A Laboratory Analysis of Suprasegmental Features in Normal and Pathological Speech of Buenos Aires Spanish According to the Theory of Phonology as Human Behavior

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1. Introduction

This study deals with the prosody of Buenos Aires Spanish (BAS) as spoken by speakers of Normal Speech (NS) and speakers of Pathological Speech (PS). The goals of this study are: (1) to compare and contrast the prosody of BAS NS (also studied by Colantoni and Gurlekian (2004, in press)) with the classic norms established for Spanish by Navarro Tomás (1944/1974), Quilis (1993), Sosa (1999), and Beckman et al. (2002); and (2) to compare and contrast the prosody of BAS speakers of NS and PS to determine the degree of variation between the two groups (BAS NS-PS). In particular, we will compare and contrast the prosodic patterns of declarative sentences, wh- questions and exclamatory sentences of men, women, and children of different ages for both NS and PS.

There is much research on PS in general (e.g. Azcoaga 1991, Carrara de Angelis 1998, Chapman 1992, Kent 1997, Sataloff et al. 1998) but there is less experimental research on pathological prosody (e.g. Baltaxe et al. 1984, McCormack & Ingram 1995, O'Halpin 2001, Snow 2001, Vaccari & Enbe in press, Enbe 2003). There is even less research – if at all – on intonation patterns in PS according to age and gender and categorized by disorder. As far as we know there is practically no research (experimental or not) comparing and contrasting the prosodical patterns of NS and PS for Spanish in general and BAS in particular. For this reason, in the present paper, among the first of its kind, we are classifying different pathological speech syndromes that affect prosody (Kent 1997) such as -- stuttering; hearing impairments; developmental speech disorders; neurological disorders; and dysphonia -- together for different age and gender groups. We will compare and contrast the prosody patterns of PS with parallel age and gender groups representing NS in order to establish an initial and general picture of whether and how the prosody of what is usually referred to as NS and PS may be the same or different. In future research we plan to have a more refined classification of all speakers of both NS and PS. The results will be analyzed according to the theory of Phonology as Human Behavior (PHB) (Diver 1979, 1995, Tobin 1995, 1997a) which has been used to describe the non-random distribution of phonemes in close to fifty different languages of diverse language families (such as English, Latin, Italian, Spanish, Arabic, Hebrew, Bukharian, Georgian, Urdu, Mawati, Finnish, Hungarian, Japanese, etc.) and has most recently been applied to the area of prosody in NS and PS in Spanish- and Hebrew-speaking adults and children (Enbe 2003, Enbe et al. in press, Green 2005).

2. The Theory of Phonology as Human Behavior

The theory of PHB, developed by William Diver and his students of the Columbia School, combines aspects of the "communication factor" inherent in Prague School phonology (Tobin 1988) with aspects of the "human factor" inherent in Martinet's diachronic phonology (Martinet 1955). The major parameters of the theory are presented according to the functional semiotic definition of language as a sign system used by human beings to communicate. The fundamental axiom underlying the theory

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is that language represents a struggle between the desire for maximum communication (the communication factor) with minimal effort (the human factor) (Tobin 1990). The fundamental contribution of the theory of PHB is that it provides a 'motivation' for the distribution within the speech signal: i.e. it tells us why the distribution of phonemes within a language is non-random.

Based on this definition of language and the above axioms inherent to the theory, one can list the four orientations underlying PHB as: (1) the communication factor; (2) the physiology of the vocal tract; (3) the acoustic medium; (4) the human factor (adapted from Diver 1979, Tobin 1997a).

The motivation for the explanation of the non-random phonological distribution within language central to the theory is based on the following seven theoretical and methodological assumptions:

(1) Users of a language behave as though they have learned certain distinctive units, the phonemes, which they deploy for communicative purposes.
(2) We cannot observe directly what it is that they behave as though they have learned.
(3) We can, however, observe the phonotactic skewing, a skewing that has been built up over the centuries and millenia in the very mouths of the speakers.
(4) We can infer that these long-range skewings represent favorings and disfavorings on the part of users of the language. (It is to be observed that the skewings are not idiosyncratic to particular languages; their general characteristics recur from language to language.)
(5) We can then examine the favorings and disfavorings against the background of the orientation -- which means with independent knowledge of what kinds of favorings and disfavorings humans are prone to in areas other than the use of language.
(6) We can infer that a disfavoring, for example, represents a difficulty in a learning process, and by a close examination of what it is that constitutes a difficulty in the way of a particular learning process, we can infer what it is that is being learned.
(7) We may identify what it is that is being learned as a characteristic of the distinctive units.

The theory of PHB was first developed in an analysis of the non-random distribution of certain classes of initial consonant clusters in English (Diver 1979) which was later extended to forty-two different languages representing seven diverse language families (Tobin 2002).

This research on initial consonant clusters as well as other in-depth studies of the combinatory phonology of other languages have uncovered and supported a set of specific phonological and phonotactic parameters explicitly derived from the theory (as opposed to traditional categories):

(1) the identification of active articulators (versus the traditional category of place of articulation which is often a label for passive articulators) and the relative difficulty of learning how to control them;
(2) the identification of relative degrees of constriction and turbulent and non-turbulent airflow, (versus the traditional category of manner of articulation) that require different articulatory control (mobile and stable) and produce different acoustic patterns for individual sounds and phonation processes (e.g. labialization, apicalization, velarization, nasalization, glottalization);
(3) the identification of the number of sets of articulators to be controlled (versus the traditional categories of voicing, fortis-lenis, ejective/non-ejective, and nasality) that require different articulatory control and produce different acoustic patterns;
(4) the identification of "phonemes of constriction" and "phonemes of aperture" (versus the traditional concepts of consonants and vowels) that require different articultory control and produce different acoustic patterns.

The above-mentioned research yielded quantitative results that support the following principles concerning the non-random distribution of phonemes in and across languages:

(1) additional articulators are disfavored;
(2) coarticulation by near articulators is disfavored;
(3) coarticulation by the same articulators/phoneme is even more highly disfavored (particularly in the roots of Semitic languages);
(4) different word (or root) positions have different communicative force and thus affect the favoring and disfavoring of different articulatory and acoustic features and phonemes;
(5) apical articuations are favored in general and in final position in particular;
(6) visual articulations are favored (particularly in word/root initial position);
(7) explosive (mobile/stop) phonemes are favored in initial position;

(8) turbulent (stable/fricative) phonemes are favored in final position;
(9) transitions from one distinct constriction to another within a single phoneme are disfavored;
(10) consonant clusters are restricted concerning different articulatory and acoustic features (e.g., mobility/stability);
(11) among constrictions, maximal constriction is favored;
(12) among apertures, maximal aperture is favored;
(13) sequences of phonemes with the same articulators are disfavored unless their juxtaposition is, by virtue of some other factor, mutually beneficial.

The theory has also been applied to the areas of developmental and clinical phonology (Tobin 1995, 1997a, b, 1999) which has established the following principles:

(14) the preservation of as many distinctive features as possible (usually 2 out of 3) in substitution processes which require more effort than deletion processes;
(15) the preservation of as many communicative oppositions as possible in the original word (e.g., the number of phonemes per word) in substitution processes which require more effort than deletion processes;
(16) the use of a readily available phoneme already found in the speaker's repertoire in accordance with the immediate phonetic environment in substitution processes which require more effort than deletion processes;
(17) the preservation of the original phonetic structure of the word in deletion processes not involving syllable reduction and in reduplication;
(18) if the original structure of the word is reduced by the deletion of syllables, the stressed syllable bearing the most communicative information is maintained;
(19) if the original structure of the word is enlarged by epenthesis, the epenthesis makes the transition to or between more difficult sounds easier.

These principles empirically support the following conclusion underlying the theory: language in general -- and phonology in particular -- can be seen as a mini-max struggle: the desire to create maximum communication with minimal effort. This synergetic principle is most evident in the non-random phonotactic distribution of phonemes in languages synchronically and diachronically and appears to be even stronger based on the data culled from all the developmental and clinical studies undertaken within the theory on both the segmental and suprasegmental levels. The theory of PHB has been placed in its historical background and compared to and contrasted with other functional and quantitative-oriented phonological theories as well (Tobin 2000).

3. Spanish Prosody

Navarro Tomás's study of Spanish prosody in different kinds of sentences (1944/1974) was supported by others (Quilis 1993, Sosa 1999), which allows us to view their data as the classic "norm" of Spanish prosody. As we can observe in Tables 1 and 2 which follow, the studies in Spanish prosody show experimental and methodological differences that make it difficult to establish clear boundaries for dialectal pattern variations and the sociolinguistic distribution of gender and age.

Classic Model	Methodology	Data	Population	Corpus	Social Group
Navarro Tomás 1944	Perceptual analysis	Experimental	Spain	Reading literary texts (declarative, interrogative, and exclamatory)	Adults (authors of literary texts)
Quilis 1993	Perceptual and instrumental analysis	Experimental	Spain; Puerto Rico; México	Spontaneous speech (declarative, interrogative, and exclamatory)	University students
Sosa 1999	Perceptual and instrumental analysis	Experimental	Spain; Perú, Argentina, Colombia; México; Cuba, Puerto Rico; Venezuela	Reading sentences (declaratives and interrogatives) and spontaneous speech	Men and women 24-34 years old and men (48-62) University degree

Table 1 – A Comparative Table of Studies in the Classic Model of Spanish Prosody.

BAS Studies in Prosody	Methodology	Data	Population	Corpus	Social Group
Colantoni & Gurlekian 2004, in press	Perceptual and instrumental analysis	Experimental	Argentina (Buenos Aires)	Reading sentences (declaratives)	1 man , 1 woman (professional radio announcers)
Enbe 2003 + Enbe, Gurlekian & Tobin in press	Perceptual and instrumental analysis	Experimental	Argentina (Buenos Aires)	Repetition of sentences (declarative)	NS and PS; 6 females (adults and children)
Present study	Perceptual and instrumental analysis	Experimental	Argentina (Buenos Aires)	Repetition of sentences (declarative, interrogative and exclamatory)	NS and PS; 18 males, 18 females divided into three age groups: children (5-8) and adults (18-50, 51-75)

Table 2 -A Comparative Table of Studies on BAS Prosody.

Colantoni and Gurlekian (2004, in press) and Gurlekian et al. (2004) described an inventory of phonetic accents which could serve as the norms of BAS prosody of NS in declarative sentences. Those who discussed variations in dialects in different sentence types (Canellada and Madsen 1987, Quilis 1993, Prieto et al. 1995, Sosa 1999, 2003, Hualde 2000, Toledo 2000, Face 2001, Beckman et al. 2002) did not deal with PS, nor did they discuss variation based on gender and age in the production of sentence types. The present study differs from all the previous ones in two major ways: (1) we are the first to compare and contrast NS - PS in BAS in general (based on our previous work on declarative sentences (Enbe 2003 and Enbe et al. in press)), and (2) we will compare and contrast the classical

Spanish prosodic patterns with the data of BAS Spanish for declarative sentences, wh- questions, and exclamatory sentences according to the sociolinguistic parameters of gender and age.

4. Experimental design

For this study 36 native speakers of BAS (18 NS and 18 PS), divided into 3 age groups: a) children (5-8), b) adults (18-50), and c) adults (51-75), with 3 males/ 3 females per group, repeated three sentences. Each speaker repeated the sentence once to avoid their becoming accustomed to the intonation pattern, save in a very small number of cases when a speaker confused the words of the sample sentence and the task was repeated.

Speaker selection was made according to the following criteria (1) for NS: (a) Native, monolingual, middle-class speakers of BAS living in Buenos Aires (centre and suburbs); (b) normal hearing and no physiological disorders in vocal folds and vocal tract; and (c) non-smokers (smoking affects fundamental frequency). (2) For PS: (a) Native monolingual middle-class speakers of BAS living in Buenos Aires (centre and suburbs), (b) a neurological or otorhinolaryngological disorder such as: (i) stuttering; (ii) hearing impairments; (iii) developmental speech disorders; (iv) neurological disorder; and (v) dysphonia.

4.1. Material

The corpus was composed of the following three sentences: (I) declarative: *El agua hierve.* ('The water boils.') (II) wh- question: *¿Dónde vive el nene?* ('Where does the boy live?') and (III) exclamatory: *¡Gol!* ('Goal!'). The sentences contain only sonorant consonants and vowels to provide a complete contour of fundamental frequency. The target sentences were checked by a board of eight experts (four speech pathologists, two linguists and two language teachers) who listened to the sentences and classified the utterances as typical BAS declarative, wh- question and exclamatory sentences. We use the single-word sentence *"¡Gol!"* ('goal') with a marked prosodic contour as a means to test in the most simple form NS versus PS.

4.2. Procedure

Each subject uttered the sentences in a repetition task. The repetition task was used due to the potential dificulties that children and speakers with PS may have in reading aloud and spontaneous speech. The utterances were recorded in a partially isolated acoustic room, using an AKG acoustics D50S dynamic vocal microphone on a Mini disc Sony MZ-R37. Waveforms were digitalized and stored on a hard disc and segmented to 16 bits using a sampling frequency of 44 kHz. Acoustic analysis was made through the "Anagraf" speech program (Gurlekian 1997) and each utterance was labelled according to the principles and procedures used for the autosegmental-metrical theory (AM-Theory) by Pierrehumbert (1980), the guidelines of ToBI labelling (Tonal and Break Indices), Beckman and Ayers (1997), and a phonetic ToBI system proposed for Argentine Spanish by Gurlekian et al. (2001). The sentences were characterized according to four descriptive tiers: (a) orthographic; (b) tonal; (c) phonemic; and (d) break. The phonemic transcription was performed in the Argentinean Spanish SAMPA adaptation (Gurlekian et al. 2001). We used the ERB (Equivalent Rectangular Bandwidth) scale rate psycho-acoustic level to characterize the fundamental frequency values. The results were analyzed by the Theory of PHB which attempts to explain linguistic phenomena in general and phonological and prosodic features in particular according to the axiom of "maximum communication with minimum effort."

5. Results and discussion

Speakers of BAS NS do not always follow the classical description of Spanish prosody. The variations are based on gender and age and, as might be expected, speakers of PS usually show an even greater variation from the classical contour than speakers of NS.

We decided to compare and to contrast our BAS data with the classic models of Spanish prosody according to three degrees of similarity:

i) Similar to classic model: means approximately identical to the classic contour in both melodic groups.

ii) Partially similar to classic model: means for a) declarative sentence: at least one melodic group identical to the classic model, b) wh-question: the presence of the highest tone in the wh-word, c) exclamatory sentences: not applicable in one-word sentence.

iii) Different from classic model: means differences in the components of the tonal contour and/or the number of melodic groups. Our data were presented in percentages obtained by grouping sentences according to these three categories.

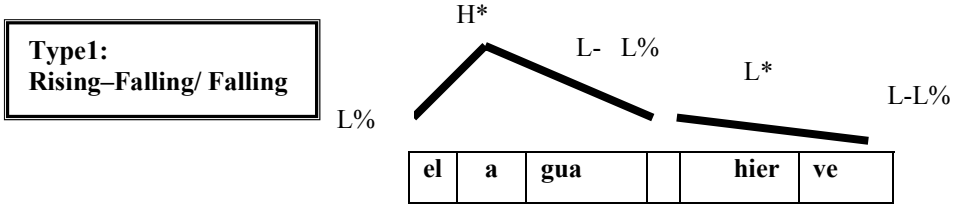
In the next sections, we will contrast the classical prosodic pattern of Spanish with the results obtained in our BAS data for each sentence type.

5.1. Declarative sentences

5.1.1. Classical patterns of declarative sentences

The two basic tonal patterns for the declarative sentences in Spanish originally presented in Navarro Tomás (1944) are: (1) Type 1: "rising-falling contour (subject) /falling contour (predicate)", which is the easiest of all prosodic patterns to produce and provides the most basic contrasts. According to Bolinger (1989:11) this pattern is found in the infant cry as the earliest form of vocalization and was later conventionalized as the most basic intonation pattern in the languages of the world. Therefore we refer to it as the unmarked pattern. Type 1 provides us a classic example of the axiom underlying the theory of PHB: minimum effort for maximum communication. In this case, a speaker exerts less effort to produce the most basic contrast in communication. (2) The second tonal pattern is "high-rising contour (subject) / falling contour (predicate)" which is used to show a clear contrast between both parts of the sentence. This pattern requires greater effort than the first, but it also provides a sharper contrast. According to PHB, the speaker exerts more effort to achieve more clear-cut and distinct communication oppositions. In Figure 1, we adapted our declarative sentence "*El agua hierve" ('The water boils'*) to the two types of patterns:

Sentence	***el***	***agua***		***hierve***	
Syllables	**el**	**a**	**gua**	**hier**	**ve**
Phon. Level	**el**	**´aGwa**		**´jerBe**	
Part of Speech	article	noun		verb	



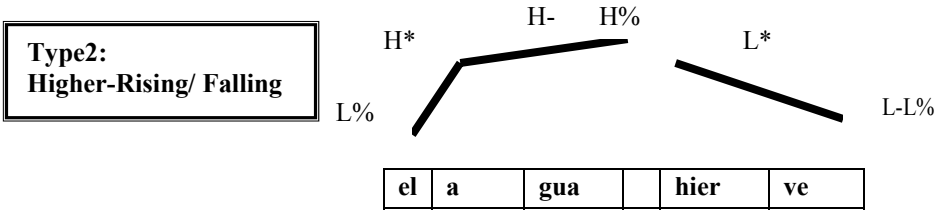


Figure 1: Classic Model of Spanish Declarative Sentences.

5.1.2. BAS declarative sentences

For BAS NS our data supported similarities with the previous research for declarative sentences in the following ways: (a) All speakers produce the sentence in two melodic groups, divided for tonal change and according to syntactic and semantic norms (the subject: el agua (*'the water'*) and verb: hierve (*'boils'*)). (b) All speakers insert pitch accents on the stressed syllables of content words (nouns and verbs) and not in function words. (c) All speakers end the sentence with a falling contour.

The distribution of our NS data differs, however, from the previous research that claims that gender is not a variable for prosodic variation (Sosa 1999). Our research for NS indicates the following:

1. Women (18-75 years) in 100% of cases are closest to the classical high-rising contour (type2).
2. Children (5-8 years), in 83% of cases, show identical characteristics to women. In 17% of cases, they present a lower pitch accent in the subject and maintain similar falling final contours.
3. Men (18-75 years) choose various types of contours: a) in 33% of cases they are identical to women (type2); b) in 33% of cases they produce the rising-falling contour (type1), and c) in 33% of cases they are partially similar to the classic model because they give more extreme emphasis to the verb.

Normal Speech	**Similar to Classic**		**Partially Similar to Classic**	**Different from Classic**
Declaratives	**Rising–Falling (Type1)**	**High-Rising (Type2)**		
Women	0%	100%	0%	0%
Men	34%	33%	33%	0%
Children	0%	83%	17%	0%

Table 3: NS: Distribution According to Gender in BAS Declarative Sentences.

These gender differences are supported by sociolinguistic research across languages in Western societies in general and in Spanish in particular. For Western societies Labov (1990), Foley (1997), and Cheshire (2002), among others, found that women favor the incoming prestige forms of the language and are more conservative than men. For Spanish in particular, Cameron (2000) and Silva-Corvalán (2001) also found that women use more standard forms than men.

For BAS PS the distribution in declarative sentences shows differences with NS (see Table 4):

1- Women (18-75 years) in 33% of cases choose the rising-falling contour (type1). The other 50% of cases are partially similar to the classical model. In 17% of cases women produce random accents in articles ("el") (*'the'*) and two contiguous accents in the same syllable ("**hier**-ve" ['ɟ'erβe]) *('boils')*.

2- Men (18-75 years) choose in 50% of cases the rising-falling contour (type1). 17% of the cases are similar to high-rising contour (type2) followed by a pause. In 33% of cases, men produce random accents in the article ("el") (*'the')* or two contiguous accents in the same syllable ("**hier**-ve" ['ɟ'erβe]) *('boils'*).

3- Children (5-8 years) in 100% of cases are partially similar to the classic models: a) In 83 % of cases the first melodic group shows a random choosing of type1 or type2. In 50% of these cases, children also choose the highest tone in the verb. However, in the final position of the sentence they have a falling contour. b) 17 % of cases have a lower contour at the first melodic group, followed by a falling tonal line in the final position of the sentence.

4- PS speakers produce more than two melodic groups per sentence separated not only by tonal contours but also by physiological pauses.

Pathological Speech	**Similar to Classic**		**Partially Similar to Classic**	**Different from Classic**
Declaratives	**Rising-Falling (Type1)**	**High-Rising (Type2)**		
Women	33%	0%	50%	17%
Men	50%	0%	17%	33%
Children	0%	0%	100%	0%

Table 4: PS Distribution According to Gender in BAS Declaratives Sentences.

We can observe and compare the speech analysis of the BAS declarative sentence *El agua hierve* ('The water boils') in NS and PS according to the differences in gender in the following figures (2- 4):

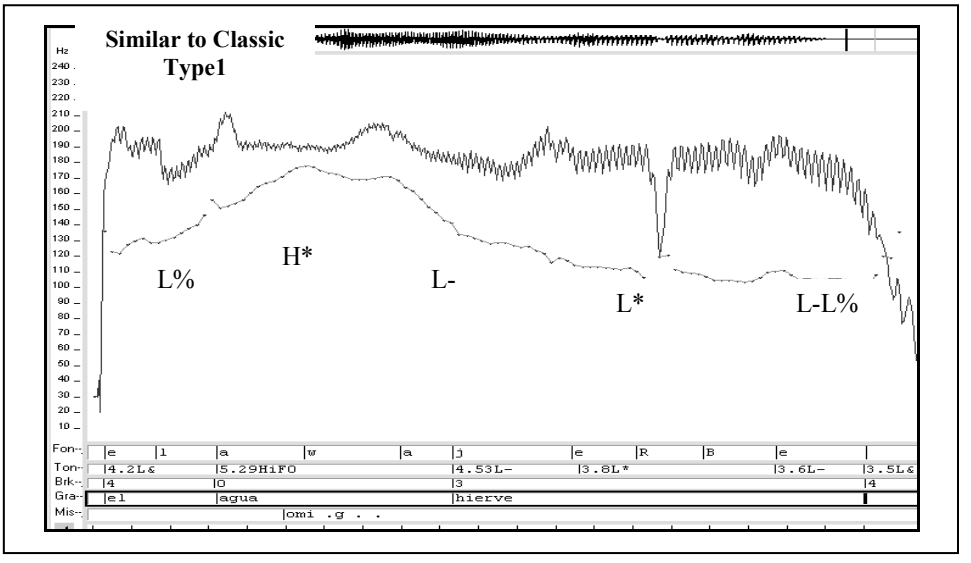


Figure 2: NS Man (19): Declarative Sentence Similar to Classic Type1.

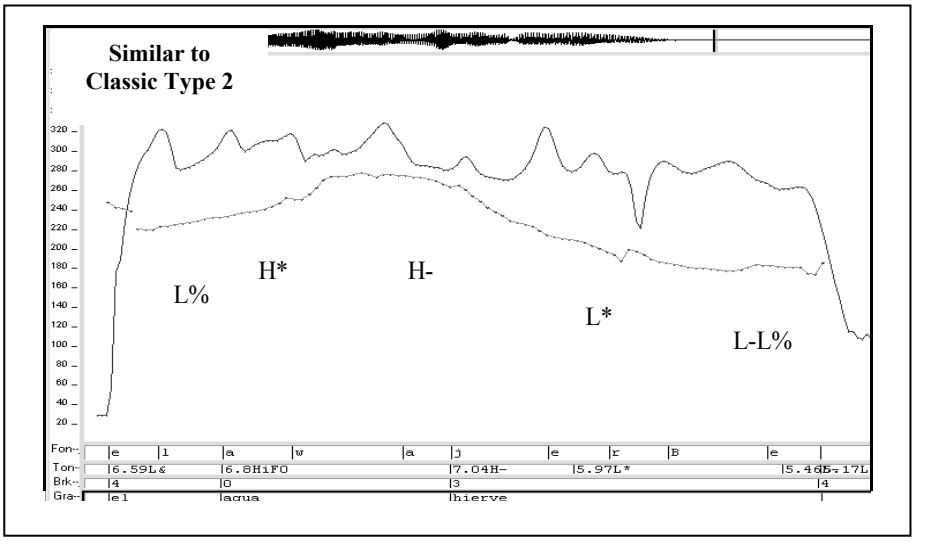


Figure 3: NS Woman (21): Declarative Sentence Similar to Classic Type2.

Figure 2 shows the declarative sentence of BAS with a classical type1 tonal contour uttered by a male speaker of NS. In Figure 3, the same sentence is uttered by a female speaker of BAS NS with a classical type2 tonal contour. In Figure 4, a female speaker of BAS PS uttered the sentence with a classical type1 tonal contour with two contiguous pitch accents in the verb ("hier-ve" ['ʝ'erβe]) and repetition of the same syllable ("i").

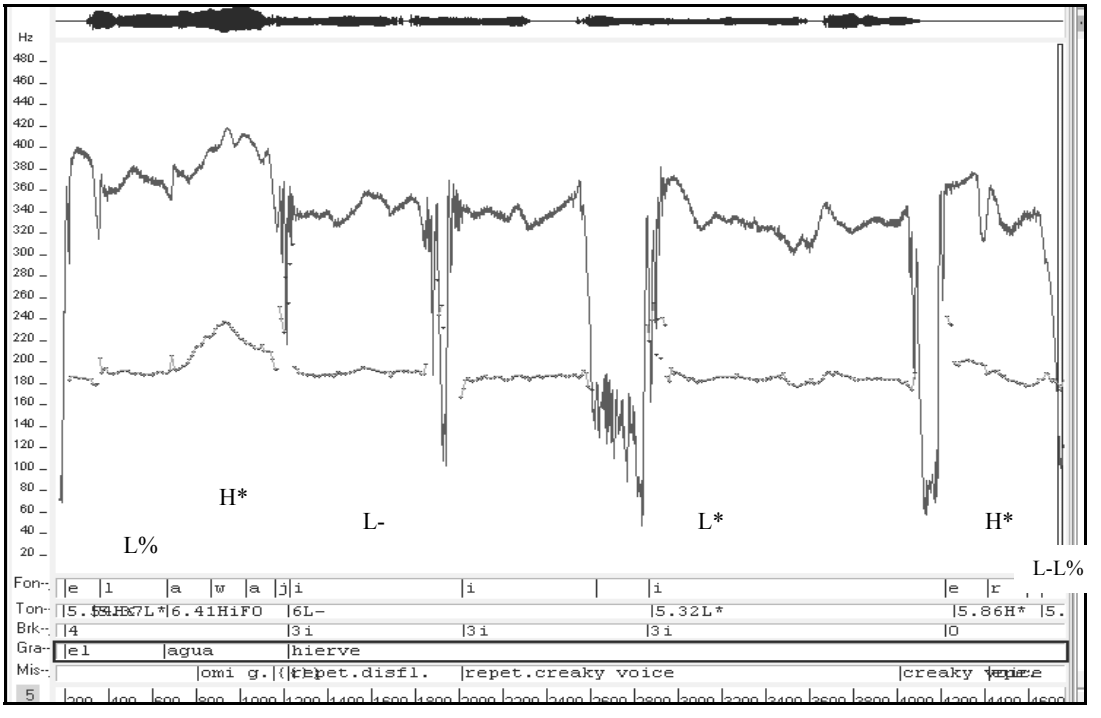


Figure 4: PS Woman (35) (Stuttering): Similar to Classic Type1. (Presents Two Contiguous Accents in the Verb "hier-ve" ['ʝ'erβe]) (Reduction of Dipthong).

5.2. Wh- questions

5.2.1. Classical patterns of Wh-questions

Navarro Tomás (1944), Quilis (1993), Sosa (2003), and others have claimed at least four different prosodic patterns for wh- questions or "pronominal interrogatives" (wh- word- verb- subject): (1) the falling "unmarked" contour, (2) the marked rising "polite" contour, (3) the marked rising – falling "emphatic" contour, and (4) the marked higher–rising contour. This last kind of contour is typical for some Latin American dialects (Puerto Rico, Venezuela, Mexico, and Colombia) (Sosa, 2003). These authors agree that the wh-word has the highest or a high tone and then the tonal line changes in different ways. The above four contours are presented in the following schema:

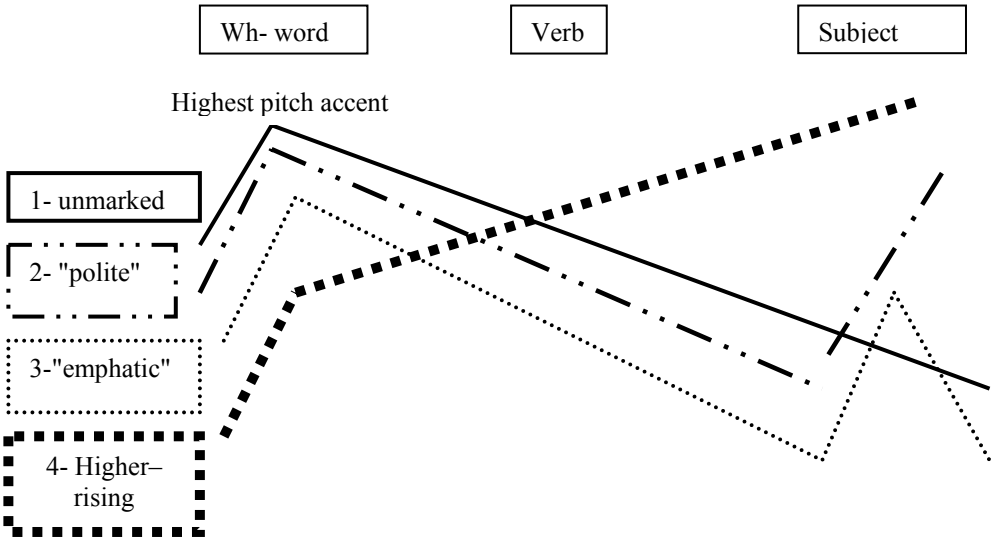


Figure 5: Classical Model of Wh-Questions in Spanish.

Navarro Tomás (1944), Canellada and Madsen (1987), and Sosa (1999) found that the initial juncture tones of interrogatives are higher than the initial juncture tones in declarative sentences for all Spanish dialects. The above authors also found that the pitch accent in the wh-word is higher than the first pitch accent in declarative sentences. Sosa (1999, 2003) found all four classical terminal contours in Latin American dialects.

We consider that wh-questions are more marked than declarative sentences semantically, syntactically and pragmatically for the following reasons:

1) Wh-questions have an obligatory interrogative marker or wh-question word.
2) There is a change in word order (wh-word- verb- subject) rather than S- V- O order as in declaratives.
3) The marked nature of wh- questions (based on (1) and (2) above) produces more variability in the prosodic patterns.

Reasons (1)-(3) above constitute the classical arguments for markedness found in the linguistics literature from Jakobson onwards (summarized in Tobin 1990).

5.2.2. BAS Wh- questions

Our data based on the sentence *¿Dónde vive el nene?* ('Where does the boy live?') show much variation from the classical wh-prosodic contours for both NS and PS:

a) None of the speakers of BAS are similar to the classical wh-questions in both melodic groups regarding the number of pitch accents and the final contour. Both NS and PS speakers produce wh-

questions with more than one high pitch accent per sentence. They prefer higher prominences in the **wh-word** (first pitch accent like the classical), but there is also a tendency to place high prominence on the **verb** (second pitch accent) and also on the **subject** (third pitch accent)**.**

b) The data which we refer to as "partially similar" concerns the placement of the highest pitch accent in the wh-word as in the classical pattern: For NS, this similarity is found in 100% of children, 67% of women and 50% of men (see Table 5).

Wh-Questions NS	Similar to Classic	Partially Similar to Classic **	Different from Classic
Women	0%	67%	33%
Men	0%	50%	50%
Children	0%	100%	0%

Table 5: NS: Comparison of BAS Wh-Questions with the Classic Spanish Wh-Questions.
**Partially similar to classic model means the presence of a highest tone in wh- word.

i. For the adults there is a further variation based on age: 100% of 51-75 year-old women place the highest pitch accent in the wh-word, as opposed to 33% of 18-50 year-old women. Therefore older women are closer to the classic norm than younger women. 67% of 51-75 year-old men place the highest pitch accent in the wh-word as opposed to 33% of 18-50 year-old men. The data therefore show that men are further away from the norm than women as in declarative sentences, but for both men and women, older speakers are closer to the norm. Therefore in wh-questions both gender and age are significant variables.
ii. 67% of all 18-50 year-old adults produce the highest pitch accent in the verb rather than in the wh-word. In this age group, we can see deviation from the norm in the same age group for both genders. In this case the variable is age rather than gender.
iii. 100% of children have the highest pitch accent in the wh-word as in the norm; however, they are only partially similar because they have additional pitch accents in the verb and subject. In this case, age rather than gender is the significant variable.

c) NS adults produce the sentence in two melodic groups, divided for tonal change and according to syntactic and semantic norms. However, in the group of NS children, 67% produce the sentence in one melodic group and 33% produce the sentence in two melodic groups, similar to adults.

d) Despite all of the differences we found for wh-questions (a-c above), we also found two similarities with the classical description: a) all NS speakers place pitch accents in the stressed syllable of the content words (as in declaratives sentences) and b) all NS speakers produce the first pitch accent in wh-questions (wh-word) at a higher fundamental frequency than the first pitch accent in declarative sentences.

e) Unlike the classical data, the initial juncture tones of wh-questions are not always higher than the initial juncture tones of NS declarative sentences. We compared the initial juncture tones of declarative sentences and wh-questions in the ERB scale for each speaker with the following results: 67% of younger women (18-50) do have a higher initial juncture tone in wh-questions but 33% have a lower initial juncture tone in wh-questions. 100% of older women (51-75) and 67% of men produce a lower initial juncture tone in wh-questions than in declaratives. 33% of younger men have a similar initial juncture tone for both sentence types and 33% of the older men have a higher initial juncture tone in wh-questions. 100% of children have a higher initial tone in wh-questions than in declaratives. Thus, for higher initial juncture tone in wh-questions: children are the closest to the classical type followed by younger women followed by older men. However, 67% of men, 100% of older women and 33% of younger women produce lower initial juncture tones in wh-questions than in declarative sentences. For initial juncture tone both age and gender are significant variables (see Table 6).

Initial Juncture Tones in Wh-Questions (NS)	Higher than Declaratives	Similar to Declaratives	Lower than Declaratives
Children	100%	0%	0%
Men 18-50	0%	33%	67%
Women 18-50	67%	0%	33%
Men 51-75	33%	0%	67%
Women 51-75	0%	0%	100%

Table 6: NS: Initial Juncture Tones in BAS Wh-Questions in Comparison with Declarative Sentences According to Gender and Age.

f) For the terminal contour in wh-questions we found similar characteristics between NS and PS, but PS shows more variation. For NS: 100% of children end the sentence with a higher phrase accent and higher juncture tones. For the adults, 100% of older women and 67% of younger women have higher phrase accents and juncture tones (similar to children). Only 33% of younger women have higher phrase accents and lower juncture tones. 100% of older men and 67% of younger men have higher phrase accents and lower juncture tones. Only 33% of younger men have a higher phrase accent and higher juncture tones (similar to children) (see Table 7).

Terminal Contour in Wh- Questions (NS)	H-H%	H-L%
Children	100%	0%
Women 51-75	100%	0%
Women 18-50	67%	33%
Men 18-50	33%	67%
Men 51-75	0%	100%

Table 7: NS BAS Distribution of Terminal Contour in Wh-Questions According to Gender and Age.

For the terminal contour in wh- questions in PS we found: 67% of children produce a higher phrase accent and higher juncture tones (similar to NS children), 17% have higher phrase accent and lower juncture tones and 16 % have lower phrase accents and lower juncture tones. 67% of younger women and 33% of older women have higher phrase accents and higher juncture tones (similar to NS children). 67% of older women and 33% of younger women produce higher phrase accents and lower juncture tones (similar to older NS men). For PS men, 100% of younger men and 33% of older men produce a higher phrase accent and a lower juncture tone (similar to older NS men), and 67% of older men produce a lower phrase accent and lower juncture tone (similar to PS children) (see Table 8).

Terminal Contour In Wh-Questions (PS)	H-H%	H-L%	L-L%
Children	67%	17%	17%
Women 18-50	67%	33%	0%
Women 51-75	33%	67%	0%
Men 18-50	0%	100%	0%
Men 51-75	0%	33%	67%

Table 8: PS BAS Distribution of Terminal Contour in Wh-Questions According to Gender and Age.

Figure 6 illustrates the variation in the distribution of tonal contours in wh-questions. The classic unmarked contour is compared with the prosodic patterns of BAS where the majority of NS speakers, both adults and children, made pitch accents in the wh- word, in the verb, and in the subject.

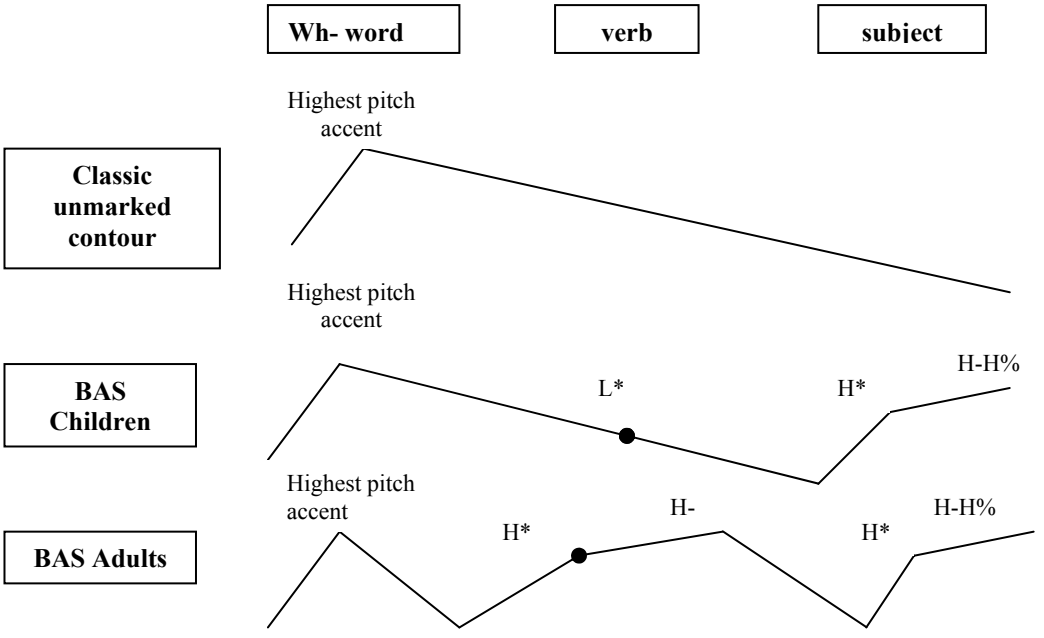


Figure 6: Pitch Contours of the Most Frequently Produced Wh-Questions (Classic and NS BAS).

Figure 7 (below) shows the sentence *¿Dónde vive el nene?* ('Where does the boy live?') uttered by one speaker of PS with stuttering. The speech analysis demonstrates the presence of higher pitch accents in the wh- word, in the verb, and in the subject, but there also appears a higher pitch accent in the article "el" ('the').

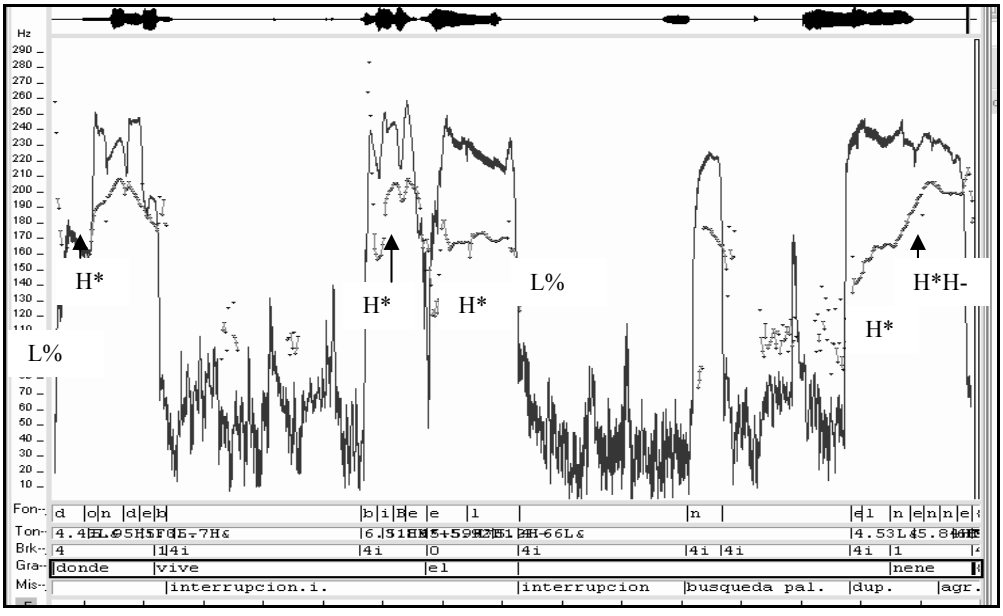


Figure 7: PS Man (27) (Stuttering): BAS Wh-Question. Highest Pitch Accent in Wh-Word and Higher Pitch Accents in Verb, Article and Subject.

5.3. Exclamatory Sentences

5.3.1. Classical patterns of exclamatory sentences

Navarro Tomás (1944) describes at least three different patterns of producing exclamatory sentences which vary according to the pragmatic and emotional state of the speaker. Our description is based on two of these models: a) **falling exclamatory** ('exclamativa descendente'): the tonal contour rises from a low tone to a higher first pitch accent and then, falls lower until the end of the sentence (type1); and b) **rising exclamatory** ('exclamativa ascendente'): the tonal contour rises from a low tone to a higher pitch accent and a higher final contour (type2) (see Figure 8).

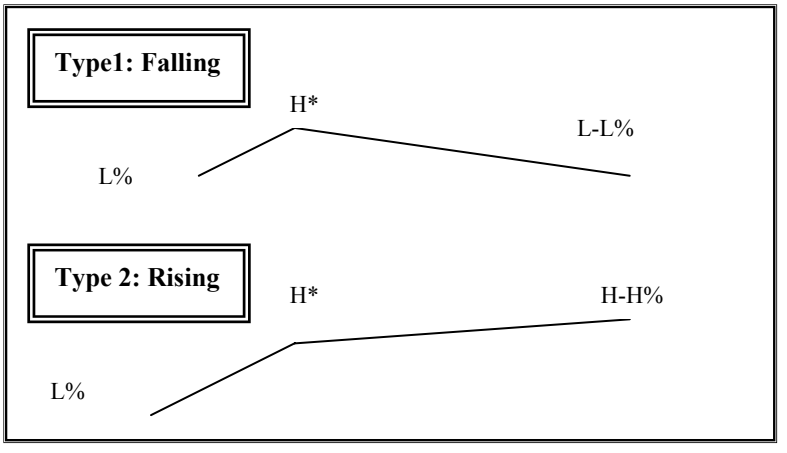


Figure 8: Classic models for Exclamatory Sentences in Spanish.

5.3.2. BAS exclamatory sentences

In exclamatory sentences, BAS NS shows the following distribution (see Table 9):

- 100% of all three groups of NS speakers produce the exclamatory sentence similar to the classic type1 (which may be because it is a one-word sentence).
- In all cases of NS, the highest pitch accents of exclamatory sentences have a higher fundamental frequency than their counterparts in declarative sentences.

Exclamatory (NS)	Similar to Classic Type1	Different from Both Classic Types 1&2
Women	100%	0%
Men	100%	0%
Children	100%	0%

Table 9: Comparison of NS BAS Exclamatory Sentences with the Classic Spanish Model.

In PS however, there are variations where both gender and age are significant variables (see Table 10):

1. 100% of women (18-75 years) produce the sentence similar to the classic type1.
2. 67% of men (18-75 years) produce the sentence similar to the classic type 1 and 33% of cases are different from both classic types.
3. 83% of children (5-8) are different from both classic types and only 17% of children have similar contours to classic model type1.
4. In all cases where the data are different, the difference is in the pitch accent and in the terminal contour: (a) Pitch Accent Differences: 100% of women produce higher pitch accents (similar to NS), followed by 67% of older men, 33% of younger men, and 50% of children. However,

as opposed to NS, 67% of younger men, 33% of older men, and 50% of children of PS produce a lower pitch accent. (b) Terminal contour: 83% of PS children produce a lower phrase accent and higher juncture tone (L-H %), completely different from both classic models.

Exclamatory (PS)	Similar to Classic Type1	Different from Both Classic Types 1&2
Women	100%	0%
Men	67%	33%
Children	17%	83%

Table 10: Comparison of PS BAS Exclamatory Sentences with the Spanish Classic Model.

Figures 9 and 10 compare BAS exclamatory sentences uttered by NS and PS child speakers.

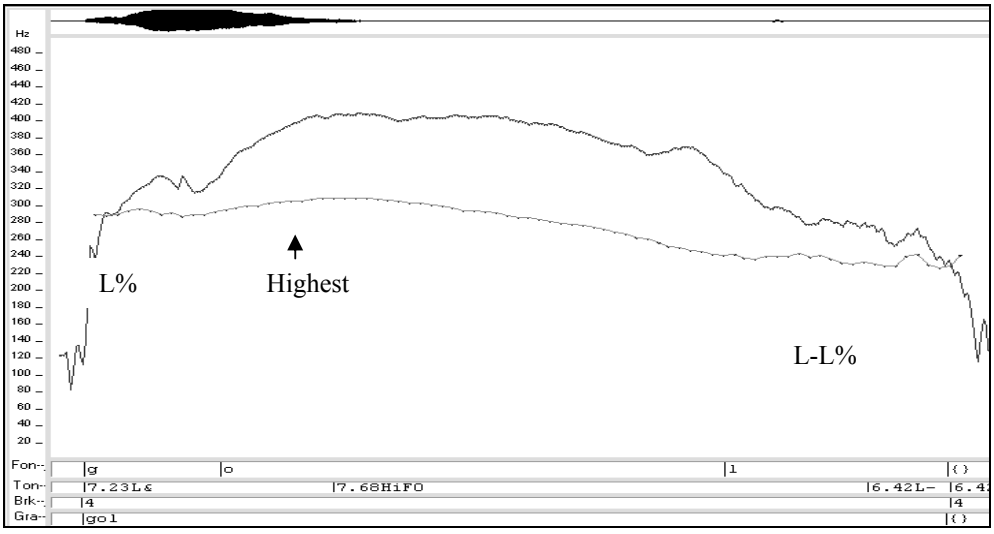


Figure 9: NS BAS Female (5): Exclamatory Sentence: Similar to Classic Type1.

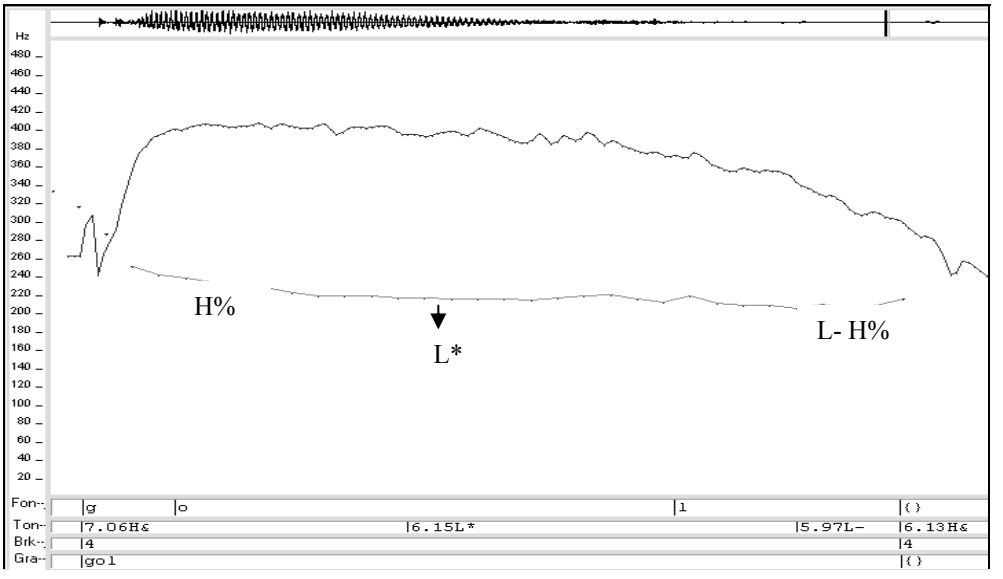


Figure 10: PS BAS Female (5) (Developmental Language Disorder): Exclamatory Sentence: Lower Pitch Accent and Higher Juncture Tone.

In exclamatory sentences, BAS NS children prefer to utter a higher pitch accent and then fall to a lower terminal contour. PS children show a preference to put a lower pitch accent in the beginning with a small tendency to rise in the terminal contour.

6. Conclusions

The major contribution of this study is the description and explanation of the variation from the classic models of Spanish prosody in BAS for three sentence types (declarative, wh-questions, and exclamatory) according to: (a) Normal versus Pathological Speech as well as (b) sociolinguistic variables such as age and gender.

In BAS, we see more gender than age differences in prosodic contours for declarative sentences. NS speakers are close to the classic model: women are closest, followed by children and men. It is more complex for PS speakers because pathology is a stronger variable than gender and age. All NS speakers produce two melodic groups separated by tonal change. PS speakers produce more than two melodic groups per sentence, separated not only by tonal change but also by physiological pauses, and place pitch accents on non-content words as well as content words.

In wh-questions, NS and PS speakers do not reflect the patterns described in the literature, i.e. the highest tone only on the wh-word, because both NS and PS speakers, of both genders and all ages, prefer more than one high pitch accent per sentence. The high pitch accent appears not only on the wh-word, but also on the verb and on the subject. Our data on NS wh-questions regarding the highest pitch accent in the wh-word are the following: all the children resemble the classic model; two-thirds of the women and one half of the men resemble the classic model, with older speakers for both genders closer to it. Our data on PS wh-questions regarding the highest pitch accent in the wh-word are the same as and even slightly better than NS speakers: 100% of the children and 67% of both the women and the men resemble the classic model (with no difference for age). Thus, for BAS wh-questions, the differences between NS and PS appear to be neutralized. The reason may be that the more difficult and marked the sentence, the more people will focus on the same marked features – the wh-word, inverted verb and subject and final interrogative tonal contour. Communicative needs will influence the amount of effort expended for the compromise between maximum communication and minimal effort.

For exclamatory sentences, the differences were for PS speakers only and the variations were both for gender and age. All NS speakers followed the classic description without exception. In PS speakers,

all the women and two-thirds of the men, but only 17% of the children, followed the norm. In declarative and exclamatory sentences the women were the closest to the classic model, while in wh-questions they followed the children, but were closer than the men, as was seen in other sociolinguistic studies of phonology in other Western societies.

Tables 11 and 12 summarize the sentence types according to age and gender in both groups of speakers (NS and PS).

NORMAL SPEECH	Gender/ Age	Similar to Classic Model	Partially Similar to Classic Model	Different from Classic Model
Declarative	Women	100%	0%	0%
	Children	83%	17%	0%
	Men	67%	33%	0%
Wh- question	Children	0%	100%	0%
	Women	0%	67%	33%
	Men	0%	50%	50%
Exclamatory	Women	100%	0%	0%
	Men	100%	0%	0%
	Children	100%	0%	0%

Table 11- NS Speakers of BAS: Distribution According to Sentence Type, Degree of Similarity to Classic Model and Age and Gender.

PATHOLOGICAL SPEECH	Gender/ Age	Similar to Classic Model	Partially Similar to Classic Model	Different from Classic Model
Declarative	Men	50%	17%	33%
	Women	33%	50%	17%
	Children	0%	100%	0%
Wh- question	Children	0%	100%	0%
	Women	0%	67%	33%
	Men	0%	67%	33%
Exclamatory	Women	100%	0%	0%
	Men	67%	0%	33%
	Children	17%	0%	83%

Table 12– PS Speakers of BAS: Distribution According to Sentence Type, Degree of Similarity to Classic Model and Age and Gender.

All of the sentence types for BAS speakers exemplify the fundamental axiom of PHB: maximum communication with minimal effort. Our data have indicated that the unmarked declarative sentences are the easiest to produce (require the least effort) in order to achieve the most basic communication contrasts. The marked wh-questions are the most difficult to produce because they: (a) begin with a stressed wh-word, (b) have an inverted word order, and (c) have an interrogative terminal contour, all of which are overt markers of communication contrast which require the greatest effort to produce. Therefore, in the unmarked declarative sentences, the distinction between NS and PS speakers is a significant variable, and the PS speakers vary more than the NS speakers from the classical pattern because of their inherent limitations. This need to focus the greater effort on the same fixed and overt communication markers in wh-questions appears to neutralize the differences between NS and PS speakers, all of whom are expending more effort to produce more clear-cut communication distinctions. With the marked – but less difficult to produce – exclamatory sentences, the NS speakers followed the

norm while the PS speakers showed variation. In both cases of marked sentences, NS speakers produce pitch accents with a higher level of fundamental frequency than in unmarked declarative sentences, which requires greater effort. It is most interesting to note that in the easiest, unmarked declarative sentences, the differences between NS and PS speakers were the greatest, followed by the more difficult marked exclamatory sentences where there was still a difference between NS and PS speakers, while finally in the most difficult wh-questions requiring the most direct, defined and fixed effort, the difference between NS and PS speakers appears to be neutralized.

The results of our research show that despite their qualitative and quantitative differences in prosody, both NS and PS speakers maintain: (a) the contrastive function of intonation, (b) a regular placement of stress in content words, and (c) a lowering of tone in sentence-final position for declarative sentences and a marked tonal contour in both exclamatory and interrogative sentences. At this preliminary stage of the present research, the theory and its clinical applications appear to be reasonably well-founded empirically and potentially promising for future research in the field of prosody in general and the prosody of Buenos Aires Spanish in particular.

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