparable location with respect to the syllable regardless of whether a word bears focus or not. This marks a contrast between PAS and other Spanish varieties, where typically we find a distinction in F0 peak location, between focused and non-focused words in narrow focus declaratives (de la Mota 1997, Face 2001a).

Interestingly, in contrastive focus declaratives, an interaction between focus and position of the word was reported. Specifically, percentage into the syllable of focused words in final position is higher than in non-focused words. That is, in final position, F0 peaks in contrastive focused words are realized later than in non-focused words. In non-final positions, however, the percentage in focused words is lower than in non-focused words. Namely, F0 peaks of contrastive focused words in non-final positions are realized earlier than non-focused words. In other Spanish varieties, such as Peninsular Spanish or Lima Spanish, F0 peaks in contrastive words (in non-final positions) tend to occur earlier than in broad focus words. Thus, these F0 peaks occur within the stressed syllable rather than after it (Beckman et al. 2002, Face 2002, O'Rourke 2005, García 2011, among others). This is exactly what we see in PAS contrastive focused words in non-final positions (i.e. early peaks in contrastive focused words), but crucially within the stressed syllable. In final position, F0 peaks of contrastive focused words are delayed, and thus not realized until later in the stressed syllable.

A possible explanation for this PAS behavior is the fact that, in final position, F0 peaks of broad focus and non-focused words are already realized early in the syllable, sometimes even in the onset, as it has been reported and discussed in Chapter 4 (§4.2.1). Therefore, if the presence of contrastive focus would prompt F0 peak retraction even further, F0 peaks may occur outside of (i.e. before) the stressed syllable. Thus, in order to avoid falling outside of the stressed syllable, but still marking contrastively focused words vs. non-focused ones, F0 peaks occur later in the syllable as a strategy to keep the contrastive focus meaning, and still remain within the boundaries of the stressed syllable.

By looking at percentage into the stressed syllable, I was able to identify this nuanced F0 peak behavior in PAS contrastive focus declaratives.

When F0 peak location was compared across the three types of declaratives, in non-final positions, percentage into the stressed syllable was significantly higher in broad focus words than in narrow or contrastive focused words. That is to say, F0 peaks in (narrow and contrastive) focused words occur much earlier in the stressed syllable than those in broad focus words. These percentages allow us to see details that a categorical analysis alone, i.e. within or after the stressed syllable, would have missed. Recall that the categorical analysis in this dissertation yielded no differences across focus types (see §4.2.1). Percentages, however, show that there is indeed a difference in F0 peak location. Now, this PAS pattern goes in the same direction as in other Spanish varieties: broad focus F0 peaks occurring later than narrow or contrastive focused F0 peaks. The only difference is that in PAS they all occur within the stressed syllable. It is also noteworthy that, in non-final positions, F0 peaks in narrow and contrastive focused words are not different in their location as a percentage into the stressed syllable. They occur at a comparable location. In final position, however, F0 peaks in contrastive focused words occur significantly later in the syllable than those in narrow focused words.

Turning to the analysis of percentage into the stressed vowel, the goal was to explore the effects of segmental information on the location of F0 peaks as a proportion of the vowel. Only those F0 peaks occurring within the stressed vowel were included in the analysis. For all types of sentences, syllable structure and position of word had significant effects on the percentage in all three focus types. Regarding syllable structure,

in broad focus declaratives, only in certain sentential positions percentage into the stressed vowel was higher (i.e. F0 peaks were realized later) in CVC syllables than in CV syllables. Similarly, only in narrow focused words, F0 peaks were realized later in CVC than in CV syllables. Among narrow non-focused words, F0 peaks were realized at a comparable location in both syllable types as a percentage into the stressed vowel. Only in contrastive focus declaratives, F0 peaks were realized later into the vowel in CVC syllables than in CV syllables. With regard to position of the word in a sentence, percentage into the vowel is lower in final position than in non-final positions. That is, F0 peaks occur earlier into the vowel in final positions than in non-final positions. These findings are expected, and mirror the results for percentage into the stressed syllable.

In contrastive focus declaratives, an interaction between focus and position of word was also found. Specifically, in final position, there were later F0 peaks into the vowel for focused words than for non-focused words. This finding is similar to that found in the analysis of F0 peaks as a percentage into the syllable. As discussed earlier, this may be a means to mark contrastive focus in PAS. Furthermore, in contrastive focus declaratives, number of words was also significant. As the number of words in a sentence increases, percentage into the stressed vowel decreases, and thus F0 peaks are realized earlier into the stressed vowel. This shows that the exact location of the F0 peak as a percentage into the stressed vowel is subject to change as number of words increases. Because number of words was used as a proxy for segmental duration, this finding may further suggest that F0 peaks are realized earlier into the vowel as vowel duration is lengthened.

When percentage was compared between all types of declaratives, no significant differences in the location of the F0 peaks as a percentage into the vowel were found. That is to say, type of focus did not affect F0 peak location into the vowel. These findings suggest that while there may be differences among F0 peak location into the *stressed syllables* between broad focus and narrow focused words, and between broad focus and contrastive focused words in non-final positions, F0 peak location into the *stressed vowels* does not show any distinction. Instead, F0 peaks maintain a similar location, and are realized at a comparable distance into the stressed vowel. These results will be further examined in §5.2 when I evaluate the Segmental Anchoring Hypothesis in relation to the present PAS data.

5.1.3 Rise Time

Several studies dealing with models of tonal alignment have examined the correlation between F0 rise time (i.e. the time between the F0 minima and F0 maxima) and duration. The discussion centers on whether or not there is a correlation between F0 rise time and the duration of the stressed syllable or a particular segment. In this dissertation, I explored the correlation between F0 rise time and stressed syllable duration, and between F0 rise time and stressed vowel duration, across the three types of declaratives. Separate analyses were carried out for F0 peaks located in non-final positions, and those located in final positions. A thorough discussion of these results in relation to the models of tonal alignment will be provided in a later section (§5.2). Here, I will present an overview of the major findings presented in Chapter 4.

Across all declaratives and the two sentential positions (i.e. non-final and final), positive correlations were found between F0 rise time and the duration of stressed syllables, and between rise time and the duration of stressed vowels. Namely, F0 rise time increases as the duration (of both the syllable and the vowel) increases. It is important to note that contrastive focus declaratives had correlations with the highest coefficients among the three types of declaratives (see §4.3.3). The correlation between F0 rise time and stressed vowel duration in narrow non-focused words, however, was not significant. This is likely due to the fact there was not significant variation in duration among stressed vowels in the first place (see §4.1.3). In narrow focused words, however, there was a significant positive correlation between F0 rise time and stressed vowel duration in non-final positions, but not in final position. This may be related to the fact that there were only 20 tokens of stressed vowels in final position included in the analysis. This low number of tokens may have prevented any type of statistical significance.

Overall these findings show that, at least in broad focus and contrastive focus declaratives, and to a lesser extent in narrow focus declaratives, positive correlations exist between F0 rise time and stressed syllable and vowel duration. These findings further suggest that, across PAS declaratives, F0 rise time is not fixed, but rather the time of the F0 rise depends greatly on duration of the syllable or vowel, and the location of the tonal events (i.e. F0 peak). I will further discuss the implications of these findings in section §5.2. where I assess the Segmental Anchoring Hypothesis in PAS.

5.1.4 Tonal Height

In this dissertation, tonal height was examined within each type of declarative as well as across the three types of declaratives. Within each type of declarative, the mean height of the initial F0 peak was consistently the highest when compared to the mean height in other positions. Moreover, in broad focus declaratives, the height of the initial F0 peak increased as the sentences became longer. The height of the final F0 peak, however, remained fairly constant regardless of the number of words in each sentence. This final peak was always the lowest peak of the sentence in broad focus declaratives. Therefore, in longer sentences, there is a wider range of F0 peak heights, which descends as the sentence progresses.

In narrow focus declaratives, F0 peaks in focused words are higher than non-focused words in the same position. It has been reported in other Spanish varieties that focused words tend to have higher F0 peaks than their non-focused counterparts (Toledo 1989, cf. Face 2000). Therefore, this finding in PAS follows the same trend as other Spanish varieties. In 4- and 5- word sentences, the F0 contour plateaus when the word bearing focus is in medial position. Specifically, in 4- and 5- word sentences, the F0 peak of the focused word matches approximately the height of the previous non-focused word creating an F0 plateau among these two peaks. In 3-word sentences, we find a similar plateau pattern when the word in focus is in final position. This finding suggests a different pattern in tonal height between broad and narrow focus declaratives. While in broad focus declaratives the F0 peak height lowers as the sentence progresses, in narrow

declaratives the F0 contour plateaus as long as the preceding word is not in initial position.

Similar to narrow focus declaratives, F0 peaks in contrastive focused words are higher than those in contrastive non-focused words in the same position. As mentioned before, this pattern is commonly found across several Spanish varieties. Additionally, in contrastive focus declaratives, when the word in medial position bears focus, the F0 peak largely surpasses the height of the preceding non-focused F0 peak. Only in 3- and 4-word sentences, when the final word bears focus, the F0 peak matches the height of the previous non-focused word, forming a plateau. This is yet another pattern, with regard to tonal height, that allows us to distinguish contrastive focus declaratives from broad and narrow focus declaratives.

When these results of the plateau effect in final position of contrastive focus declaratives are taken into consideration along with tonal alignment, it raises the question of whether or not F0 peak height is the only factor that distinguishes between narrow and contrastive focused words. In non-final positions, contrastive focused words are clearly marked because their F0 peaks surpass that of the preceding word, and this pattern is unique to contrastive focus declaratives. In final position, however, we find the same pattern in both narrow and contrastive focus declaratives; that is, F0 peak height plateaus with the preceding word. In final position, however, tonal alignment seems to distinguish between which type of focus is being used: narrow or contrastive. Specifically, in final position, F0 peaks are realized late into the stressed syllable in contrastive focused words. Therefore, within a contrastive focus declarative, either F0 peak height or F0 peak

location as a percentage into the syllable mark the contrast between focused and non-focused words. These findings suggest that tonal height marks the difference between focused and non-focused words in non-final position. In final position, however, F0 peak location helps marking contrastive focus. With these two acoustic manifestations, contrastive focused words can be differentiated from contrastive non-focused words, and from narrow focused words. More specifically, narrow focus declaratives employ a tonal height plateau, while contrastive focus declaratives mark focus through higher F0 peaks in non-final positions, and through tonal height plateaus in final position, with a later F0 peak. I will return to this issue in §5.3 during my analysis of phonological representations in PAS.

5.1.5 Insights from Spontaneous Data

The goal of the analysis of spontaneous data in this dissertation was to offer insights on the intonational patterns of PAS in a less controlled setting. Although limited in number of tokens, results from the spontaneous data showed consistencies with the results obtained in the reading task. The analysis of spontaneous data contained only 21 pitch accents. Nevertheless, the analysis of the spontaneous data seems to complement the findings reported in the reading task. Specifically, F0 peaks were realized consistently within the stressed syllable, regardless of focus type. Moreover, in 20 of the 21 tokens analyzed, F0 peaks were reached within the stressed vowel. Overall, the results from the spontaneous data confirm the analysis of the reading task presented in this dissertation.

Both methodologies have their own benefits. Sentences obtained in reading tasks, for example, are more controlled in nature, and the investigator can manipulate various factors such as stress patterns, syllable structure, sentential length, etc. Similarly, in the reading task, the number of tokens are often higher, and are potentially comparable among all speakers in the study, given that all speakers utter the same sets of sentences. On the other hand, spontaneous data is commonly considered a closer approximation to the actual speech patterns used by speakers, leading to possibly different results in the analysis of each type of data (cf. Lickley et al. 2005). In fact, differences in intonational patterns have been found between reading and spontaneous data (Hirschberg 1990, Refice et al. 1997, Grice et al. 1997, Face 2003, Henriksen 2009). Unlike these studies, I did not observe differences between the two different tasks, i.e. reading vs. interview, with regard to tonal alignment, as to whether the F0 peaks falls within the stressed syllable or after it. In fact, spontaneous data from the interview strengthened the results found in the reading task given that in all cases F0 peaks aligned with the stressed syllable.

In summary, results from spontaneous data in this dissertation show similarities with those findings reported in the reading task with respect to tonal alignment. My claim here is not to say that PAS spontaneous data as a whole is equivalent to laboratory (i.e. reading) data, as I only analyzed a low number of F0 peaks, in a very limited set of declaratives. Instead, the fact that in this small set of data I find comparable results to those found in the reading task highlights the benefits of using different methodologies when examining intonation. Additionally, spontaneous data from this study provide

support to the reliability of using reading tasks when studying intonation, as also claimed by Lickley et al. 2005. Nonetheless, further research in PAS will need to go beyond examining sentences extracted from interviews, as used in this dissertation, and rather find more elaborate techniques of eliciting (semi-) spontaneous data.

5.2 Evaluating the Segmental Anchoring Hypothesis in PAS

Before assessing how PAS data relates to SAH, it is important to recapitulate the basis of this hypothesis. The Segmental Anchoring Hypothesis suggests that tonal events (i.e. F0 minima or F0 maxima) anchor to specific segmental landmarks (Arvaniti et al. 1998). These specific landmarks, or ‘anchors’ could be, for instance, a vowel, a coda, or the onset of the stressed syllable. Without any external pressures, such as prosodic boundaries, tonal events consistently align with its anchor, regardless of syllable structure, segmental duration, or other segmental factors. SAH also predicts that F0 rise time is not constant. The opposite hypothesis, however, stipulates that there are no tonal anchors. Instead, the location of tonal events is influenced by different segmental factors. According to the Non-Segmental Anchoring Hypothesis, we can expect to find a fixed F0 rise time. Therefore, any variation in the segmental material may affect the location of tonal events with respect to the segmental string.

Most studies that examine tonal alignment with regard to these segmental anchoring hypotheses consider only the rising accents found in prenuclear positions of broad focus declaratives. Prosodic boundaries have an effect on F0 rising accents located in final position (Steele 1986, Silverman & Beckman 1990), and therefore particular

attention is paid to those pitch accents located in non-final positions as a way to avoid such boundary effects. As an example, Arvaniti et al.'s (1998) study considered tonal alignment only in prenuclear accents of broad focus declaratives. As detailed in Chapter 2 (§2.4), scholars examine SAH by exploring how changes in the segmental string (e.g. syllable structure, segmental duration, and speech rate) affect the location of F0 peaks. I now evaluate SAH based on the findings of PAS intonation reported in this dissertation. For each part of this discussion, I will begin by focusing on broad focus declaratives, because this has been the norm in previous literature on SAH. I will then expand on these findings to include my data on narrow and contrastive focus declaratives.

First, it is important to note that there are two ways to conceptualize the notion of ‘anchoring’. In previous studies, scholars have looked at F0 peaks consistently aligning with a particular segment—whether it be a vowel, a coda, or an onset. Another way to view an anchor, however, is to look more closely at the segment itself. If the F0 peak aligns consistently to a particular segment, we can explore whether it occurs at the same point within that segment, or whether it occurs in different locations throughout the segment. For example, if the coda serves as a segmental anchor, we can look within the coda to see whether the F0 peak is consistently realized at the beginning of the coda, or if it is realized in different parts of the coda. In my analysis of PAS data, I will evaluate both of these approaches to anchoring.

With regards to broad focus declaratives, around 87% of F0 peaks in prenuclear positions were realized within the stressed vowel, regardless of differences in number of words (as a proxy of segmental duration differences) and syllable structure (CV and

CVC). These findings show that the vowel serves as an anchor point for F0 peaks in broad focus declaratives. If we move beyond broad focus declaratives, the same pattern is also evident in narrow focus and contrastive focus declaratives. In 95% of the cases in narrow focused words, and in 99% of the cases in contrastive focused words, F0 peaks are realized within the stressed vowel. In non-final non-focused words of narrow and contrastive focus declaratives, there are also high rates of F0 peaks occurring within the stressed vowel (in narrow non-focused words, 89% in CV syllables, and 91% in CVC syllables; in contrastive non-focused words, 93% in CV syllables, and 81% in CVC syllables). Spontaneous data also showed categorical alignment with the vowel in prenuclear positions. These findings overwhelmingly support the conclusion that the vowel consistently serves as a segmental anchor in non-final positions, across different types of sentences. Overall, these findings give strong support for SAH in the present PAS data.

When we consider F0 peak location as percentage into the vowel, the support for SAH becomes less evident. Specifically, in broad focus declaratives, syllable structure affects F0 peak location as a percentage into the vowel in prenuclear positions. This finding is evidence that syllable structure conditions the location of the F0 peak within the vowel. In other words, there is clear evidence that F0 peaks align with the vocalic segment, but there is still variation within that segment that results from changes in syllable structure. When I examined other types of declaratives (narrow and contrastive), the same results emerged, although in narrow non-focused words no effects of syllable structure on F0 peak location were found. In narrow focused words, however, changes in

F0 peak location were reported. These findings show that across sentence types, the location of the F0 peak within the vowel is susceptible to change due to different syllable types. Examining F0 peak location as a percentage into the vowel allows us to test SAH in a more detailed manner, by exploring exactly what is occurring within the segmental anchor. In this case, the PAS experimental data shows that there is variation in peak location within the vocalic segmental anchor. These results do not match the predictions of SAH since, within the vocalic segmental anchor, there is an effect of segmental material, i.e. syllable structure, on the location of the F0 peak.

As stated earlier in this section, F0 rise time is another measurement that can be used to assess SAH. One of the predictions of SAH is that rise time is not fixed, but rather it varies so that F0 peaks can reach an intended anchor. In this dissertation, I examined correlations between F0 rise time and segmental duration in order to examine if F0 rises vary in time according to the length of the vowel. In the data, consistent positive correlations between rise time and vowel duration in non-final positions were found for broad focus and contrastive focus declaratives. Narrow focus declaratives' lack of correlation was likely due to the fact that vowel duration did not vary significantly. Overall, and with respect to broad and contrastive focus F0 peaks in non-final positions, these positive correlations show that F0 rise time is not constant. The fact that F0 rise time varies as segmental duration changes is evidence in favor of SAH; as segmental duration changes, the F0 peak continues to align with its anchor. These findings support SAH since F0 rise time is not constant; instead, it varies according to segmental length. The Non-Segmental Anchoring Hypothesis instead predicts that the F0 rise time would

remain fixed, and if there are segmental duration changes, then alignment would also change the precise location within the anchor where it takes place.

When all of these PAS data are considered together, there is strong support for SAH. Both categorical evidence (i.e. alignment to the vowel) and F0 rise time data support this hypothesis. I, therefore, argue that PAS data do support the Segmental Anchoring Hypothesis. I make this claim because in PAS there is anchoring to a segment, as explained in the hypothesis' definition. However, I also acknowledge the fact that using only a categorical approach to SAH may hide significant variation even within a particular anchor.

These findings are different from Prieto & Torreira (2007), who find no segmental anchoring in Peninsular Spanish.¹⁴ Their results show inconsistent alignment in their data: F0 peaks occur in the vowel in CV syllables, and in the coda in CVC syllables. Therefore, in Peninsular Spanish, there seems to be alignment with two distinct syllabic elements. PAS is different, however, in that there is consistent alignment to a single syllabic element: the vowel. Yet, the effects of segmental information (i.e. syllable structure) can still be observed within that anchoring segment.

Overall, PAS data suggest that by looking at categorical alignment to a segment alone, we may have an incomplete picture of how tonal alignment exactly works. I recognize that different methodological approaches may yield different results with

¹⁴ Prieto & Torreira (2007) also examine the effects of speech rate for SAH. The authors find that speech rate has an effect for peak location in Peninsular Spanish, but since I did not examine speech rate in the present PAS data, I am unable to compare the two studies on those grounds.

regard to SAH. That is, depending on how the data is analyzed, results can either support or refute SAH. In the present PAS data, tonal alignment to a segment as a categorical location supports SAH, but results on tonal alignment measured as a percentage into the syllable or vowel, as used in this dissertation, seem to go against SAH (i.e. there is variation in the location of the F0 peak *within* the vowel) or at least complicate the basic definition of SAH.

Another issue to consider is how flexible SAH can be with regard to its predictions. As stated earlier in this section, most studies examining SAH explore prenuclear accents of broad focus declaratives. Interestingly, PAS data have shown that even in the presence of a segmental anchor (i.e. the vowel) for broad focus declaratives, different alignment targets may also emerge for narrow/contrastive pitch accents within the same vowel. This suggests that even though the segmental anchor is the same for the three different types of declaratives, they are in fact distinguished by where exactly in that vowel the alignment is reached. This should be taken into consideration in future works or revisions of SAH.

More precisely, subsequent studies will need to define ‘anchor’, and also which methodologies are more appropriate to assess SAH. We need to determine if we define anchoring with reference to a segment (e.g. vowel, onset), or if we conceive of it as an exact location into the segment, by either measuring how far from a particular landmark tonal events occur, or by considering it as a percentage into a segment. The present dissertation shows that, in PAS, depending on the level of precision used in the method of analysis, we could find different results regarding SAH.

5.3 Revisiting the Phonological Representations of PAS Rising Accents

As described in Chapter 2 (§2.3.1), the phonological representations of Spanish pitch accents have stood out as one of the most discussed topics in Spanish intonation in the past two decades. In the current version of Sp_ToBI, three rising accents have been proposed for all Spanish varieties: L^*+H , $L+H^*$, and $L+>H^*$ (Estebas-Vilaplana & Prieto 2008). The graphs shown in Chapter 2 are repeated in Figure 37 below for convenience.

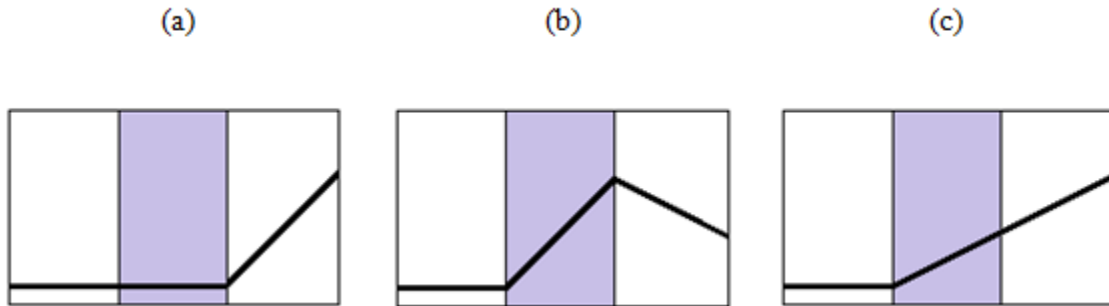


Figure 37: 3-way distinction in Spanish rising accents. L^*+H (graph a), $L+H^*$ (graph b), and $L+>H^*$ (graph c).

The intonational patterns of PAS rising accents reported in this dissertation constitute a challenge for the current proposal of Sp_ToBI. I have shown that across broad, narrow, and contrastive focus declaratives, the F0 contour of each pitch accent rises during the stressed syllable, and crucially reaches its peak during the stressed syllable. Contrary to other Spanish varieties, such as Peninsular Spanish or Lima Spanish, where the location of the F0 peak (i.e. after or within the stressed syllable) can distinguish between a broad focus word from a narrow or contrastive focused word (cf.

Willis 2003), in PAS this particular distinction is not found. Rather, the lateness in F0 peak location typical of broad focus declaratives only occur when F0 peak location is measured as a proportion into the stressed syllable. Namely, F0 peaks in broad focus declaratives are realized later than those in narrow/contrastive focused words, but in both instances F0 peaks occur within the temporal boundaries of the stressed syllable. When F0 peak location is measured as a percentage into the stressed syllable, only then significant differences emerge between broad and narrow focused words, and between broad and contrastive focused words. Furthermore, there are later peaks in broad focus words when compared to narrow and contrastive focused words, but there is no difference between narrow and contrastive focused words.

I have shown in this dissertation that F0 peak location (as a percentage into the stressed syllable) can distinguish between broad and narrow/contrastive focused words. However, no difference between narrow and contrastive focused words can be reported since, in the current data, F0 peaks in narrow and contrastive focused words occur at the same location within the stressed syllable. Crucially, broad focus words and narrow/contrastive focused words do show differences. Phonological representations in Sp_ToBI, however, do not take into consideration F0 peak location as a percentage into the syllable, but rather whether F0 peaks fall within or outside of the syllable (cf. Willis 2003). Thus, there is no means in the current Sp_ToBI system that accounts for variation in F0 peak location within the stressed syllable. In what follows, I will first review the current phonological representation proposed for PAS (García 2011), and will detail the

advantages and shortcoming of this proposal. I will then assess two alternatives to the issue of phonological representations for PAS rising accents in light of the present data.

As discussed in §2.3.2.2, one of the main conclusions in my early work on PAS declaratives was the need to include a tritonal pitch accent, $L+H^*+L$, in order to phonologically account for the intonational patterns of PAS rising accents in narrow and contrastive focused words (García 2011).¹⁵ In that study, I noted that the most preferred pitch accent for PAS broad focus declaratives was $L+H^*$. Specifically, this pitch accent denotes that F0 peaks occur within the temporal boundaries of the stressed syllable (see graph b in Figure 37). This was true for both prenuclear and nuclear accents. When examining narrow and contrastive focus declaratives, however, I found that in narrow/contrastive focused words F0 peaks also occurred within the stressed syllable. One crucial difference, however, was that in narrow and contrastive focused words the realization of the F0 peaks occurred much earlier than in broad focus words. Since in narrow and contrastive focused words, F0 peaks were also realized within the stressed syllable, the pitch accent $L+H^*$ was first considered as a possible phonological representation. However, narrow/contrastive focus declaratives convey different pragmatic meanings than broad focus declaratives. While in the former only one word in the sentence is highlighted, i.e. the focused word transmits new information, in the latter no word is highlighted more than the others, and the entire sentence contains new

¹⁵ In García (2011), the tritonal pitch accent was actually represented as $L+H^*]\sigma+H$, following Face & Prieto's (2007) analysis. In the present discussion, however, I use the current labeling notation of Sp_ToBI (Estebas-Vilaplana & Prieto 2008) to refer to this tritonal pitch accent, $L+H^*+L$. Both representations, however, denote the same pattern.

information. This observation led me to consider, and eventually propose, a tritonal pitch accent for cases of narrow and contrastive focused words in PAS. The pitch accents in Sp_ToBI (see Figure 37) were not able to represent those PAS patterns; particularly, the early realization of the F0 peak, and the occurrence of the rise and fall within the stressed syllable.¹⁶ Figure 38 below shows a schema of the tritonal pitch accent. The bolded line represents the F0 pitch contour, and the shaded region indicates the stressed syllable.

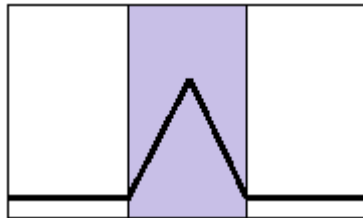


Figure 38: A schema of the F0 contour in the tritonal pitch accent proposed for PAS (García 2011).

Similar F0 behavior was found in Argentine (Porteño) Spanish for cases of narrow/contrastive focused words, and words with emphatic reading (Gabriel et al. 2010). Gabriel et al. propose a tritonal pitch accent to phonologically account for this F0 pattern. The authors describe this tritonal pitch accent as a rising accent where “the peak is preceded and followed by a valley, i.e. the F0 contour rises and fall within the metrically

¹⁶ It must be noted here that in García (2011), I used the same tritonal pitch accent for cases of narrow and contrastive focused words because the F0 peaks in both contexts were realized much earlier than those in broad focus words, and the F0 contour started to fall in the same stressed syllable. I did not observe any difference in F0 peak location between narrow and contrastive focused words. In fact, I argued that the difference between narrow and contrastive focused words was related to tonal height.

strong syllable” (291). It is important to recall here that, in these two varieties (PAS and Argentine Spanish), a high percentage of F0 peaks realized within the stressed syllable occurs in broad focus declaratives. Therefore, one could argue that, in order to mark a focal accent in varieties such as PAS and Argentine Spanish, the realization of the F0 peak within the stressed syllable is not as crucial as the actual F0 movement (i.e. rise and fall) within the temporal boundaries of the stressed syllable. Yet, what distinguishes PAS from Argentine Spanish with regard to this tritonal pitch accent is the fact that Gabriel et al. report its occurrence in final position of focus declaratives. In all figures that they present in their study, this tritonal pitch accent hardly appears in content words located in prenuclear positions. In García (2011), however, I showed instances of this tritonal pitch accent in content words located in subject, verb, and object position of SVO declaratives. Moreover, in the present data, I have found additional evidence of this F0 rise-fall movement within the stressed syllables in non-final position. Figure 39 below shows an instance of a contrastive focused word in the sentence *Miranda revende la lavanda* (‘Miranda resells the lavender’), produced by speaker PAS02. In this sentence, the word *revende* bears contrastive focus. Figure 39 shows the F0 contour in the upper section of the graph. The first tiers below the F0 contour represents the tones tier, where F0 peaks are marked with an H, and F0 valleys (i.e. the start of the F0 rise) with a L. The numbers next to them represent their position in the sentence (i.e. 1 = initial, 2 = medial, 3 = final). Below the tones tiers, the stressed vowel, the stressed syllable, the content words, and the sentence are transcribed orthographically and segmented accordingly. For the sake of clarity, the stressed syllable (-ven-) of the focused word is highlighted. We can

observe the rise-fall movement of the F0 contour within the stressed syllable of the contrastive focused word.

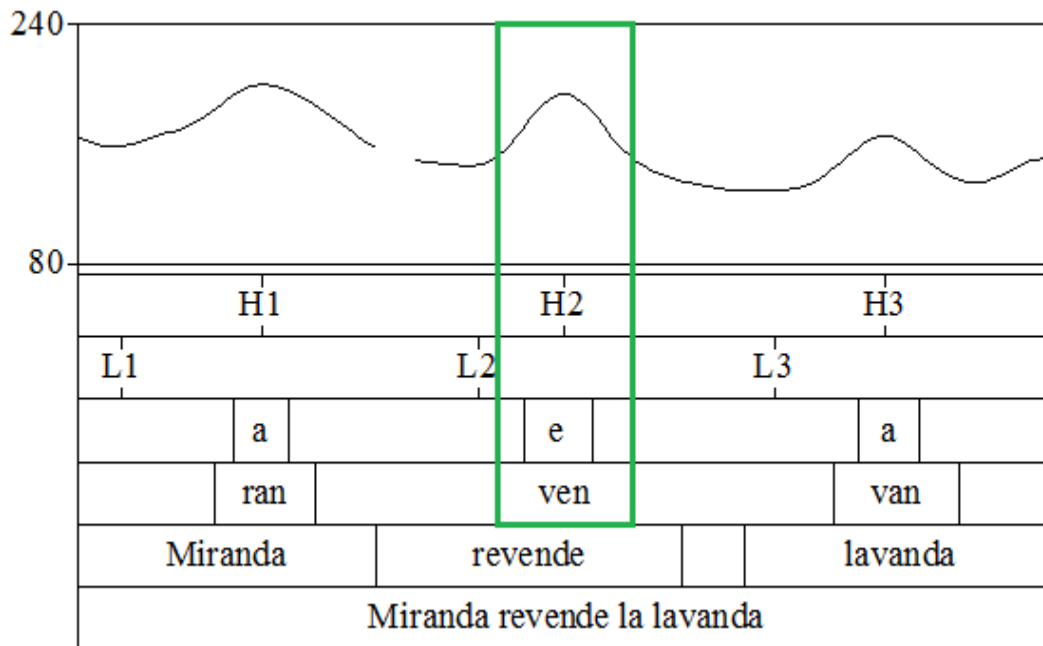


Figure 39: F0 contour of a contrastive focus declarative uttered by speaker PAS02.

As described in §2.3.2.3, the addition of a complex accent unit such as the tritonal pitch accent into the inventory of pitch accents has already been evaluated in other languages (Gili-Fivela 2002 for Pisa Italian, Ferreira 2009, for Brazilian Portuguese, Kügler 2014, for Swabian German). However, scholars have addressed the issue of how to explain this F0 pattern without the need to postulate such a complex pitch accent. One of the main reasons to avoid a tritonal pitch accent is its inherently tonal complexity, i.e. the presence of three tones in one pitch accent. In a system of prosodic annotation where only monotonal and bitonal pitch accents exist, a tritonal pitch accent results in a

problematic solution. Moreover, and particularly for Spanish varieties, questions emerge about the validity and the strength of newly proposed pitch accents and boundary tones based exclusively on the phonetic realization of F0 contours, without assessing meaningful contrasts among the pitch accents (Sosa 2003, Face 2014). The concern is whether scholars conceive these phonological representations solely as phonetic descriptions of the F0 contours, or instead if these phonological representations indeed mark a contrast in meaning in a given language or variety. Particularly for PAS and Argentine Spanish, the fact that in broad focus words the F0 rise and the F0 peak need to occur within the stressed syllable, but for narrow/contrastive focused words, the F0 rise and the F0 peak, as well as the F0 fall, need to occur within the stressed syllable (see Figure 39), suggests that these two F0 contours are not only phonetically distinct, but also that they are phonologically contrastive. They convey different meanings. This gives further support for the addition of the tritonal pitch accent to the Sp_ToBI repertoire of rising accents.

One first alternative to the tritonal pitch accent representation is the presence of an intermediate phrase L-. This alternative, put forth by Nibert (2000) and Hualde (2002) for (Peninsular) Spanish, indicates that the presence of an intermediate phrase after the bitonal pitch accent (or after H* in Nibert 2000) is responsible for the lack of F0 displacement to the post-stressed syllable in cases of focused words. According to Nibert and Hualde, there is no need to posit a focal pitch accent. One advantage of this proposal is the fact that the use of an intermediate phrase avoids the complexity of a tritonal pitch accent. In addition, it employs a phrase accent, an existing element in the annotation

system of intonation. Under this proposal, stressed syllables in a broad focus word in PAS would bear the bitonal pitch accent, L+H*, whereas stressed syllables in a narrow/contrastive focused word would bear the same bitonal pitch accent, followed by a low intermediate phrase, i.e. L+H* L-. This low intermediate phrase could also explain the immediate fall of the F0 peak commonly found in focused words (Face 2002).

There are, however, issues related to this alternative. First, the proposal does work well with those varieties such as Peninsular Spanish, where the location of the F0 peak, i.e. after or within the stressed syllable, in declaratives is central to distinguish between broad and narrow/contrastive focus. As shown in this dissertation, the distinction based on F0 peak location with respect to the stressed syllable is not found in PAS, or in Argentine Spanish. In PAS, F0 peaks are realized within the stressed syllable across the three types of declaratives, but what seems to matter is the rise-fall movement within the stressed syllable in cases of narrow/contrastive focused words. This proposal of the intermediate phrase boundary does not account for the fact that there is a rise-fall movement within the stressed syllable of a focused word. Instead, it emphasizes that the F0 peak is retracted toward the left. The second problem of this proposal is that the presence of an intermediate phrase boundary would be accompanied, at least in some cases, by a pause after the focused word. Although it might occur in other varieties, no such pause was found in my PAS data. Finally, and most compelling perhaps, is the fact that the use of this intermediate phrase boundary would result in only one pitch accent for PAS: L+H*. Research in other Spanish varieties has shown that narrow/contrastive focus is indeed denoted by a distinct phonological representation, and therefore we can expect

that PAS and Argentine Spanish would also have distinct phonological representations for broad and narrow/contrastive focused words. This distinction would be lost if only one pitch accent were posited for PAS or Argentine Spanish.

A second alternative to the tritonal representation was suggested in the examination of vowel duration in PAS declaratives by García (2014) (see §2.3.2.3). In this previous work, I found that, in broad focus declaratives, PAS has phonetically longer stressed vowels than Lima Spanish. This observation led me to hypothesize segmental duration as a factor responsible for the alignment of the F0 peak with the stressed syllable, at least in PAS broad focus declaratives. Therefore, by having longer segments, the F0 contour may have more time to reach its peak within the stressed syllable. In other words, F0 peaks in PAS broad focus declaratives have their target after the stressed syllable, as in other varieties, but the long duration of their segments causes the tonic alignment of the F0 peak. Thus, the bitonal pitch accent, $L+>H^*$, may indicate that F0 peak displacement to the post-stressed syllable. On the other hand, for cases of narrow/contrastive focused words, the bitonal pitch accent $L+H^*$ may indicate the previously reported alignment of the F0 peak with the stressed syllable in other Spanish varieties (Face 2001a, Beckman et al. 2002, O'Rourke 2005, among others, cf. Willis 2003).

García's (2014) proposal suggests that the F0 rise in PAS broad focus pitch accents is constant. Therefore, the distance between the tonal events (i.e. L and H) in a pitch accent may be temporally fixed, and long segments trigger the realization of F0 peaks within the stressed syllable. Yet, in this dissertation, it has been shown that, in PAS

broad focus declaratives, F0 rise time is not constant (see §4.3.1). This finding lends evidence against García's proposal. Furthermore, the fact that changes in the number of words in a sentence, which serves as a proxy of segmental duration, was not a significant factor in the F0 peak location of PAS broad focus declaratives (§4.2.1.1 and §4.2.2.1) further rejects García's hypothesis. In conclusion, I claim that the intonational patterns found in PAS broad focus declaratives obey to a particular intonational, rather than segmental, characteristic of this variety. Second, I recognize the coexistence of these two features in PAS: phonetically long vowels and tonic alignment, but I have not found any evidence to support a cause-effect relationship between the two.

Overall, in this dissertation, I maintain the need to include a tritonal representation to account for cases of narrow and contrastive focused words. This representation (as proposed by Gabriel et al. 2010 and García 2011) captures the rise-fall movement within the stressed syllable that is found in narrow and contrastive focused words. This phonological representation best describes the pattern found in PAS, and could also be used to represent the behavior observed in other varieties, such as Argentine Spanish. Thus, although this tritonal pitch accent is currently not present in the Sp_ToBI repertoire of rising pitch accents, there is compelling evidence that it should be added in future revisions.

My proposal involves a bitonal pitch accent for PAS broad focus—namely, L+H*, and one tritonal pitch accent for narrow and contrastive focused words, L+H*+L. In this tritonal unit, the second low tone signals that the fall after the high tone needs to start in the stressed syllable. Thus, this second low tone represents the immediate F0 fall

in the contour after reaching its peak. Furthermore, the presence of this second low tone emphasizes that the rise-fall movement in the F0 contour, crucial for cases of focused words, occurs within the stressed syllable. Additionally, based on analyzed data in the present dissertation, there is no reason to believe that narrow and contrastive focused words have different phonetic manifestations with regard to tonal alignment. In both cases, F0 peaks are realized at a comparable location within the stressed syllable, and both show evidence of a rise-fall movement within the stressed syllable. There is, however, a difference between narrow and contrastive focus words with regard to tonal height patterns, but the current Sp_ToBI system cannot address (yet) meaningful contrast in tonal height. The addition of a tritonal pitch accent and the inability to account for meaningful contrast of pitch accents through tonal height suggest that the Sp_ToBI system may need to reassess its repertoire, and expand in order to account for patterns found in newly studied varieties of Spanish.

Chapter 6: Conclusions

The main goal of this dissertation was to examine tonal alignment of rising accents in Peruvian Amazonian Spanish (PAS) as spoken in the city of Pucallpa. I collected production data from 13 monolingual PAS speakers in two different tasks: a reading task and an interview. In the reading task, speakers produced broad, narrow, and contrastive focus declaratives. In the interview, speakers were asked to talk about a particular topic for one or two minutes. I then performed acoustic and statistical analyses of the reading task data, focusing on three dependent variables: F0 peak location (both as a categorical and a continuous variable), F0 rise time, and F0 peak tonal height. The independent variables were: number of words (as a proxy for segmental duration), syllable structure, position of the word, and focus type. I then used the findings from the reading task to assess the Segmental Anchoring Hypothesis in PAS, as well as to revisit the current phonological representation of PAS rising accents.

6.1 Evaluating the Research Questions

My first research question involved the effect of segmental information on tonal alignment in Peruvian Amazonian Spanish (PAS) rising accents. I predicted that all F0 peaks in PAS will be realized within the temporal boundaries of the stressed syllables, regardless of segmental duration, syllable structure, position of the word, and focus type.

I made this prediction based on my previous work in PAS (García 2011). Results in this dissertation support my hypothesis since in over 98% of the cases, F0 peaks were realized within the stressed syllable across the three types of declaratives.

A second prediction was that F0 peaks align with a particular syllabic element—the stressed vowel, regardless of segmental information. This prediction was also correct since, across the three types of declaratives, most F0 peaks were realized within the stressed vowel, irrespective of number of words in a sentence (proxy of segmental duration), syllable structure, or focus type. It was also hypothesized that, in final position, some F0 peaks could be realized in the first part of the stressed syllable—the onset, given that prosodic boundaries such as the end of the intonational phrase may retract the F0 peak (Hualde 2002). Results corroborated this prediction as they showed that, although most F0 peaks were realized within the stressed vowels, F0 peak alignment with the onset was found in final position.

Tonal alignment in this dissertation was also examined as a continuous variable: as a percentage into the stressed syllable and the stressed vowel. Examining tonal alignment as a continuous variable, I predicted that F0 peak location measured as a percentage would not be significantly different among focus types (i.e. broad, narrow, and contrastive). When considering percentage into the syllable, results showed that F0 peaks in broad focus words were realized significantly later than those in narrow and contrastive focused words in non-final position. No differences were found between narrow and contrastive focused words. There was a difference, however, between the three types of focus in final position. When examining percentage into the stressed

vowel, there were no significant differences between the three types of focus in non-final position. There was, however, significant differences in F0 peak location as a percentage into the vowel in final position. Overall, these results partially supported my predictions.

Regarding my first research question, I aimed to explore whether evidence from PAS provides support for the Segmental Anchoring Hypothesis or the Non-Segmental Anchoring Hypothesis. Results in this dissertation showed that the stressed vowel serves as a segmental anchor for all declaratives, since most F0 peaks align with the stressed vowel, regardless of segmental information. Thus, the present PAS data provide supportive evidence for SAH. This is further supported by results from the F0 rise time analysis. These results showed that overall F0 rise time in PAS is not fixed or constant (as commonly predicted by SAH). This evidence, i.e. F0 peak location as a categorical variable and F0 rise time, represents strong support for SAH, and differs from what has been claimed for other Spanish varieties such as Peninsular Spanish (Prieto & Torreira 2007). Nonetheless, closer examination of tonal alignment within the stressed vowel (i.e. as a percentage) showed variation in the location of F0 peaks even within the segmental anchor.

My second research question deals with the phonological representation of PAS rising accents. In this dissertation, I claim that PAS declaratives can be best analyzed using two different phonological representations: one for broad focus and narrow/contrastive non-focused words, and one for narrow/contrastive focused words. For broad focus and narrow/contrastive non-focused words, the representation is a bitonal pitch accent, L+H*. For narrow and contrastive focused words, the representation is a

tritoneal pitch accent, L+H*+L. Both of these pitch accents indicate that the F0 peak is realized within the stressed syllable. However, the tritoneal pitch accent denotes that there is an F0 rise and fall within the temporal boundaries of the stressed syllable. I also claim that the distinction between narrow and contrastive focus declaratives is evident through differences in tonal height. Finally, my proposal in this dissertation highlights the fact that the current Sp_ToBI cannot account for newly intonational patterns found in understudied varieties such as PAS. Thus, the Sp_ToBI system may need to continue developing in tandem with new data from a wide range of Spanish varieties.

Lastly, the third research question in this dissertation sought to compare results from laboratory (i.e. reading) and spontaneous data regarding tonal alignment. Overall, the analysis of PAS declaratives in the interview task revealed similarities with those findings reported in the reading task. In both tasks, F0 peaks were realized within the stressed syllable. Furthermore, most F0 peaks in the spontaneous data aligned with the stressed vowel, even when they were part of CVC stressed syllables. In this dissertation, PAS spontaneous data corroborated the findings of the reading task, which on the one hand emphasizes the benefits of using multiple tasks, and on the other hand validates the use of reading tasks when examining intonation. For PAS declaratives, the present study represents the first attempt to describe their intonational patterns in a less controlled context. More broadly, it also adds to the body of research that examines intonation using spontaneous data.

6.2 Contributions

The present dissertation makes several contributions to the field of Hispanic Linguistics. First, it adds to the research on Spanish phonetics and phonology, and more specifically, on tonal alignment and intonational phonology. With regards to tonal alignment, this work shows the importance of considering each variety of a language on its own right, since it has been shown here that the predictions of a model do not necessarily apply to all varieties in a language. The present work also contributes to the ongoing research on Spanish intonation, by offering new data and providing suggestions on how to best refine our current repertoire of phonological representations of Spanish rising accents. Furthermore, this dissertation highlights the importance of incorporating both reading and spontaneous data in our study of intonational phenomena. By using experimental data, we can reevaluate, and when necessary, modify current theories in linguistics.

This dissertation also contributes to Spanish dialectology and to our overall understanding of the diversity in Peruvian Spanish. Particularly in the area of intonation, this dissertation adds to the recent work on the three main varieties of Peruvian Spanish (O'Rourke 2005, 2012; García 2011; Elías-Ulloa 2015). As shown in previous works and in this dissertation, PAS shares at least one intonational feature with Andean Spanish (from Cuzco). Namely, both PAS and Andean Spanish exhibit F0 peak alignment with the stressed syllable in prenuclear accents of broad focus declaratives. This feature sets them apart from Lima Spanish. This finding can provide us with a fresh look at the classification of Peruvian Spanish. Based on phonological features, for example, Escobar (1978) groups together Amazonian Spanish and Lima Spanish under the label “No-

Andean Spanish”. Ramírez (2003), on the other hand, argues that each variety is distinct from each other. Nonetheless, Ramírez claims that Amazonian Spanish and Andean Spanish are much closer to each other, not only linguistically but also socioculturally. Based on recent work on intonation in Peruvian Spanish, it is reasonable to agree with Ramírez, and suggest that PAS and Andean Spanish have more similarities at the intonational level. While this is true at least for broad focus declaratives, there is still much work to be done in Peruvian Spanish intonation in order to fully characterize the intonation of the three main Peruvian Spanish varieties. Last but not least, this dissertation also contributes to the recent boom of studies on Amazonian Spanish, by providing a meticulous description of the PAS intonational system. By doing so, the present work continues the recent efforts of scholars working in this variety of placing PAS among other more studied varieties in the field of Hispanic Linguistics.

6.3 Future Research

This dissertation represents a stepping stone for future studies, not only in PAS but in Spanish intonation more broadly. In this dissertation, I have looked at F0 peak location with regard to the assessment of the Segmental Anchoring Hypothesis. Further examination will need to determine the exact location of the preceding F0 valley as well. Incorporating both tonal events in our analysis of tonal alignment would help us obtain a more complete picture of the pitch accent as a whole. In most varieties of Spanish, the F0 valley occurs within the vicinity of the stressed syllable (c.f. Willis 2003). In this dissertation, I assumed this to be the case based on my previous work on PAS and the

previous literature. However, it is also a possibility that the F0 valley could be anchored to a specific location in the segmental string. These issues remain to be explored in future studies.

There are also other ways in which we can further explore tonal alignment in PAS. For example, it would be stimulating to attest whether or not the claims made in this dissertation about PAS are supported in subsequent research in other cities in Peru's Amazonian region. As many Amazonian Spanish scholars agree, there is more than one PAS variety. Therefore, it would be interesting to see if there are differences in the tonal alignment of the PAS spoken in other major Amazonian cities such as Iquitos or Puerto Maldonado. Related to this point, it would also be helpful to collaborate with a native PAS speaker, who with the proper training, would assist me with the interviews. This may allow speakers to speak more naturally because the interviewer may not be seen as an outsider. As detailed in Chapter 3 (§3.2), I interviewed 40 speakers, but only was able to include the analysis of 13 of those speakers. I struggled in two main ways when collecting data. Some speakers did not complete the tasks, and others were less comfortable with the interview, and thus were less inclined to speak naturally. Another possible way to avoid these problems in future studies would be to have shorter tasks (i.e. fewer sentences), but collect usable data from more speakers.

An additional area for future investigation is to examine sentences with various other pragmatic meanings. Elías-Ulloa (2015), for example, suggests that PAS may have different patterns in declaratives than in interrogatives (e.g. yes-no questions). Although foundational work on PAS intonation has focused primarily on declaratives, it is also

important to explore other sentences as well. Moreover, additional data from other types of sentences will allow us to obtain a wider understanding of PAS intonation.

It would also be interesting to explore how the distinction between declaratives plays out at the perceptual level. Foundational work on PAS has allowed us to have a basic understanding of PAS intonational patterns. A second step in the future would be to complement production data with perception studies. A perception task would allow us, for instance to determine whether there is a phonological contrast in the perception of the speaker between broad, narrow, and contrastive focus declaratives. For example, one can manipulate audio recordings from PAS to have the phonetic characteristics of a particular declarative type. A PAS speaker would then have to assess the appropriateness of that recording, given a particular prompt. These tasks would let us explore phonological contrasts from a perceptual standpoint. Additionally, this type of work would enable us to further explore the role of tonal alignment in PAS.

Lastly, another path for future research is the effects of Amazonian languages on PAS intonation. Although many speakers of this variety are monolingual Spanish speakers, it is possible that Amazonian languages has influenced the Spanish spoken in this region. Historically, Spanish has been in contact with various Amazonian languages. In Pucallpa, for instance, the contact has been primarily with the Shipibo-Konibo language, but in other cities the contact languages are different. Elías-Ulloa (2015) has started this research in Pucallpa examining yes-no questions spoken by monolingual PAS speakers, bilinguals (Shipibo-Konibo Spanish), and Shipibo-Konibo speakers. By further exploring the prosodic system of Amazonian languages, we can better assess the

likelihood of Amazonian languages' impact on PAS intonation. This type of work would also place PAS at the same level of other Spanish varieties (such as Argentine Spanish, Basque Spanish, Cuzco Spanish, Yucatan Spanish) where language contact is part of the conversation when examining their intonational patterns. In conclusion, this dissertation continues bringing PAS to the foreground as a variety of future investigations.

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Appendix A: Stimuli for Reading Task

Target sentences with CV stressed syllables

Set 1

Donaba la corona.

Lorena donaba la corona.

Lorena donaba la corona con manera.

La señora Lorena donaba la corona con manera.

Set 2

Valora la novela.

Manola valora la novela.

Manola valora la novela por dinero.

La señora Manola valora la novela por dinero.

Set 3

Revela la melena.

Ramona revela la melena.

Ramona revela la melena con demora.

La señora Ramona revela la melena con demora.

Target sentences with CVC stressed syllables

Set 4

Divulga la demanda.

Yolanda divulga la demanda.

Yolanda divulga la demanda de Ronaldo.

La cobarde Yolanda divulga la demanda de Ronaldo.

Set 5

Revende la lavanda.

Miranda revende la lavanda.

Miranda revende la lavanda de Dominga.

La cobarde Miranda revende la lavanda de Dominga.

Set 6

Demanda la milonga.

Belinda demanda la milonga.

Belinda demanda la milonga de Rolando.

La cobarde Belinda demanda la milonga de Rolando.

Additional target sentences produced only by one speaker

Set 7

Remanda la redonda.

Melinda remanda la redonda.

Melinda remanda la redonda de Domingo.

La cobarde Melinda remanda la redonda de Domingo.

Set 8

Negaba mi modelo.

Manola negaba mi modelo.

Manola negaba mi modelo con remedo.

La señora Manola negaba mi modelo con remedo.