

Thesis Project:

Intonational development and yes-no questions: Evidence from Puerto Rican and Peninsular Spanish

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Abstract:

The purpose of this thesis is to investigate how children acquire the intonational contours that are used to encode yes-no questions in their different forms in Peninsular and Puerto Rican Spanish. This will be done through the analysis of longitudinal data of four children and their caretakers. Therefore, both child production and child-directed speech (CDS) will be analyzed in this thesis.

Just a handful of studies have investigated the acquisition of intonation using the Autosegmental Metrical (AM) model (Pierrehumbert 1980; Ladd 1996; Jun 2005). This model allows for a principled analysis of intonational contours, allowing for the comparison of nuclear configurations, which are known to be a perceptually salient indicator of the pragmatic meaning of an utterance. The two dialects to be investigated are fundamentally different in the direction of the intonational contour used for broad focus yes-no questions. Peninsular Spanish typically uses a fall-rise ( $L^* HH\%$ ) while Puerto Rican Spanish prefers a rise-fall ( $iH^* L\%$  or  $iH+L^* L\%$ ).

While many studies claim that intonational development is heavily dependent on the ambient language, other researchers believe that intonational development is largely constrained by physiological factors (Lieberman 1967; Kent & Murray, 1982; Snow 2002, 2006; Lleó et al. 2004). It is often argued that some contours (falling) are easier to acquire than others (rising). Because the two aforementioned dialects allow for analysis of both falling and rising contours, any issues with contour direction during the path of acquisition should become apparent. Based on preliminary research showing that at least in PRS, caretakers modify the input at different points during the acquisition path, I will investigate the entire course of acquisition. Both CDS and child speech are investigated looking at intonational development over time (various points in the corpus) as well as overall.

The data will be discussed within the tenets of the constructionist framework, which allows for a usage-based account of grammar. This framework has not been used previously to account for intonation for adults or children, and this thesis is novel in its attempt to do so. The study will be relevant not only to linguists, but also to developmental psychologists and speech pathologists.

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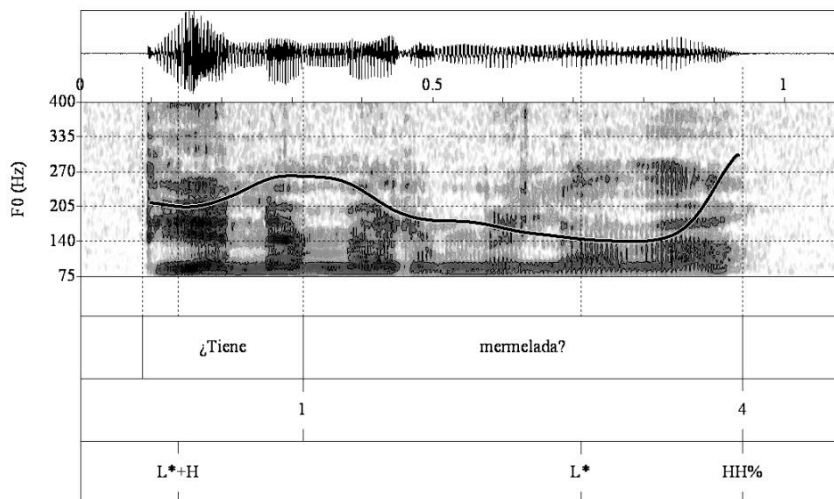
## **1. Introduction**

### **1.1. Project goals**

There is a small but emerging body of literature concerned with first language acquisition and the development of intonational grammar (Prieto & Vanrell 2007; Fikkert & Chen 2007; Frota 2008; Prieto et al. submitted). These seminal studies show that children master the basic patterns of their respective languages in their early production. For instance, Prieto et al. (submitted) conclude that from the onset of meaningful speech, the Catalan- or Spanish- acquiring children they studied were producing basic, phonologically distinct  $f_0$  contours of their ambient language. These accounts have all been carried out using the Autosegmental Metrical framework (Pierrehumbert, 1980; Ladd 1996/2008; Gussenhoven 2004; Jun 2005) for intonation, facilitating cross-linguistic and cross-dialectal analysis. The use of the AM framework also allows for a more principled account of how children progress through intonational development than has been posited in earlier studies. The present research aims to compare specifically the acquisition of yes-no questions by toddlers, using longitudinal data from two dialects of Spanish: Peninsular and Puerto Rican. How do children from these dialects use the input to acquire the various intonational contours available in their dialect for yes-no questions?

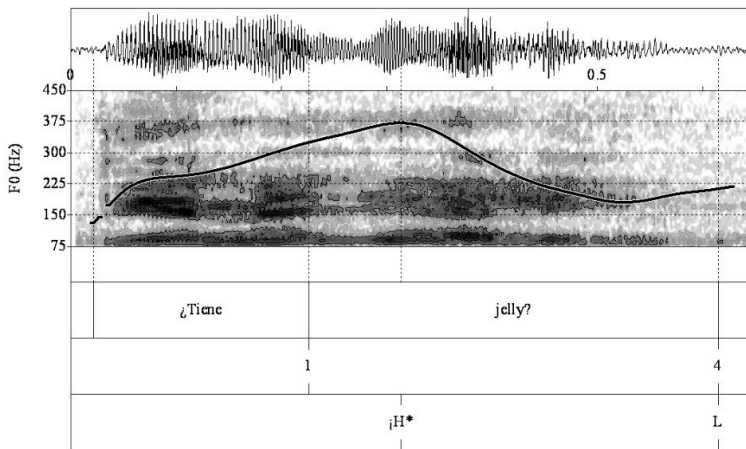
Traditional accounts of Spanish intonation describe these dialects as differing fundamentally in terms of the general direction of the pitch contour (Quilis 1987; 1993; Sosa 1999). Sosa (1999) outlines a "Caribbean vs. non-Caribbean" distinction such that Caribbean dialects present a final rise-fall, and non-Caribbean dialects present a final

fall-rise.<sup>1</sup> The chapters on Peninsular Spanish (PS) and Puerto Rican Spanish (PRS) in Prieto & Estebas-Vilaplana (2010) and Armstrong (2010a) also reveal fundamental differences in contour type shown in Figures 1 and 2, so that the PS contour is characterized by a rise from a low tone, while the PRS contour is characterized by a fall from a high tone. The typical PS contour is labeled L\* HH% within the current Sp\_ToBI system, phonetically realized as a low plateau during the last accented syllable followed by a rise to a high level. For the same pragmatic use, the contour in PRS is always realized with a fall: ¡H\* L%. This final fall is realized as a high plateau in the nuclear accented syllable followed by a low boundary tone. Figure (1) and (2) show the fundamental differences in the direction of the contours used to encode yes-no varieties in PS vs. PRS:



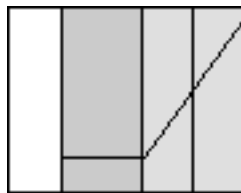
**Figure 1:** *f0* pitch trace of a typical PS production of a yes-no question: ¿Tiene mermelada? 'Do you have jam?' produced with a L\* pitch accent and HH% boundary tone.

<sup>1</sup> With increasing research on intonation across dialects of Spanish, we find that both contour types are indeed possible in both Caribbean and non-Caribbean varieties, with varying pragmatic restrictions (cf. Prieto & Roseano (eds.), 2010)

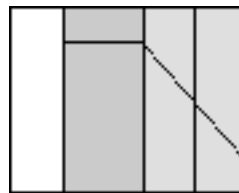


**Figure 2:** *f0* pitch trace of a typical PRS production of a yes-no question: ¿Tiene jelly?<sup>2</sup> 'Do you have jelly?' produced with a *iH\** pitch accent and *L%* boundary tone.

The schematic representations of Figures 1 and 2 are illustrated in Figures (3) and (4):



L\* HH% - PS



*iH\** L% - PRS

Figure 3: schematic representation of the typical contour found for yes-no questions in PS (*L\* HH%*).

Figure 4: schematic representation of the typical contour found for yes-no questions in PRS (*iH\* L%*)

Between the two varieties, many different nuclear configurations are found for other yes-no question types, based on pragmatic factors. Escandell Vidal (1998), for example, examined the relationship between the types of contours used for different types of yes-no questions in PS, while Armstrong (2010b) examined the relationship between

<sup>2</sup> Puerto Rican Spanish borrows heavily from American English, as shown in this example where the lexical item *jelly* is much more common than the one used in PS, *mermelada*.

discourse conditions and choice of nuclear configuration in PRS. Both dialects use different pitch accents and boundary tones to encode different types of information when producing questions. For instance, while PS uses many different pitch accents and boundary tones for different question types, PRS tends to prefer a low boundary tone, mainly showing variation in pitch accent choice (with the exception of tag questions and polite questions/offers).

Given the differences I have mentioned between the dialects, i.e. fundamental differences in contour direction as well as different phonological strategies for encoding various pragmatic meanings, these dialects offer an interesting opportunity to explore both empirical and theoretical questions of intonational development. Prior research on intonational development makes different predictions about the expected acquisition paths for each dialect. As I will show below, some theories would make predictions based on the physiological "naturalness" of the contour types I have described, while others predict an acquisition path that is highly sensitive to the linguistic experience of the child, i.e. learning. The next section provides an overview of the most relevant work done in the field of intonational development.

## **1.2. Prior work on intonational development**

Infants practice pitch control even at the "coo" stage, before they begin to produce canonical babbling. Additionally, the pitch patterns produced during the "coo" stage are the first patterns that best match their mother's productions between 2 and 4 months (Beckman, 2003). For example, Whalen et al. (1991) showed that an infant's ambient language (French vs. English) can be distinguished in infants' repetitive babbling sequences. They studied five French- and five English- acquiring children (0;7 – 0;11), and found that the French children produced more rising intonation contours than the English children. Beckman states, "The infant has already begun to make robust generalizations about how to comprehend and reproduce some of the intonational

categories that will become relevant later for segmenting utterances into phrases and for specifying the meaning of the phrases in the larger discourse context" (p. 85). Mampe and colleagues (2009) showed that at as early as three days old, infant cries reflected the most frequent F0 contours of their ambient language. In their cries, French infants produced significantly more rising (low to high) contours, while German infants produced significantly more falling contours (high to low). The thirty French infants that took part in the study by Mampe et al. (2009) had a mean age of 3.1 days (ranging from 2-5 days old), and the thirty German infants had a mean age of 3.8 days (ranging from 3-5 days old). The authors argue that their data support the idea that newborn melody production is based on 'well-coordinated respiratory-laryngeal activity' (p. 2) and is not constrained by the respiratory cycle, a widely held assumption, as we will see below.

Levitt & Utman (1992) also show evidence for the effect of language experience on early prosodic development. In a cross-sectional study (0;5; 0;8; 0;11 and 1;2) examining one French- and one English-acquiring child, the authors found prosodic differences in the children's productions. The results revealed that the French-acquiring children produced non-final syllables that were more similar in duration than the American infant did, which reflects what is known for adult-directed speech. Given the rhythmic differences between the languages (French is known to show greater isosyllabicity in non-final syllables than English), the behavior of the French infant seems to be language-specific.

DePaolis, Vihman Kunnari (2008) showed language-specific effects on infant production in a study of 10 French-, 5 Finnish- and 5 Welsh-acquiring infants at the 4-word stage. These authors examined the production of different acoustic cues: f0, intensity and duration, finding differences based on ambient language. Intensity and duration showed high variability in all three languages. However, they found a low correlation in Finnish between f0 and intensity, which was significantly different from the other languages investigated. The authors suggest that the Finnish infants were beginning to control f0 and intensity independently offering as a possible explanation that because Finnish has

low variability in duration ratios along with fixed word stress, it is possible that infants have access to a model so transparent that they are able adjust to a pattern of rhythmic production very early, in effect allowing the use of  $f_0$  and intensity as separate cues. The clearest differences across languages were found for duration. If the language exhibits final syllable lengthening, as in French, the children tended to produce an overly long second syllable in their disyllabic words. Finnish- and Welsh- acquiring children, however, seemed to settle on a more stable production system.

The study of 5 French-acquiring and 5 Japanese-acquiring children carried out by Hallé et al. (1991) found that at the 25-word point, disyllables produced by the children were similar to those of adults in terms of  $f_0$  and duration. This period is at around the time when children make the transition from babbling to early words. Most importantly for the purposes of the present research, the authors found that the production of rises was heavily favored by the French-acquiring children, while the Japanese children tended to produce falls or flat contours. These tendencies reflect the typical distribution of contour types in the ambient language. Differences in final lengthening were found such that Japanese children did not produce final lengthening, while French children did. This is also consistent with tendencies in the ambient languages, suggesting that the children's production analyzed in this study was due to learning.

Considering the types of contours children would have to acquire to successfully produce questions in either PS or PRS, the issue of contour direction is relevant. The above studies suggest that intonational and prosodic development is learned and is tied to salient properties of the ambient language. However, many predictions and justifications have been made based on the work of Lieberman (1967; 1985), who argued that infants lacked pitch control before the age of three months. His argument is based on the physiology of the newborn - they are born with their ribs almost perpendicular to their spines, which impedes them from producing steady subglottal air pressure by countering the air pressure that is generated by the elastic recoil of the

lungs since they lack control of the intercostal muscles. This sort of control is necessary in order to produce a rise in  $f_0$  in phonation. If the elastic recoil of the lungs is not countered, the result is falling intonation. According to Lieberman, this lack of control will impede the child from successfully controlling pitch ( $f_0$ ). The prediction from this is that infants would not be able to control rising contours since they are not able to counter the elastic recoil of the lungs. This would mean that they could not successfully counter declination, or the fall of  $f_0$  throughout an utterance. The idea that physiological mechanisms govern intonational development follows a biologically based hypothesis that is often used to explain child production of intonational contours.

Even though this biologically based hypothesis should only apply to children prior to the third month of life, it is not uncommon to find data that are explained based on the idea that production of rising and falling intonation contours depends heavily on physiological constraints, even for toddlers. Kent & Murray claim (1982) claim that 3, 6 and 9 month old acquirers of American English produce mainly falling contours, making the suggestion that this is due to physiological constraints, i.e. the rising contours are more difficult to produce. This is an oft-cited paper in more recent work aiming to justify production results based on biologically motivated theories. Wells 's (1978) results showed that children prefer falling tones in their early one- and two- word utterances and must learn the special usage of rises. Crystal (1986) proposed a tentative path of intonational acquisition states that at the first stage child only produce falling tones. They then contrast falling versus level tones and not until these contour types are contrasted do they contrast falling versus rising tones. Crystal developed this path of acquisition largely based on the claims of Menn (1976) and Halliday (1975).

Recent work by Snow also incorporates the idea that intonational development is physiologically constrained. Snow (2006) investigates contour direction (rising vs. falling) and accent range for 60 American English- acquiring infants between the ages of 0;6 and 1;11. His results showed that for both rising and falling contours, the youngest (6-8

months) and the oldest children (18-20 months) had wider pitch ranges than the 9-11 or 12-14- month-old groups, thus showing a U-shaped curve. Additionally, wider pitch accent was found for falling intonation than for rising intonation. Snow explains much of his findings on the basis of physiological constraints. He suggests that the reason for the difference in accent range for rising versus falling contours is their "different physiological bases" (p. 292), a key assumption of the breath group theory. Developmental differences for rising and falling contours are discussed for three- and five-year-olds in Loeb & Allen (1993) as well as Snow (1994) for one- and four-year-olds. Snow & Stoel-Gammon (1994) also claimed that rising tones were more 'marked' based on their findings that final-lengthening is acquired more slowly for rising contours than for falling ones. Additionally, Snow proposes an "extension" of the breath group theory, such that the wide accent range found for the youngest group is also physiologically based. Snow offers an emotion-based account of his results, such that the "adult-like" rises and falls are due to rapidly changing falls and rises produced by the children as related to their emotional responses. This would be considered physiological since emotional arousal affects  $f_0$ . Therefore, the U-shaped curve represents the following pattern: "adult-like" production of intonation controlled by emotion/physiological states (6-8 months), a regression period during which intonational expressiveness is suppressed (9-14 months), and finally "adult-like" production due to linguistic factors (18-20 months). One major issue with Snow's study is that he refers to the ability of the child produce appropriate accent range as intonational development. Therefore his U-shaped curve is based solely on production of appropriate accent range. He does not consider whether specific contours produced by children are perceived by adult listeners as meaningful. It is problematic to assume that intonational development and accent range production are the same thing.

Fikkert & Chen (2007) also offer physiologically based justifications for their findings that the majority of the contours produced by the Dutch-acquiring toddlers in their study between the ages of 1;4 and 2;1 were falling. They looked for language-specific effects

based on the presence of a continuation contour in Dutch, wondering whether this rise could be found in the child speech. They found that for statements and imperatives, falls were heavily favored in the child production and offer that this is due to universal production mechanisms. It seems perhaps odd that the authors would expect to find a continuation rise at this stage of development, when the children were producing only one- and two-word utterances.

Other work explicitly refers to rising pitch in general as "marked". Lleó et al. (2004) extended the "rising is more marked idea" in their discussion of the acquisition of pitch accent types, arguing that since one bilingual (German/Spanish) child showed a better command of a falling prenuclear pitch accent (H\*L) than he did for a rising one (L\*H), that the difference was based on the falling pitch accent being less marked than the rising one.

The studies I have just described show that although there has been a fair amount of work showing evidence for a strong relationship between contour production and ambient language, biologically-based accounts are still accepted in the literature. As I have mentioned earlier, the present study is concerned with a child's intonational development specifically for yes-no questions in PS and PRS. I now discuss some preliminary findings that will have methodological implications for this study.

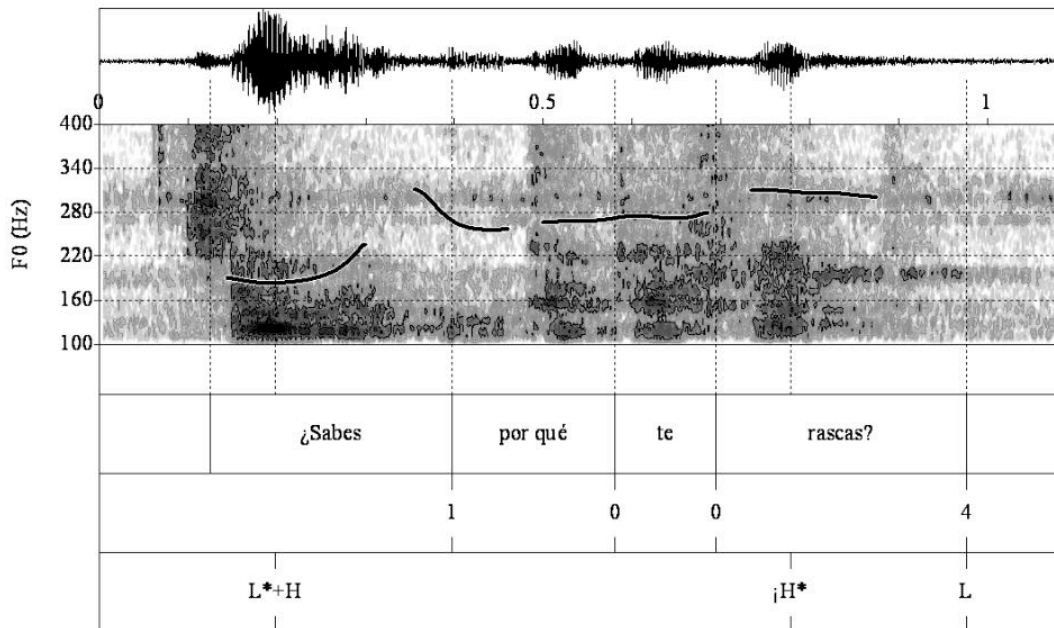
### **1.3. Preliminary findings**

Preliminary analysis of the data for one PRS-acquiring child has revealed another instance of input modification by parents (as I have mentioned about for the tonal acquisition literature). 377 yes-no questions of child-directed speech (CDS) data were coded for pragmatic meaning. They were segmented using Phon (Rose 2007) and exported for prosodic analysis in Praat (Boersma & Weenink, 2010) using the Sp\_ToBI system (Beckman et al. 2002 Estebas & Prieto, 2009). 227 utterances were analyzed

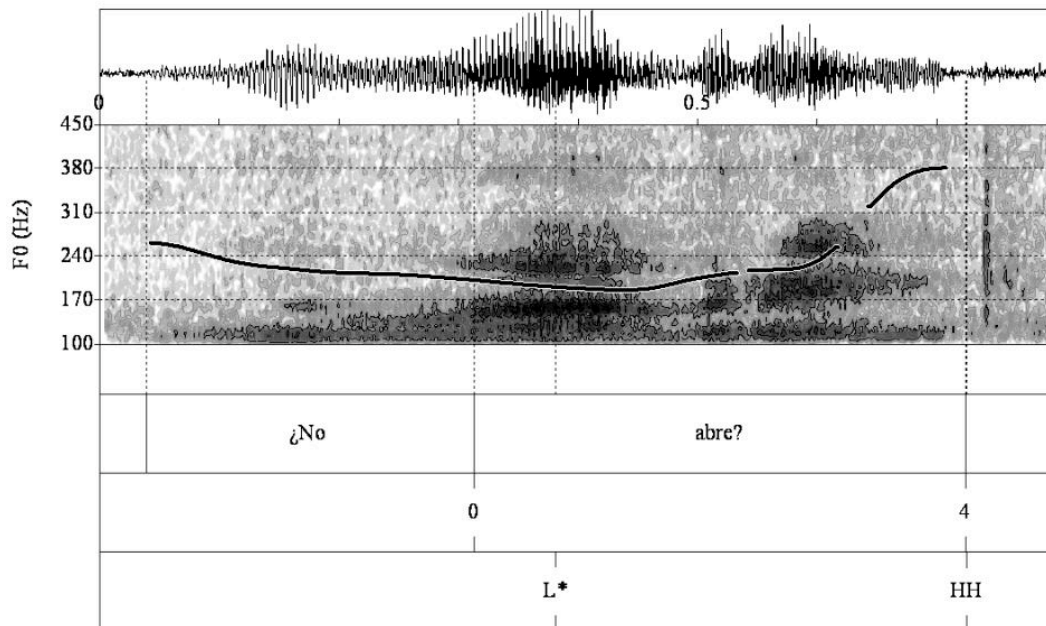
from the first four recording sessions of the corpus (at the age of 1;7) and 150 utterances from the last four recording sessions of the corpus. (when the child was 2;10). The majority of the yes-no question contours were indeed falling, confirming the fundamental difference between PS and PRS that has been cited before (Quilis 1987, 1993; Sosa 1999; Armstrong 2010a; 2010b). Additionally, the analysis revealed a non-canonical use of L\* HH% for yes-no questions including but not limited to broad focus and confirmation-seeking yes-no questions, offers, tests (adult "quizzing" child) and requests. As I have stated above, a falling contour is expected for yes-no questions in PRS. While L\* HH% does exist in PRS, it is restricted to tag questions. This analysis revealed an unexpected use of L\* HH% (Armstrong, 2010c) for yes-no questions that cannot be categorized as tags. Within the 116 minutes of recording for the first portion of the corpus, one non-standard use of L\* HH% for questions occurred every 1.93 minutes, while during the 111 minutes of recordings that were coded for the later portion of the corpus, the ratio was one question every 22 minutes. The use of L\* HH% for non-tags versus its use for tag questions was significantly higher during the early portion of the corpus ( $\chi^2=38.8$ ,  $df=1$ ,  $p<0.00$ ). Overall, non-standard uses of L\* HH% occurred in 26% of all CDS questions in the early portion, but only 3% in the later portion. Use of L\* HH% is especially notable given this variety's resistance to rising contours to encode interrogativity as I have noted, though H\* HH% is indeed found in pragmatically restricted contexts.

Figures 5 and 6 show examples of a canonical yes-no question and a non-canonical one from CDS data analyzed from the Mayagüez corpus. Figure 5 shows the question *¿Sabes por qué te **rascas**?* 'Do you know why you're scratching?' produced by the child's father. This yes-no question is produced with the contour expected for broad focus yes-no questions in PRS: a high plateau (iH\*) produced throughout the nuclear stressed syllable –[ras]– followed by a low boundary tone (L%). The low boundary tone is not visible in the figure due to loss of pitch tracking, which is fairly common due to background noise, creaky voice and voiceless final segments. Figure 6 shows an example of a non-canonical

yes-no question confirmation question produced by the child's babysitter, *¿No abre?* 'It doesn't open?'. This question was produced with a nuclear configuration which we would typically expect to be restricted to tag questions in PRS, a low plateau throughout the nuclear accented syllable (L\*) followed by a high rise in the posttonic (HH%). For this sort of confirmation question in PRS, the  $iH^*$  L% is typically used in adult speech.



**Figure 5:** *f0* pitch trace of a canonical CDS production of a yes-no question in PRS: *¿Sabes por qué te rascas?* 'Does it itch?' produced the canonical yes-no question intonation: a  $iH^*$  pitch accent and L% boundary tone.



**Figure 6:** *f0* pitch trace of a non-canonical CDS production of confirmation-seeking yes-no question in PRS: ¿No abre? 'It doesn't open?' produced with a L\* pitch accent and HH% boundary tone.

Variation found in CDS has been documented by Estigarribia (2010), who argued that parents facilitate the acquisition process by providing variation in the input. While the traditional claim has been that variation in the input makes the task of learning harder, Estigarribia proposes that structural variation within a system also facilitates learning. This allows children to acquire simpler structures and gradually acquire more complex ones. However, it would be difficult to argue that the non-standard nuclear configuration L\* HH% is "simpler" than ¡H\* L%. One possible explanation for the appearance of non-canonical intonational contours associated with specific pragmatic meanings can be hypothesized by considering the claim by C. Snow (1986), who argued that children are sensitive to utterance-types and can keep them in separate categories based on intonation. Estigarribia suggests that the salient difference in intonation contours between declaratives and interrogatives in (American) English are why children do not produce inverted subjects in declaratives. Therefore, it is possible that the non-

canonical question contour is a salient cue used to highlight a difference in utterance type. This will be investigated more thoroughly once the analysis is complete. It will also be of great interest to understand how children respond to canonical and non-canonical uses of intonation contours in their production.

Tonal modification in CDS has also been described for languages with lexical tone. Li & Thompson (1977) describe errors in production of tones by Mandarin-acquiring toddlers, such that low tones are substituted for falling tones, while high tones are substituted for the rising and dipping tones. They also state that in the children's production, the neutral tone, which is associated with unstressed syllables, is sometimes interpreted as a full tone, accounting for this based on infant-directed speech, for which they note "overproduction" of stress. Demuth (1993), in a case study on the acquisition of Sesotho tones, also cites evidence for overproduction of stress at the early stages. Commenting on these two studies, Vihman (1996) points out a need to consider the nature of the input and considers the idea that what have been accounted for as "errors" are possibly consequences of the input available to children (this is also noted by Estigarribia 2010). Erbaugh (1992) has also reported tone modification in child-directed speech (CDS) for Mandarin when parents produce nouns in reduplicated forms. The motivations for input modification as well as how children respond, as Vihman points out, merits further investigation.

In a study of Peninsular Spanish- and Catalan- acquiring children, Thorson et al (2009) analyzed the use of different nuclear configurations and their pragmatic uses for both CDS and child speech. They showed that the overall production of the children between these ages closely reflects the adult inventory of intonational patterns as well as appropriate pragmatic uses of the contours. While both languages use a rising nuclear configuration for questions, falling contours can be used in both varieties with different pragmatic restrictions. But for both languages, Thorson et al showed that the children acquired the rising contours earlier than the falling ones. Furthermore, they showed

that for the Central Catalan case, the nuclear configuration L+H\* L% was very infrequent in the CDS and did not in fact occur in the child speech for that language. Like the preliminary findings in PRS, the authors also report non-standard pragmatic uses of nuclear configurations but could not account for them.

My own preliminary findings, taken together with those of Thorson et al., show the limitations of earlier studies and the claims they have made about intonational development. The majority of studies are lacking in two major ways: a.) failure to consider how child production matches that of the input, CDS and b.) failure to consider the *course* of development. By only considering the overall child vs. CDS production, we can be missing very important pieces of the acquisition path. That said, it will be important to represent both the end state *as well as* the course of development for both the child speech and the CDS. There has been much more focus on end states than the course of development itself, and this dissertation will be novel in the sense that both will be considered.

#### **1.4 Specific Goals**

The overarching goal of the thesis will be to compare the child production with CDS for both dialects, PS and PRS, in order to understand how the form (intonation contour)-function (pragmatic meaning) pairings in child speech mirror the CDS. This comparison will be carried out by doing an overall comparison of the child speech and the CDS as well as an examination of the data at different points throughout the corpora, i.e. throughout the course of development. Based on the preliminary data, which suggested that the actual input may change throughout the course of development, looking at various points throughout the acquisition path will allow me to understand when and if the input changes, and how the children respond to such changes. A recent ongoing, unpublished study by Ko shows that mothers demonstrate abrupt changes in CDS speech rate in the child's acquisition process for American English: around the child's

first words and later at the two-word milestone. The question of whether the changes are abrupt or gradual should also be considered.

A related question to my overarching goal is: Are children's choices in intonation contour influenced by the same factors that influence adult choices? This will be possible to answer based on my previous work on the pragmatic factors which restrict contour choice in yes-no questions in PRS (Armstrong, 2010b), as well as investigation on question types for Peninsular Spanish (cf. Prieto & Estebas-Vilaplana 2010; Escandell Vidal 1998). Understanding the pragmatic restrictions guiding contour choice for PS and PRS will allow me to understand whether caretakers and children are sensitive to the same restrictions we find in adult speech for these dialects.

The choice of these specific dialects was driven by the earlier claims I have cited which argue for the strong role played of physiological constraints on the acquisition of intonation contours. As I noted, in adult speech PS favors a fall-rise contour for yes-no questions, while PRS favors a rise-fall contour (even though the preliminary results show non-canonical contour use in PRS CDS). Based on Thorson et al.'s (2009) analysis showing that rising contours are readily acquired by children, I hypothesize that intonational development is governed by something other than physiological constraints. I will explore a usage-based account (Bod 1998; Tomasello 2003; Goldberg 2006) for intonational development, in which the child's linguistic system is shaped by linguistic experience.

## **2. Theoretical framework and Methods**

### **2.1 The Autosegmental-Metrical Framework**

The intonational analysis will be carried out using the Autosegmental-Metrical (AM) Framework, which was a result of Pierrehumbert's (1980) seminal work on American

English. This framework has been used for a wide array of languages (Jun 2005; Gussenhoven 2004; Ladd 1996/2008, among many others) and continues to develop.

Within the AM framework, tonal prominences are designated as high (H) and low (L) tones. Pitch movements associated with metrically strong syllables in an utterance are called *pitch accents* while those associated with prosodic boundaries are called *boundary tones*. The tones may be monotonal or bitonal. For the case of bitonal pitch accents, the starred tone (L\* or H\*) is primarily associated with the stressed syllable, while an additional high or low tone may be secondarily associated with either the pretonic or the posttonic syllables. Boundary tones mark the ends of prosodic units. In Spanish, there are intermediate boundary tones and boundary tones that mark intonational phrases. The current Sp\_ToBI system (Beckman et al., 2002; Estebas-Vilaplana & Prieto, 2008) allows for a mid-level tone (M) as well as bitonal boundary tones that account for complex movements that mark the end of an intonational phrase.

## **2. 2 The Constructionist Theory of Grammar and Acquisition**

Based on my hypothesis that intonational development is largely governed by the child's experience with the input as opposed to physiological constraints, a theoretical framework allowing for a usage-based analysis is necessary. As Goldberg & Suttle (2009) note, a constructionist approach is compatible with a usage-based theory of grammar (Bod 1998; Tomasello 2003; Goldberg 2006). For example, we know that adult speakers reproduce very subtle phonetic distinctions available in the input in a statistically similar way to what is available in the input. This idea can be extended for the question of acquisition, for which we might consider the case described by Mampe and colleagues (2009) that I have noted above.

Constructions are pairings of form and function that a child has learnt. According to Goldberg & Suttle's overview of the framework, constructions are understood to be learnt based on positive input as well as general cognitive and social abilities. These include idioms as well as phrasal linguistic patterns. While to my knowledge there are no existing accounts of intonation using the constructionist framework, the relevant task for the child in intonational development fits squarely within the notion of constructions. The acquisition of nuclear configurations in the meaningful speech of children is directly dependent on the child's acquisition of a form (the intonational contour) and its function (utterance type or more specific pragmatic meaning associated with the nuclear configuration). Differently from traditional generative theories of acquisition, the constructionist approach does not assume innate universal linguistic principles, and one prediction of such a model is that constructions will vary in diverse ways cross-linguistically. For example, Goldberg & Suttle give the example of passive constructions. A passive in language A may differ from a passive in language B in a myriad of ways: presence/choice of auxiliary, presence/choice of adposition or case marking, discourse restrictions, etc. In a similar fashion, the nuclear configurations used to convey different utterance types cross-linguistically differ in their phonetic implementation as well as their phonological inventories, i.e. the pitch accents and boundary tones used cross-linguistically vary (for intonation languages like Spanish and English), as well as the actual phonetic implementation of these. Additionally, contour choice is governed by different pragmatic restrictions across varieties of languages. Therefore, a yes-no question in language A may differ from that of language B, and we know this to work the same way cross dialectally (as I have shown to be the case for yes-no questions, for example, in Peninsular versus Puerto Rican Spanish).

Using the constructionist model, Cameron-Faulkner et al. (2007) analyzed the development of English multiword negation, using a dense database of mother-child dyads for one child between the ages of 2; - 3. They focused on the emergence and usage of negators in both the child's and the mother's speech using two analyses. The

first was an overall analysis of the child's speech compared to the mother's speech in order to provide an overall picture of negator usage across the sample. This analysis showed a gradual and systematic development of negator selection in the speech of the child, which followed an obvious trajectory of three different negator forms. A more fine-grained analysis was run for both the child's and the mother's speech for all neg + verb utterances and indicated the same cline as was found in the overall analysis. When the authors ran a function-based analysis of neg + Verb utterances (i.e. the specific function of the verb), they found that how fast the child moved through the cline of the three observed forms varied based on function. This allowed the authors to conclude that child's speed of movement throughout the cline within a particular function depended on function-based effects in the input. They were able to account for the child's cline of usage based on nuances in the input. The sort of analyses used to analyze the acquisition of constructions (in this case negator constructions in English), is therefore fruitful and supports a usage-based model of acquisition.

As I have stated above, it is not difficult to conceptualize intonational contours as constructions. Using the AM framework, I will define an intonational construction as a nuclear configuration, i.e. the combination of a pitch accent followed by a boundary tone along with its pragmatic meaning. The compatibility of the constructionist model with usage-based theories of grammar makes the constructionist model attractive one for my analysis. One possible issue with the constructionist model is that it does not assume a division between semantics and pragmatics (Goldberg & Suttle, 2009). The potential difficulty with this lack of distinction is that within the model context-induced vs. conventional uses of intonational contours cannot be accounted for. It is my hope to verify to what extent the constructionist model can account for my data. Testing this model will also be a novel contribution to the field of acquisition, since the constructionist model has not been used in the past to account for intonational phenomena in general.

## 2.3 Methods

### 2.3.1. Materials

For the CS analysis, data from the *Ojea* corpus and *López-Ornat* corpora from CHILDES will be used. The data are from two PS- acquiring children, Irene (Oviedo dialect) and María (Madrid dialect) and their caregivers. These data have already been analyzed by Thorson et al. 2009. For the PRS analysis I will be using two different corpora as well. The recordings are from two PRS –acquiring children: Ana (Mayagüez dialect) and Cristina (San Juan dialect). The first child's data comes from the Cross-linguistic Early Syntax Study (CLESS) (Lillo-Martin & Snyder 2002) from the University of Connecticut and the second the University of Puerto Rico at Río Piedras corpus (Hernández & Cabrera, 2002). The PRS data begin later than the PS data: the CLESS corpus begins at 1;7, while the University of Puerto Rico corpus begins at 2;2.

### 2.3.2. Digitization and Phonetic Transcription in Phon

The data will be segmented and phonetically transcribed using the Phon software (Rose, MacWhinney, Byrne, Hedlund, Maddocks, O'Brien, & Wareham, 2006). All meaningful yes-no questions uttered by the caregivers and the children are being segmented and phonetically transcribed in Phon. They are then exported into .wav form for prosodic analysis in Praat (Boersma & Weenink, 2009). Table 1 shows the coding scheme for the data:

Table 1. *Coding scheme for child speech and CDS*

(1) Orthographic transcription
(2) Prosodic transcription
(3) Pragmatic meaning
(4) Annotation of fundamental difference between adult and children's intonation patterns

### **2.3.3. Pragmatic analysis**

When considering intonational development as form-meaning pairs, the onset of intentional speech and the cognitive prerequisites for intention are areas that are crucial to this specific type of acquisition. Intonational development is situated at the intersection of many linguistic interfaces, but perhaps most importantly the pragmatic/phonology interface. Children must not only be able to produce intonational contours, but they must also map them to pragmatic meanings. I will review the literature on joint attention and pursuit of goals, two areas that are absolutely necessary for children to infer implicated propositions through questions and also to produce the implicatures themselves. According to Tomasello (2003), in the first months of the child's first year, she has developed a new form of cognitive representation (a dialogic cognitive representation), which allows for 'collaborative cultural practices such as linguistic communication and other forms of symbolic interaction' (689). Perner (1991) observes that the formation of multiple models allows infants the ability to hypothesize about mental states and ask (perhaps an infant rendition of) "what would I experience if I were in the other person's position?" during the second year of life. The newly developed ability to engage in joint intention and attention seems to be another important advancement when considering the issue of questions and requests.

It will also be important for me to benchmark (albeit generally) the assumed cognitive maturity for the children included in my study. I will provide a review of literature on pragmatic acquisition in order to make clear the pragmatic stages that correspond to the ages of the children in my study. This will allow me to show at which stages I expect the children in the study to be pragmatically, which directly relates to the pragmatic analysis. For instance, Tomasello et al. (2005) in their description of infants' ontogenetic pathway for human social engagement describe three stages of motivation to share emotional states: dyadic engagement (0;3, shared emotions and behavior), triadic engagement (0;6, shared goals and perceptions), and collaborative engagement (joint intentions and attention). I will also situate the children in terms of what kind of

learning they can be assumed to be doing based on age (procedural vs. declarative vs. secondary procedural, cf. Vihman, in press).

The analysis of early child speech has been analyzed using basic speech acts that take into account the pragmatic intentions of the child (Dore, 1973a; 1973b; 1975; Ninio, 1992; Ninio et al., 1994). Dore (1973a) defines primitive speech acts (PSAs) as a rudimentary expression making some reference as well as a device-indicating primitive force, which is typically an intonation pattern. Therefore different intonation patterns can be used with one word to label, ask or call, for example. Therefore, not all meanings are equal – some are rudimentary, and some are not. What qualifies a pragmatic meaning the and contour used to encode it as rudimentary? As shown in Prieto & Estebas-Vilaplana 2010 and Armstrong 2010a and 2010b, within the realm of questions, different pragmatic intents are encoded intonationally in different ways when we compare PS and PRS. For instance, PRS has a very specific contour used to encode incredulity, while PS has two contours that are used for counter-expectation (and not necessarily incredulity). Therefore, for each dialect the type of information that can be conveyed intonationally for question type differs. If we consider that each dialect has a different set of questions types associated with specific contours, it is not for certain which of these question types can be considered "primitive" or "rudimentary". Which form-meaning pairs are acquired early-on? Some insight is provided if we consider the results of Thorson et al. (2009). For example, in Thorson et al's study, 94% of the CDS questions coded for their PS data were characterized by three common contours: L\* HH% (most often for broad focus yes-no questions), L+H\* HH% (offers) and L+H\* L% (echo questions). Consequently, these happened to be the same common contours in the production of the children in the study. Can these pragmatic uses be considered the "primitives" of questions for children? The same authors found that for Central Catalan the most typical CDS contours (91% of the data) and pragmatic meanings were: confirmation-seeking (H+L\* L%), broad focus yes-no (L\* HH%), offers (L+H\* HH%) and echo questions (L+H\* L%). However, echo questions only accounted for 7% of the data.

The child speech revealed that the most frequent contours reflected those of the CDS again. L+H\* L% did not appear in the child data. Is there some sort of threshold in terms of the amount of contours or pragmatic uses (or the pairings of these) that children can use productively? It seems from the CDS production data for PS and Central Catalan that caretakers primarily use a small number of form-function pairs when asking children questions. Therefore, I plan to consider a.) the form-meaning pairs available in adult-directed speech (ADS) for both dialects of Spanish b.) which of the meanings are used in the CDS and whether they are used with the same contours as ADS c.) whether the most common pragmatic uses are similar for both dialects d.) how form-meaning pairs match up between child speech and CDS for both dialects. This would allow me to understand what the PSAs are within the domain of questions for PS and PRS.

Utterances will be judged as meaningful or non-meaningful based on Snow (2006). Whether the utterance is judged meaningful or non-meaningful will be based on the following criteria:: (1) the utterance has some phonetic relation to an adult word, (2) it is used appropriately in context, (3) consistency, and (4) the caretaker's confirmation that the child's utterance was meaningful.

I will label for the following question types:

Table 2. *Pragmatic labeling conventions*

<b>Broad-focus (B):</b> Broad focus yes-no questions
<b>Narrow focus (N):</b> Questions where some element is focused intonationally
<b>Confirmation-seeking (C):</b> Through a question, the speaker elicits confirmation for some hypothesis s/he has formed. The belief conditions for confirmation questions may vary.

<b>Offers (O):</b> A speech act through which the speaker presents something for acceptance or rejection (this includes invitations)
<b>Requests (R):</b> A speech act of petition or solicitation through the use of a question
<b>Echos (E):</b> Repetition of all or part of a phrase that the speaker feels the need to repair clearly
<b>Counter-expectation echos (C):</b> Repetition of all or part of a phrase based on some emotional reaction (rather than a need to repair)

While Thorson et al. included confirmation-seeking questions as one category in their study, it will be important to distinguish between two different confirmation types: those that confirm a proposition ( $p$ ) and those that confirm the negation of a proposition ( $\sim p$ ). In PRS there is a difference in choice of nuclear configuration between these two utterance types, and it is therefore important to make the distinction when doing the pragmatic labeling.

#### **2.3.4. Intonational analysis**

The intonational analysis will be conducted using the AM framework as described in Section 2. The Peninsular Spanish data for both child speech and CDS have already been prosodically labeled using Praat (Boersma & Weenink, 2010). The most recent accounts of Peninsular and PRS for adult speech will be used for this analysis (Prieto & Estebas-Vilaplana, in preparation; Armstrong, in preparation).

### **3. Thesis Organization**

The thesis will consist of six chapters, as described in the following sections.

#### **3.1. Chapter 1: Introduction**

The introduction chapter of the thesis will consist of a literature review on the areas of intonational development as well as cognitive development in children. In this chapter I will briefly address the claims regarding physiological constraints on intonational development. I will argue that evidence from the babbling literature shows that use of pitch control mirrors intonational patterns in the ambient language very early on, perhaps even days old as claimed by Mampe et al. I will provide a review of studies in intonational development, ending with the most recent studies of intonational development within the AM framework. I will make a case for monitoring how the input changes throughout the acquisition period.

### **3.2. Chapter 2: Yes-no questions in Peninsular and Puerto Rican Spanish**

This chapter will present an overview of yes-no questions in the two varieties of Spanish being investigated. I will compare and contrast the contours that have been described in Prieto & Estebas-Vilaplana (2010) as well as in Armstrong (2010a). I will provide an account of the phonological categories that are used for yes-no questions in these varieties as well as their pragmatic uses. I will show where the two varieties overlap and diverge in terms of their intonational phonologies in the area of questions.

### **3.3. Chapter 3: Theoretical Framework and Methods**

In this chapter I will describe the Constructionist Theory of Grammar and its implications for acquisition in general. Since this model has never been used to account for intonation or intonational development (to my knowledge) I will lay out the kinds of predictions this model would make for the present study. I will also use Peter's (1985) Operating Principles to create a model for how children extract constructions (in this case, intonational contours) from the input.

In the methods portion of this chapter I will lay out the detailed methods to be used. I will describe the corpora that were used for the study as well as relevant information

about the children and caretakers. I will describe how the videos were digitized and how they were transcribed. I will also describe in detail the phonetic and pragmatic analysis of the data.

#### **3.4. Chapter 4: Analysis of the child data**

The methodology for the analysis is described in Section 2.4. In this chapter, I will report on the findings from the analysis. I will report on the overall acquisition as well as the course of acquisition, to be able to find changes in the production of the child over time. At this point, I plan to show the acquisition patterns of the children in one-month intervals. Should the data reveal that it would be preferable to present the data in a different manner, I will do so.. I will report on the types of questions produced by the children as well as the contours associated with them, pointing out any changes over time. I will compare the Peninsular Spanish results to the PRS results, and I will also report on each child individually.

#### **3.5. Chapter 5: Analysis of CDS data and comparison with child speech**

A recent study looked at evidence from a bilingual child considering the idea of frequency in the input. Kim et al. (2006) examined the speech of a bilingual child with a Castilian Spanish-speaking mother and American English-speaking father. They compared the prosodic development of the child for two stages: 2;6 and 3;0. They noted that while in Spanish, L+H\* is preferred for a nuclear pitch accent and L\*+H is preferred for prenuclear pitch accents in declaratives, H\* is the most frequent pattern in English declarative sentences in both positions. The results revealed that in both languages, the child produced more H\* than his mother or father. However, he seemed to keep nuclear pitch accents in each language separate. Even though the child was more Spanish dominant, he never substituted L+H\* (the Spanish prenuclear pitch accent) for H\* in prenuclear position in his English. However, in both the child's Spanish and English he produced H\* more than 50% of the time in prenuclear position. The authors point out here that markedness cannot account for the child's production of L+H\* in nuclear

position. The only difference between L\*+H (prenuclear) and L+H\* (nuclear) is the timing of the rise. The authors then point out that the number of pitch accents in prenuclear position is much smaller than the number of pitch accents in nuclear position (due to short mean length of utterance in both the child's and the parents' speech). They note the likelihood that most content words were realized with nuclear pitch accent. Therefore, it is possible that children receive more nuclear pitch accents than prenuclear pitch accents in the input (they note the parents speak to the child in very short phrases), accounting for the paucity of L\*+H in prenuclear position in the child's Spanish. Therefore, the study suggests that we might make predictions based on the frequency of the pitch accent in the input rather than markedness.

The findings and argument from Kim et al.. shed light on an important area that seems to be ignored in the other studies that I have mentioned: the input the children receive. Their data not only show interesting findings about child acquisition of pitch accents, but also indirectly make an important point about input as a moving target. While it is well known that parents produce short utterances in CDS, Kim et al.'s study sheds light on a consequence of how parents modify the input.

This methodology is also detailed in the Methods section of the thesis. I will report on the CDS in the same fashion that I will report on the child speech: a chronological report broken up into 1-month intervals as well as an overall view. Here I will also compare the CDS to the child speech for both dialects. I will point out where the CDS and the child speech converge and overlap for all areas analyzed: phonetic implementation of contours, use of phonological categories, form-meaning pairings (i.e. choice of nuclear configuration as it relates to pragmatic meaning). In this section I will be able to report on if and how parents change the input throughout the acquisition process and how children's production reflects such modifications.

### **3.6. Chapter 6: Conclusions**

In the final chapter of the thesis I will discuss the findings as well as their theoretical significance to the field.

#### **4. Time Frame**

##### **May 2010 – October 2010**

Finish data analysis for PRS child speech and CDS. Write Chapter 2 (comparison of Peninsular and PRS yes-no questions). Develop Chapter 1 (it is my understanding that the introduction continues to be worked on throughout the thesis writing process). Begin chapter on methodology.

##### **October 2010 – January 2011**

Complete methodology chapter. Write Chapters 4 & 5 reporting on the results of child speech and CDS.

##### **January 2011 – May 2011**

Complete introduction and conclusion chapters.

##### **June 2011**

Thesis defense

#### **5. Annotated Bibliography.**

1. Beckman, Mary, Manuel Díaz Campos, Julia T. McGory, and Terrell A. Morgan. 2002. Intonation across Spanish, in the Tones and Break Indices framework. *Probus* 14: 9-36.

This is the first proposal for the existing Sp\_ToBI system, which is the labelling system that is used in the thesis for intonational transcription of both the child speech and the CDS.

- 2.. Estigarribia, Bruno. (2010). Facilitation by variation: right-to-left learning of English yes/no questions. *Cognitive Science*, 34, 68-93.

This study speaks to the hypothesis that optional structural variation in language facilitates syntactic learning, which the author calls "facilitation by variation". The question of child acquisition and the inversion of yes-no questions in English has always been a point of debate, but the study shows that children aren't always receiving inverted questions in the input. This is highly relevant to my thesis since I am interested in showing how modifications to the input affect production of intonational contours. I should be able to make analogies between the arguments made for syntax and the acquisition of nuclear configurations.

3. Mampe, Birgit, Angela D. Friederici, Anne Cristophe and Kathleen Wermke. 2009. Newborn's cry melody is shaped by their native language. *Current Biology* 19.1-4.

This study is the first of its kind to show a learning effect for intonation in the production of human neonates. While it seems that Lieberman's claims have been overextended to older children, Lieberman definitely claims that children are unable to control subglottal pressure to produce rising intonation prior to the age of three months. This study suggests that learning occurs *in utero* and also that intonation is not restricted by the respiratory cycle even for 3-day old babies.

4. Oller, D. Kimbrough (2000), *The emergence of the speech capacity*, Lawrence Erlbaum Associates, Mahwah, NJ.

The claim that falling contours are acquired before rising ones needs to be dismissed at the outset of the thesis. Work by Oller on babbling shows at the squeal and growl stage pitch is controlled very well. It is important to present this evidence at the outset.

5. Prieto, P., A. Estrella, J. Thorson and M.M. Vanrell. (in preparation). Is prosodic development correlated with grammatical and lexical development? *Evidece*

from emerging intonation in Catalan and Spanish. To appear in: *Journal of Child Language*.

This study shows, counter to Snow's claim, that intonational development does not correlate with syntactic development, but shows evidence for correlation with lexical development. The authors argue against biologically-based theories, based on evidence that Spanish and Catalan children acquire rising intonation early on. They also present counter-evidence to Snow's claim that falling contours stabilize before rising contours, finding that children cannot always reach low boundary tones, instead realizing a mid tone.

6. Snow, David. 2006. Regression and reorganization of intonation between 6 and 23 months. *Child Development*, 77, 281-296.

This study gives a general overview of the biologically-motivated theory, which makes predictions about intonational development and contour type such that rising contours will stabilize later than falling contours. Snow argues for a U-shaped curve model which accounts for his accent range data.

7. Thorson, J., J. Borràs-Comes, V. Crespo-Sendra, M.M. Vanrell and P. Prieto. (2009). The acquisition of melodic form and meaning by Catalan and Spanish speaking children. Paper presented at Phonetics and Phonology in Iberia (PaPI). Las Palmas, Spain: 17-19 June.

This study serves as a point of departure for what we already know about the acquisition of yes-no questions and contour direction. When we look specifically at an area where rising contours are possible (i.e. yes-no questions) they are found in child speech (contrary to claims that children favor falling contours). Additionally we find that even in Catalan where both falling and rising intonation contours are possible for questions, the rising contours are preferred. I will be looking at the Peninsular data described in this study, but sectioning it off so that I can find any modifications in the input and whether the child speech mirrors these.

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