

# Strategies for Word Stress Acquisition in Brazilian Portuguese\*

Raquel Santana SANTOS (Universidade de São Paulo) - raquelss@usp.br

## 0. Introduction<sup>1</sup>

In this paper, I discuss the acquisition of Brazilian Portuguese (henceforth BP) word stress for non-verbs and focus on the different strategies children use in order to place prominences on their utterances while the word stress algorithm has not been acquired. I propose that some of these strategies show the setting of word stress parameters (although the complete parameter setting depends on other kinds of information, such as morphological and syllabic structure information, for example).

The paper addresses the issue of which prosodic constituent children start working with and how the development of prosody proceeds during the acquisition process. As opposed to the prevailing wisdom in the literature (cf. Demuth 1994, Fikkert 1994, Demuth and Fee 1995), which favors a bottom-up view of prosodic development, I argue, based on production data, that a bottom-up development cannot be universal, for children start from higher levels and go down in the prosodic hierarchy when acquiring BP.

This paper is organized as follow: section 1 describes the adult algorithm for word stress in BP; section 2 describes the subjects and the methodology used here; sections 3 and 4 describe the different strategies used by children in their acquisition of word stress; section 5 discusses the prosodic development in BP; finally, section 6 presents some concluding remarks.

## 1. Word Stress Algorithm – Adult Pattern

Most words in BP bear primary stress on the second syllable from the end (63% - henceforth penultimate stress); the other possible stresses are on the final syllable (18% - henceforth final stress) and on the third syllable from the end (07% - henceforth antepenultimate stress) (see Cintra 1997). In this paper, I assume Lee (1995)'s proposal for word stress algorithm in BP, according to which the lexicon of BP is ordered in two levels:  $\alpha$ , where we find derivational processes such as suffixation, irregular inflection and some compositional processes; and  $\beta$ , where we find the regular inflection of verbs and non-verbs, diminutive degree formation, as well as adverb formation. His proposal can be sketched as in (1):<sup>2</sup>

---

\* In Marina Tzakosta, Claartje Levelt & Jeroen van de Weijer (eds.), **Developmental Paths in Phonological Acquisition**. Special issue of **Leiden Papers in Linguistics** 2.1 (2005), 71-91. <http://www.ulcl.leidenuniv.nl> ISSN 1574-4728.

<sup>1</sup> This paper is based on chapter 5 of Santos (2001). Previous versions were presented at Developmental Paths in Phonological Acquisition (2004) and at the University of Nijmegen (2004). I'm thankful for the audiences of these presentations for comments and suggestions. Special thanks to Paula Fikkert and Jairo Nunes for valuable comments on an earlier draft. All the remaining errors are mine.

<sup>2</sup> Although here I will discuss only the stress patterns of non-verbs, it is worth noting that, despite its apparent complexity, extrametricality in verbs only appear at school age.

(1)	Domain:	$\left\{ \begin{array}{l} \text{non-verbs: } \alpha \\ \text{verbs: } \beta \end{array} \right.$
	Constituent:	binary
	Boundary:	right
	Head of the constituent:	$\left\{ \begin{array}{l} \text{non-verbs: } \left\{ \begin{array}{l} \text{default: } \text{right (ws)} \\ \text{marked: } \text{left (sw)} \end{array} \right. \\ \text{verbs: } \left\{ \begin{array}{l} \text{default: } \text{left (sw)} \\ \text{marked: } \text{right (ws)} \end{array} \right. \end{array} \right.$
	Iterativity:	no
	Syllable quantity:	no
	Extrametricity:	yes, it is morphologically conditioned and subject to the Perifericity Condition:
		$\left\{ \begin{array}{l} \text{non-verbs: thematic vowel iff in the end of the word} \\ \text{verbs: } [-\text{mos}] \text{ (for the Imperfect, Past Perfect and Future Perfect of the Indicative and Imperfect of Subjunctive)} \end{array} \right.$

For nouns, this algorithm derives the word stress as in (2) - (4), with the default value for head. If there is a thematic vowel at the end, it creates a penultimate stress (cf. (4)), otherwise it results in a final stress (cf. (2) and (3)). However, even some words that bear penultimate stress result from a marked setting, as can be seen in (5). Finally, the antepenultimate stress can only be derived by conjoining the marked value with extrametricity, as shown in (6). In the case of a two-syllable word with an extrametrical element, the visible syllable is assigned prominence, as seen in (7):<sup>3</sup>

(2)	(3)	(4)
( w s )	( w s )	( w s )
[ka.fɛ]	[ko.lar]	[ka.va.l > o]
‘coffe’	‘necklace’	‘horse’

(5)	(6)	(7)
( s w )	( s w )	( s )
[la.pis]	[mu.zi.k > a ]	[ka.z > a]
‘pencil’	‘song’	‘house’

## 2. Subject and Methods

The corpus analyzed in this study is part of a larger corpus of longitudinal records on the acquisition of Brazilian Portuguese belonging to the *Projeto de Aquisição da Linguagem* of the Universidade Estadual de Campinas (for a description of the corpus of

<sup>3</sup> “>” marks extrametrical elements, “s” and “w” represent strong and weak syllables, respectively.

the project, see Lemos 1995). The corpus analyzed here is constituted by production data by two Brazilian children - R. (female) and T. (male) - from 1;1 to 3;4 years of age. The children are from middle-class families and their parents are university graduates.

The children's spontaneous production was audiorecorded on a weekly basis, in half-hour sessions, in a naturalistic way. The data referring to both the children and their caretakers were phonetically transcribed on a perceptual basis by a first researcher and the transcriptions were checked by the author of this paper or another researcher. Only the data whose transcriptions were agreed upon by both researchers were taken into consideration here.

The data were segmented into words only when children's utterances had more than one stress prominence. Utterances were identified according to standard intonational and pause criteria. Given that utterances with more than one prominence generally appear in later periods (from 2;5 on), until then the whole utterance (including unintelligible ones) was analyzed as a token.

Finally, since the analysis of the data was meant to be qualitative rather than quantitative, all the different intonational contours and relevant phonological processes were registered even if they appeared only once.

### 3. Results

The first result concerns children's units. Based on the findings of previous studies focusing English and Dutch (cf. Fikkert 1994 and Demuth 1996, among others), we should expect to find monosyllabic or foot size words in the beginning of the acquisition process. However, what we found was that the segment sequences children cut from their interlocutor's utterances were not words. Usually, they are phonological phrases or part of phonological phrases, as can be seen in (9) and (10):

Child's production	Target or Adult's utterance
(9) [ati u po'po]	/a.'ki.u.po.'pɔ/ 'here is the popo' (R.1;5.18)
(10) mother: /u.'li.vru # 'vã.mu.'le.u.'li.vru/	'the book. Let's read the book?'
[ a?le.u.'li]	'read the book' (T.2;2.26)

In (9), the child's utterance corresponds to a whole phonological phrase in the adult language. In (10), the child cut the adult's utterance, taking part of one phonological phrase (corresponding to a VP). Interestingly, in this example he takes only part of the noun (/li.vru/), which shows that he is not focusing on words but rather that he is using the prominences of the adult's utterances as the basis for his cuts.

It is not the case that children never produce monosyllables (cf. Scarpa 1999). They produce a few but, when they do, they repeat them with the addition of a preceding filler-sound, as shown in (11):

(11) R. [la] ~ [la] ~ [ala]	
R. [ala] ~ [ala]	
R. [ba] ~ [aba]	(R. 1;3.19)

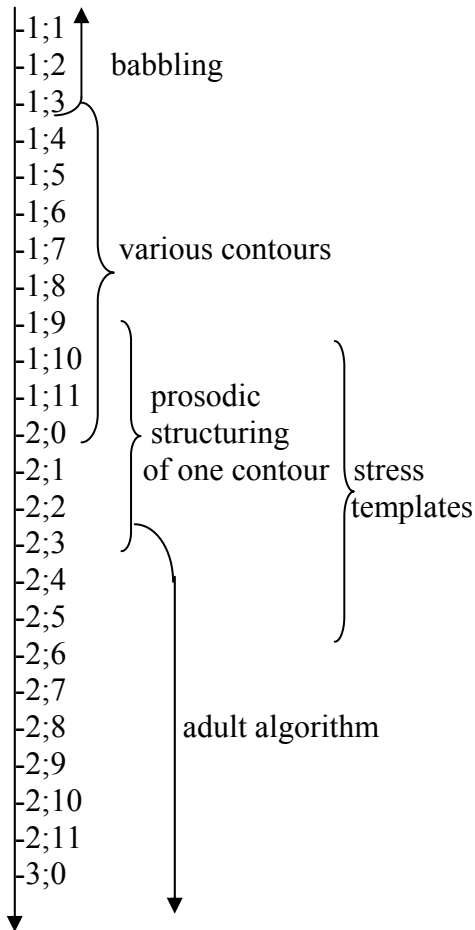
Another salient result in children's data is that they use different strategies to place the stress prominence on their utterances before the adult algorithm of word stress is used productively.<sup>4</sup> These strategies occur predominantly in certain periods of the acquisition process with some overlapping in some periods. With respect to the acquisition of BP, I identified three different strategies – various intonational contours, prosodic structuring of one intonational contour, stress templates – before the adult algorithm is productively used.

In (12) – (13) below, I summarize these strategies taking into account children's age:

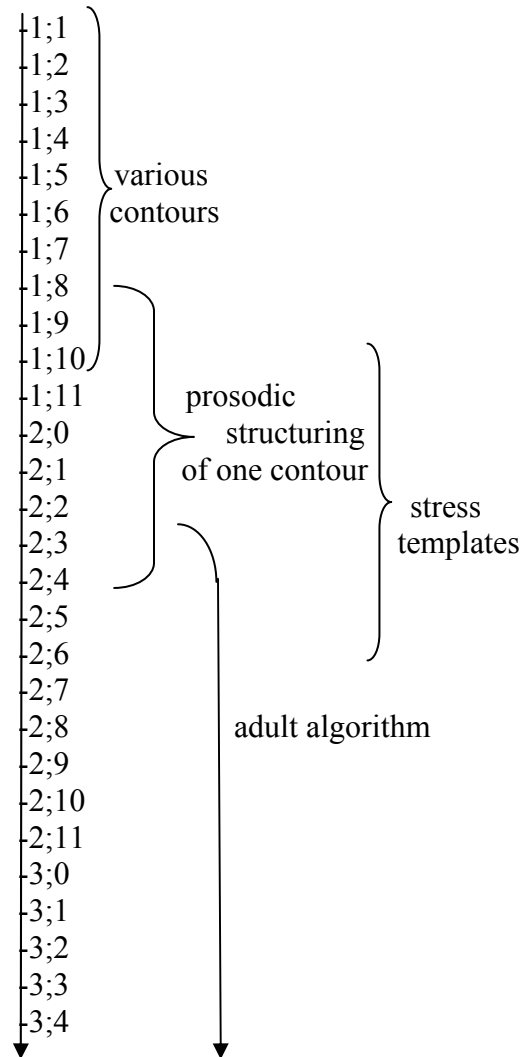
---

<sup>4</sup> Cf. Santos 2003 for a discussion on bootstrapping of word stress in BP.

(12) T.



(13) R.



#### 4. Different strategies used

Assuming Lee's (1995) proposal for word stress in BP, in the course of acquisition children need to set the following parameters: domain, constituent, boundary, head, syllable quantity, iterativity, and extrametricity. The strategies discussed here lead children to set the following parameters: boundary, directionality, constituent, and extrametricity. Other parameter settings - sensibility to syllable quantity (Santos 1998) and domain of application (Santos 2001) - need additional information from other domains. However, it must also be said that not all strategies are responsible for parameter settings; they can be only an artifice to mark stress prominences while the stress parameters are not set.

## 4.1. Various Intonational Contours

### 4.1.1. The contours

Between 1;3 and 2;0, T. and R. developed a primitive system of intonational contours. Gebara (1984) mapped the development of the intonational system of R. and T., grouping the contours according to their use. Her results can be summarized in (14) and (15):<sup>5</sup>

(14) Development of T's intonational system

a) early acquisition (from 1;4 to 1;7)

TONE	CONTOUR	USE
1T	H+L* L̄ L% or L+H* L̄ L%	To signal the complete phase of an event. To set up a dialogue. Emphatic function.
2T	L* L̄ L%	Solitary speech.
3T	H+L* H̄ H% or L*+H H̄ H%	Used for two items: [ majs ] 'more', and [ lujs ] 'light'.
4T	H* H̄ L% or L+H* L̄ L%	Reference to the names of the people of his familiar circle. Vocatives.

a) later acquisition (from 1;7 to 2;0)

TONE	CONTOUR	USE
5T	L+H* L+H L̄ L%	Exclamative tone.
6T	H* H̄ H% or L L+H* L̄ L%	Request for location of something. Confirmation questions. Mands and modality for verb forms. Repetition of the topic introduced by his interlocutor.

(from Gebara 1984:58, 59)

(15) Development of R's intonational system

a) early acquisition (from 1;2 to 1;5)

TONE	CONTOUR	USE
1R	H+L* L̄ L%	Completion marks. Progressive phase of a goal-oriented action. Introspective speech.
2R	L* L̄ L% or L+H* L̄ L% (this last one is a latter acquisition)	Request or proto-imperative forms. Preparatory phrase of the action the child is about to perform. Primitive forms of statements such as negation, greeting formulae, and answers to

<sup>5</sup> Gebara (1984) actually employed contour lines to describe the intonational patterns of the corpus. For purposes of the current discussion, I rewrote Gebara's original notation in terms of Pierrehumbert's (1987) system, which distinguishes two tone levels (High and Low), boundary tones (represented by %), pitch accents (represented by \*), and the phrase accents (represented by ˘). The only loss with this notation, which will not be crucial for my argument, is that it does not distinguish a high-low tone from a high-medium tone, which is the case of 4R and 5R in (15).

		yes/no questions. Demands. Emphatic announcements. Agreement or acknowledgement.
3R	L+H L L+H* L̄ L% or L+H L+H* L- L%	To signal location of familiar objects. Invitation for shared attention.
4R	H* L̄ L%	Ostention. Where-questions.
5R	H* L̄ L%	Request tone.
6R	H* H̄ L% or L+H* L̄ L%	Vocatives.
7R	H* H H%	Proto yes/no confirmation questions. Proto wh-questions for location of people and objects. Permission questions. Elicitation device. Invitation for shared actions. Dialogue maintenance.
8R	L* L̄ H% or L* H̄ H%	To signal initial or progressive phase of a goal oriented and intentional action. Cohesion of clauses. Enumeration of objects.

b) latter acquisition (from 1;5 to 1;8)

TO NE	CONTOUR	USE
9R	H* L̄ L%	Call for involvement of the interlocutor. Deprivation. Reference to previous information (topicalization). Incomplete clauses.
10R	H* L̄ H%	Warning. Definiteness. Firm agreement.
11R	H L* L̄ H%	Invitation and request for permission formulae. Interrogative locative expressions.

(from Gebara 1984:98, 120, 155, 159)

This variety of contours and the treatment of the utterances as a non-analyzed string lead to further agreement with Dore, Franklin, Miller, and Rammer's (1975) suggestions that early speech is not organized by grammatical categories, but by relations between the conceptual meanings and the phonetic output. Initially, children have an inventory of intonational contours from which they interact with adults in different ways. Vigário and Frota (1992), for example, observe that it is possible to analyze children's early utterances as having only a prosodic meaning (declarative, interrogative), without having a lexical meaning associated to them. That is, while the utterances have only a prosodic meaning, they do not have a segmental structure, which appears only later on, in the discourse. Gebara's results summarized above show that there is no isomorphy between contours and their meanings, although there is a distinctive intonational system being acquired.

#### 4.1.2. Filling the contours

During this period, the segmental sequences children took from the adults' input can vary. Children's utterances can have the same segmental sequence that adults have, as in (16), (17), (18) and (19):

(16) [ wa'waw ] tone: 2T / aw.aw / 'bowwow' (T.1;4.29)

- (17) [ a.'ki ] tone: 1T / a.'ki / 'here' (T.1;5.21)
- (18) [ paj'ʔi.ju ] tone: 6T / pa.sa.'ʔi.ju / 'birdie'(T.1;6.3)
- (19) [ sa.'pa.tu ] tone: 1T / sa.'pa.tu / 'shoe' (T.1;7.23)
- (20) [ newtikuta / skohje ] tone 1T '??' (T.1;3.17)
- (21) father: /ke.kja.kō.te.'sew.kwa.ga.'xa.fa/ 'what happened with the bottle?'  
[ kotika'fafa ] tone: 2R / kwa.ga.'xa.fa / 'it happened with the bottle (?)' (R.1;6.6)
- (22) [ ma.ma.'ma.na ] tone: 2R / ba.'nã.na / 'banana' (R.1;6.3)
- (23) [ ka.le.'le.la ] tone: 2R / a.za.'ne.la / 'the window' (?) (R.1;6.6)
- (24) [ a.'fe.sa ] tone: 2R / 'fe.ʃa / 'close' (R.1;6.22)
- (25) [ a.kō.'kō ] tone: 3R / ɔ.u.kō.'kō / 'look the coco (=chickie)' (R.1;6.22)

However, these sequences are not always words in the adult language, as shown in (20). In order to complete the intonational contour that carries the 'meaning' used, children used segmental sequences - filler-sounds -, whose function is to fill the intonational template (Scarpa 1994).

In other cases, the children's target was larger than the contour to be used. In these cases, children took parts of the adult's utterances, usually the most prominent ones, as in (10) and (21). In both examples, the segmental sequences used were the ones that carried prominence in the adult's utterance (phrasal, primary or secondary stress, for example).

Another case where children used filler-sounds was when the segmental sequence cut out from adult sentences was not sufficient to fill the intonational template, as in (22), (23), (24) and (25). In order to fill these templates, children used filler-sounds to fill initial weak positions.

This strategy is not responsible for any cue for parameter setting. Children are working with the association of intonational contours and 'meanings'. However, since all the utterances must have a prominence, this strategy bootstraps children's utterances so that they can have stress prominences. In this period children's utterances are not too constrained regarding their size; they can be even 6-syllable long (as in (21)). Consequently, it cannot be said that children are working with the foot level and neither that the prominence heard is the head of the foot.

## 4.2. Prosodic Structure of the Intonational Level

### 4.2.1. Structuring the intonational contour

At about 1;8 there was a modification on R's. and T's systems, which remains until 2;3. They had different ways to use the same strategy, that is, to work with the prosodic grammatical organization of the contour. As pointed out by Gebara (1984), by this time T. started using only one contour, 6T. By working with only one contour, T. realized that the segmental sequence not always fills the chosen contour and this took him to work with contour filling. For T., the contour chosen had the **L L + H\* L- L%** pattern.

R. did not generalize any contour. However, as pointed out by Santos (1995), R. only added filler-sounds to a falling contour (2R, 4R, 5R, 7R, 9R) with the possibility of a low pre-nucleus. To represent these different contours, one variety of 2R, 2rh: L+H\* L- L % is used here.

Superimposing R. and T. contours, it can be observed that a high strong syllable, a low pre-nuclear syllable and an optional low post-nuclear syllable are necessary for both children. The contour also allows another optional low pre-nuclear syllable, taking the following form: (L) L H\* (L)%

This pattern does not corroborate proposals that children work initially with a trochaic (sw) pattern (Gerken 1994, Fikkert 1994, Vihman 1996 among others). The use of filler-sounds with just one contour indicates that children are working with the structure of this intonational contour. Children choose one default contour and work with its prosodic grammatical structure (sequences of low and high syllables) by filling its segmental sequence with parts of the adult's utterance, filler-sounds and modifications of the segmental sequence. Before this period, the association between sound and meaning was without any analysis. At this moment, children start using the phrasal stress from the input as the stress of the intonational contour (accent) of their utterances.

As for the prosodic structure with which children work, the nuclear intonational stress is to the right. This structure can have more than one pre-nuclear syllable. Although only one post-nuclear syllable is allowed, and even this is optional. In other words, the structure children use as default in their utterances is iambic, as shown in (26):

(26)	(L)	L	H*	(L) %		intonational contour
	(σ)	w	s	(σ)		iambic estructure
		[ a	'paw ]		/ paw /	'woody' (T.1;11.2)
		[ be.	'ke. du]		/ br̃n.'ke.du /	'toy' (R. 1;10.0)
	[ ?ə	mi	'ni. nə]		/ me.'ñ.na /	'girl' (T. 2;2.28)

The use of filler-sounds and the preference for the prominence pattern of the intonational contour provide evidence that children are still using accent instead of stress. However, the use of the intonational nuclear stress indicates that the word stress boundary is on the right. Even children's earliest sequences are sensitive to the restriction that stress has to be on one of the word's last three syllables. There are no cases violating this restriction.

By means of this strategy, it is possible for children to work with the parameters that are responsible for word stress boundary and directionality. Stress is always on the right boundary of the word, as well as the prominence of the intonational contour. Although in the adult language these two stresses are different and have different domains of application, children work with them as being the same.

#### 4.2.2. Filling the intonational structure

Although children must fill the chosen contour, it is not always the case that the cut-off they make from the input accords well with the contour they are working with. There

are only a few cases in which children modify the stress, that is, 'mistakes' such as (27) and (28). Changing the stress is the most radical way to fill the chosen contour and it is not common because the cut-off from the input is made from the nuclear syllable. Besides, this strategy is only possible with three syllable words. In the remaining cases (words with more or less syllables), other ways of tone filling are needed. When they need to fill pre-nuclear syllables (that is, the left side of the contour), children have four different possibilities: earlier filler-sounds (cf. (29)-(30)), lengthening of the nuclear syllable (cf. (31)), maintenance of the stressed pre-nuclear syllable (cf. (32)-(35)), and maintenance of the most adjacent syllable (cf. (36)-(39)):

(27)	[ mu.'zi.ka ]	/ 'mu.zi.ka /	'song' (T.2;0.21)
(28)	[ gra.'va.dor ]	/ gra.va.'dor /	'keep-recorder' (R.2;0.5)
(29)	[ ʔm'bi.so ]	/ 'bi.ʃu /	'animal' (T.1;11.04)
(30)	[ u.'bu.pi ]	/ 'pu.pi /	Pupi (T.1;11.02)
(31)	[ pa: u ]	/ paw /	'woodie' (T.1;11.2)
(32)	[ za.'mo ]	/ 'za.ma.'mow /	'had mummums' (T.2;0.26)
(33)	[ pa.'sĩ.ju ]	/ pa.sa.'rĩ.ju /	'clownie' (R.1;8.25)
(34)	[ ka.'fi.ju ]	/ ko.e.'fi.ju /	'bunny' (R.1;8.25)
(35)	[ mas.'ko ]	/ ma.ʃu.'kow /	'hurt' (T.2;0.26)
(36)	[ fe.'rẽ.tʃi ]	/ di.fe.'rẽj.tʃi /	'different' (T.1;9.24)
(37)	[ pwi.'tãw ]	/ ka.pi.'tãw /	'captain' (T.1;11.2)
(38)	[ ne.'kĩ.ju ]	/ bo.nẽ.'kĩ.ju /	'dolly' (T.2;2.28)
(39)	[ dʒi.'vĩ.jə ]	/ a.dʒi.'vĩ.jə /	'guess' (R.1;11.12)

On the right side of the intonational nucleus, the child has three options to fill the post-nuclear position: maintenance of the closest syllable to the nucleus (Wijnem, Krikharr and Den Os 1994; cf. (40)-(41)), maintenance of the most complex syllable - **cvc** – (Gerken 1994; cf. (42)), and lengthening of the syllable that bears the phrasal stress (cf. (43)). In this last case, it is possible that both post-nuclear syllables are jointed (cf. (44)):

(40)	[ ə.'ʃi.kə ]	/ 'ʃi.ka.ra /	'cup' (T.2;2;10)
(41)	[ a.'ã.pə ]	/ 'lãm.pa.da /	'lamp' (T.2;5.25)
(42)	[ 'õ.bus ]	/ 'o.ni.bus /	'bus' (T.2;0.21)
(43)	[ si'ri: ]	/ si.'ri /	'crab' (T.1;10.0)
(44)	[ a.'a.ve ]	/ 'ar.vo.re /	'tree' (R.2;4.2)

(45) summarizes children's ways of structuring the intonational contour:

(45)	(L)	L	H*	(L)	%
			stress change		
	filler-sounds	filler-sounds	phrasal stress $\sigma$	adjacent $\sigma$	
	stressed $\sigma$	stressed $\sigma$		complex $\sigma$	
		adjacent $\sigma$		lengthening of the nuclear $\sigma$	
		lengthening of the nuclear $\sigma$			

### 4.3. Stress Templates

#### 4.3.1. The templates

Another strategy children used was to assume that words are disyllables. This is arguably a different strategy from the last one because there is no longer any need for a pre-nuclear syllable, as there was in the case of the (L) L H\* (L)% contour. This strategy occurred mainly between 1;10 and 2;5 for both children.

The strategy of fixing a contour to the prosodic word allows children to realize that intonation stress is not the same as word stress. That is, the contour chosen by children for analysis permits a final weak syllable and a pre-nuclear weak syllable, as has been seen. This pattern leads children to the conclusion that word stress in BP is on the right boundary of the word, but it is not necessarily final. For the same intonational contour, it is possible to have words with stress on the final syllable (iambic pattern) or on the second syllable from the end (trochaic pattern), as shown in (46):

(46)	L	H*	L	%	intonational contour
	<b>w</b>	<b>s</b>		<b>#</b>	iambic pattern
		<b>s</b>	<b>w</b>	<b>#</b>	trochaic pattern

This possibility makes the binary phrasal constituent a stress template. With this stress template, children have two domains to stress: the word domain and the intonational phrase domain. These two domains are co-occurrent and sometimes can create different or even contradictory stress patterns, from a child's point of view.

The fact that the intonational stress fits the word stress and that weak syllables are optional, lead children to produce both penultimate stress (cf. (47) - (48)) and final stress (cf. (49)). The data in (48) is to be analyzed as work with the stress template because the pre-nuclear filling is not obligatory:

(47)	L	H*	(L)	%	
	blɔ	kus			/ˈblɔ.kus/
	xa	bu			/ˈxa.bu/
	s	<b>w</b>	<b>#</b>		
					‘now’ (T.2;3.4)
					‘tail’ (R.2;2.2)

- (48) L H\* (L) %  
kas te lu / kas.'tɛ.lu / 'castle' (T.2;3.18)  
ka rã ba / ka.'rãm.ba / 'gosh' (R.2;2.19)  
w s w #
- (49) L H\* (L) %  
si ri / si.'ri / 'crab' (T.2;3.4)  
sa bãw̃ / sa.'bãw̃ / 'soap' (R.2;2.19)  
w s #

Since most words in BP are stressed on the second to last syllable, checking the frequency of stress patterns in children's production does not necessarily show an (initial) trochaic or iambic tendency. The data that can bring some light to this issue are the ones in which children have the possibility to reduce a string of syllables from an utterance to either a trochaic (**sw**) or an iambic (**ws**) pattern.

The results show that children reduced penultimate stress words that fit the contour chosen (penultimate stress three syllable words - **ws**) to two syllable words during the whole period analyzed. This reduction, however, did not privilege either stress pattern (trochees or iambs). Children reduced three syllable words with penultimate stress to two syllable words with a final stress (cf. (50)-(52)), as well as to two syllable words with a penultimate stress (cf. (53) - (55)):

- (50) [ a.'gɔ ] / a.'gɔ.ra / 'now' (T.2;3.4)  
(51) [ dʒi.'ba ] / ẽj.'baj.fu / 'under' (R.1;11.12)  
(52) [ ver.'du ] / ver.'du.ra / 'vegetables' (R.2;0.20)
- (53) [ 'zẽ.du ] / fa.'zẽj.du / 'doing' (R.2;2.2)  
(54) [ 'o.lju ] / xe.'lɔ.ʒju / 'watch' (T.2;2.28)  
(55) [ 'su.kɛ ] / a.'su.kar / 'sugar' (T.2;2.28)

As a result of this strategy, the parameter of the constituent can be set. Before that, children used three syllable utterances and the stress should have been applied to this string. By now children can distinguish the two levels - intonational and word level -, and work with them independently. Consequently, their utterances can be smaller or larger than three syllables.

#### 4.3.2. Filling the stress template

When the target word is disyllabic with a trochaic pattern, children's production can be isomorphic to this template (cf. (56) - (59)). However, it is not always the case that the

goal fits the binary template. In case it doesn't, children may either delete or insert syllables to fill this template. If the goal is smaller than the template, filler-sounds can be inserted into word endings and a resyllabification process takes place (cf. (60) - (61)). In addition, children can cut off weak syllables from the input (cf. (62)) or change diphthongs into two syllables (cf. (63) - (64)). In cases in which the goal is longer than the template, children reduce it to two syllables. In this situation, they may delete either pos-nuclear syllables (cf. (65) - (68)) or pre-nuclear syllables (cf. (69)-(70)):

(56)	[ 'pã.tɐ ]	/ 'plãn.ta /	'plant' (T. 1;10.22)
(57)	[ 'bi.su ]	/ 'bi.fu /	'animal' (T.1;11.14)
(58)	[ 'pɔ.dʒɪ ]	/ 'pɔ.dʒi /	'can' (R. 1;11.12)
(59)	[ 'ka.zɐ ]	/ 'ka.za /	'house' (R.1;11.25)
(60)	[ 'lu.zɪ ]	/ lus /	'light' (T.2;3.18)
(61)	[ 'doj.sɪ ]	/ dojs /	'two' (T.2;4.18)
(62)	[ 'poj.nɐ ]	/ 'põj.na /	'put it on the' (T.2;0.11)
(63)	[ 'fo:.ɪ ]	/ foj /	'gone' (T.2;4.26)
(64)	[ 'se:.u: ]	/ sew /	'your' (R. 1;11.25)
(65)	[ 'õ.mu ]	/ 'o.ni.bus /	'bus' (T. 2;1.18)
(66)	[ 'ʃi.kɐ ]	/ 'ʃi.ka.ra /	'cup' (T. 2;2.10)
(67)	[ 'ã.mɐ ]	/ a.ma.'rɛ.lu /	'yellow' (R. 2;3.12)
(68)	[ 'mu.zɪ ]	/ 'mu.zi.ka /	'song' (R. 2;5.25)
(69)	[ 'olju ]	/ xe.'lɔ.ʒju/	'watch' (T. 2;2.28)
(70)	[ 'su.kɐ ]	/ a.'su.kar/	'sugar' (T. 2;2.28)

As for the iambic pattern, when the target words are disyllabic, there will be no problem for children to produce them correctly (cf. (69) - (72)). If the goal is longer than the template the children are working with, a syllable is omitted, either in the pre-nuclear position (cf. (73)-(76)) or in the post-nuclear position (cf. (77) - (79)):

(69)	[ pu.'lo ]	/ pu.'low /	'jumped' (T.2;1.21)
(70)	[ si.'ri ]	/ si.'ri /	'crab' (T.2;3.4)
(71)	[ fo.'gãw̃ ]	/ fo.'gãw̃ /	'stove' (R.2;0.12)
(72)	[ ta.'fɛ ]	/ ka.'fɛ /	'coffe' (R.2;1.5)
(73)	[ a.'po ]	/ es.ka.'pow /	'run away' (T.1;11.14)
(74)	[ ga.'do ]	/ gra.va.'dor /	'keep-recorder' (T.2;4.18)

(75)	[ maj.'sa ]	/ a.ma.'sar /	'crush' (R.1;11.12)
(76)	[ pi.'tãw̃ ]	/ ka.pi.'tãw̃ /	'captain' (R.2;3.6)
(77)	[ a.'gɔ ]	/ ar.'gɔ.la /	'hoop' (T.2;3.4)
(78)	[ ver.'du ]	/ ver.'du.ra /	'vegetables' (R.2;0.20)
(79)	[ a.'ke ]	/ a.'ke.le /	'that' (R.2;3.12)

Interestingly, there was no case in which monosyllabic words were changed to fit either a trochaic or an iambic pattern. At this period, monosyllabic words are produced correctly.<sup>6</sup>

(80) and (81) summarize children's ways to fill the weak position of the trochaic and iambic patterns:

- (80) trochaic pattern: filler-sounds  
deletion of the pre-nuclear syllable  
deletion of the pos-nuclear syllable  
weak syllables from the input  
changing diphthongs in two syllables
- (81) iambic pattern: deletion of the pre-nuclear syllable  
deletion of the pos-nuclear syllable

#### 4.4. Adult Pattern

The last strategy refers to the use of the stress algorithm of the adult language. The previous strategies lead children to localize the boundary and direction of application of the algorithm, as well as to set the binary constituent parameter. However, with only these parameter settings, it is not possible to derive antepenultimate word stress, which is dependent on extrametricality and marked head assignment. This pattern of stress occurs at 2;0 for T., although it is only productive from 2;3. In R's utterances, these words are productive at 2;2. It must be said that only nouns were found ((82)-(89)). This is so because verbs with stress on the third syllable from the end (1<sup>st</sup> person plural in past tenses) are a late acquisition that occurs at school age.

(82)	[ 'mu.zi.kɐ ]	/ 'mu.zi.ka /	'song' (T.2;3.4)
(83)	[ 'plas.tʃi.ku ]	/ 'plas.tʃi.ku /	'plastic' (T.2;3.4)
(84)	[ 'ɔ.ku.lus ]	/ 'ɔ.ku.lus /	'glasses'(T.2;3.4)

<sup>6</sup> In the whole period analyzed, there were only five monosyllabic words changed in to two-syllable words (at around 2 years old), as in ['lus] 'light' realized as ['lu.zi] and [na.'ris] 'nose' realized as [na.'ri.si]. These data have in common the fact that including an epenthetic vowel avoids a complex syllable structure – cvc -. That these words ended in a trochaic pattern follows from the fact that the stress in the original syllable was maintained. For the acquisition of syllable structure in BP and its relation to the acquisition of word stress, cf. Santos 2001.

(85)	[ e.li.'kɔ.pi.te.ru ]	/ e.li.'kɔ.pi.te.ru /	'helicopter' (T. 2;4.0) <sup>7</sup>
(86)	[ 'sa.ba.du ]	/ 'sa.ba.du /	'Saturday' (R. 2;2.19)
(87)	[ 'lɔ.ʒi.ku ]	/ 'lɔ.ʒi.ku /	'logical' (R.3;2.19)
(88)	[ ʒi.'nas.tʃi.kə ]	/ ʒi.'nas.tʃi.ka /	'gymnastic' (R. 2;6.8)
(89)	[ ma.'lɛ.va.lə ]	/ ma.'lɛ.vo.la /	Malévola (R. 2;6.19)

The production of these words by children indicates that they are not bootstrapping their word stress in intonational stress; if that were the case, there would be only one post-nuclear syllable. Only by acquiring extrametricality and conjoining it with marked head assignment is it possible to generate antepenultimate stress; consequently, this is considered to be the main characteristics of the fourth strategy, the adult algorithm.

## 5. Discussion

As was seen in section 4, children use different strategies in the course of language acquisition in order to have prominences on their utterances. Some of the strategies discussed were argued to result in parameter setting: the strategy of structuring an intonational contour leads children to set the boundary and direction of word stress, and the stress template strategy shows that children are working with a binary constituent as a stress template. The adult algorithm is only reached after children set the extrametricality parameter and learn the extrametrical elements.<sup>8</sup>

The strategies discussed allow us to consider two general approaches to the language acquisition process. The first one has the word as the basis for the acquisition process, while the second one takes the phonological phrase as children's starting point.

### 5.1. Approach I

Recent studies based on Germanic languages (cf. Fikkert 1994, Gerken 1994, Demuth 1996ab, Vihman 1996 among others) conclude that children's early grammar starts

<sup>7</sup> The primary stress on the fourth syllable from the end results from the insertion of an epenthetic vowel [i] after the stress algorithm has applied.

<sup>8</sup> It may also be the case that the strategy of structuring the intonational contour makes it possible for the iterativity parameter to be set. In this period, children produce utterances with more than four syllables, which would allow more than one binary constituent, as in (i):

(i)  
 (\* .) (\* .)  
 σ σ σ σ

An iterative system as in (i) wouldn't prevent a child from producing a four-syllable utterance with the stress on the fourth syllable from the end (while the boundary parameter is not set) or with more than one stress (while the End Rule was not applying), at least in the beginning of the process. However, in the data examined the stress is always in the final or in the penultimate syllable. This suggests that either the pattern of children's utterances is incompatible with an iterative parameter or that there is an ordering in the parameter setting: boundary >> iterativity or End Rule >> iterativity. I will leave a full exploration of this issue to another opportunity.

with a syllable. Demuth (1996ab) proposes four stages in the acquisition of prosody, as sketched in (90):

- (90) Stage I: core syllables (**cv**)  
Stage II: minimal word is a binary foot  
Stage III: prosodic words larger than a binary foot  
Stage IV: prosodic words fit the target form

According to this proposal, children's word template starts with core syllables and then change to a binary foot. This second stage would be very early in the acquisition process and most of the studies (Allen and Hawkins 1980, Fikkert 1994, Gerken 1994, Archibald 1995, Demuth 1996ab, Taelman 2004, among others) claim that this foot has a trochaic pattern. After stage III, children go to a stage where prosodic words can be larger than a foot, and finally they reach the adult pattern.

The proposal of a prosodic word that is one foot long, which was originally advanced based on Germanic languages, has been extended to other languages, as well. Hochberg (1988ab), for instance, assumes that children acquiring Spanish start with a binary constituent, although no tendency was – either trochaic or iambic – found for the binary constituent.<sup>9</sup>

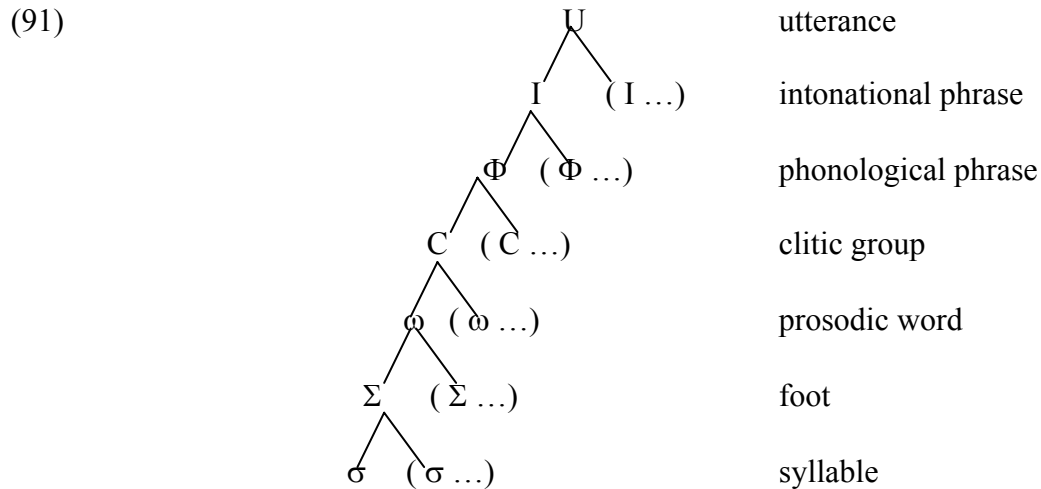
The common property among these views is that the prosodic development goes from the lowest level up to higher levels of the prosodic hierarchy in a bottom-up fashion (cf. Selkirk 1984, Nespor and Vogel 1986), as can be illustrated in (91):

---

<sup>9</sup> Rapp (1994) tested the production of nouns by 8 children from 1;6 to 2;0 years old to check their truncation patterns and found that disyllabic words with final stress tend to have the pre-nuclear syllable completely deleted, while disyllabic words with penultimate stress tend to have a partial deletion. She also tested the sequence **wsw**, in order to check if there was any tendency for a special template. Out of 57 tokens, 36,8% (21 tokens) had total elision and, out of these 21 tokens, 95,2% (20 tokens) created a trochaic pattern, while 4,8% (1) generated an iambic pattern. She thus concluded that the disyllabic word with penultimate stress is the preferred template by children acquiring BP.

However, these results contradict our findings about truncation and the stress template produced by children (the third strategy discussed here), where no tendency was found. Two points are worth mentioning, though. First, Rapp was not analyzing the prosodic development in BP, but truncation patterns. Second, a study using naturalistic data by Baia (2004) obtains results similar to the ones reported here. She looked at the stress mistakes one child made from 1;4 to 1;6 years old for both verbs and non-verbs. She found only 14 of such mistakes, 5 in the direction of a trochee and 9 in the direction of an iamb. As for changes in **wsw** sequences, there were 15 tokens: 53,3% (8 tokens) were produced as iambs and 46,7% (7 tokens) were produced as trochees. Although with fewer data than Rapp's study, Baia's results also indicate that there seems to be no tendency towards a trochaic pattern. Hence, the contradicting results may have arisen from the different methodologies employed: in Rapp's experiments, the task was to nominate a picture or to complete a sentence initiated by the interviewer (usually, with the target noun being mentioned by the interviewer in the previous sentence). Whereas, in Baia's study and the study discussed here, children were engaged in a natural conversation and were producing whole sentences.

A full re-examination of these results and their implications for the setting of the head parameter is a topic I am exploring in working in progress.



If the prosodic development takes place in a bottom-up fashion, children's utterances should be one syllable long in the beginning and later grow in size. However, what was seen in the data of BP is that children's utterances are rarely produced as monosyllables. When children produce monosyllables, they repeat them and add preceding filler-sounds. Therefore, Brazilian children are not following the same development as proposed for the Germanic languages.

## 5.2. Approach II

Another way to look at prosodic development was proposed by Scarpa (1999, 2000), working with the acquisition of BP. Taking into account the fact that the prosodic hierarchy can be filled by one syllable, as shown in (92) below, Scarpa points out that nothing should prevent the earliest prosodic template of the first "words" from being templates from a higher level:

- (92)
- (\*) U
  - (\*) I
  - (\*) Φ
  - (\*) C
  - (\*) ω
  - (\*) Σ
  - (\*) σ
  - [ε] 'yes'

If only monosyllabic words are taken into consideration, there is no way to know whether or not children start from the lower levels. However, the fact that children tend to avoid monosyllables and repeat them with filler-sounds is evidence that they do not start from the lowest level. She also observes that one-syllable utterances and minimal words are usually found at the same time and form a primitive prosodic set for a primitive lexicon. Scarpa

therefore concludes that the prosodic templates of the first “words” are templates from higher prosodic levels. Thus, the prosodic development occur in a top-down fashion in her analysis.

The data examined here show that children are not restricted to monosyllables in the beginning of the acquisition process, but they rather start with long sequences of segments. After this unconstrained sequence of syllables (first strategy), children start producing three-syllable sequences (second strategy), and only later do they confine their data to a binary constituent (third strategy). This does not fit Demuth’s proposal of prosodic development; rather it seems to be in accordance with Scarpa’s proposal.

If we pay attention to the prominences on children’s utterances, again we have evidence for Scarpa’s proposal. In the beginning of the process, the prominences are not taken from the adult’s *words*, but rather from the *phonological phrase* or *intonational phrase* of the adult’s utterances. In the second stage, the structuring of the intonational contour shows that even when children’s utterances are one word long, the phonological processes that take place preserve an iambic structure, with the possibility of a pos-nuclear syllable. This prominence to the right is characteristic of phonological phrases and intonational phrases, not of lower levels.

Finally, if we look at the phonological processes children use in order to fill different contours in the first strategy and the contour chosen for prosodic structuring in the second strategy, we see that a common process is to add filler-sounds. Interestingly, these filler-sounds always fill pre-nuclear positions, pushing the prominence to the right. If they were used in order to fill a trochaic binary foot, we would expect to find them to the right of the word, after the last stressed syllable. However, we only find this kind of filler-sound when there is a complex syllable – cvc- which is then resyllabified in two syllables: cv-cv. This seems to be a phonological process employed to avoid complex syllables and not to create a trochaic pattern (cf. Santos 2003).

These results are also in consonance with other findings in the literature. Studies on the acquisition of prosody show that the intonation system is developed very early for children. Gebara (1984), working with BP, shows that children start to develop an intonation system at 11 month old. She also argues that it is not until the half of the second year that children’s productions are stabilized in what concerns the lexical use of word forms. For example, in the beginning of the acquisition process children use the past tense for present or imperative, which suggests that the meaning of children’s utterances is more heavily based on their intonation than the their segmental structure. These view is in accordance with Dore, Franklin, Miller and Rammer (1975), for whom children early speech is an inventory of intonational contours to interact with adults, and with Vigário and Frota (1992) and Freitas (1997), who argue that children’s early utterances in European Portuguese are constituted mainly by an intonational system empty of phonological segmental information or lexical meaning. All these studies suggest that children, in the very beginning, work with intonation, which is the highest level of the prosodic hierarchy.

Other studies about other aspects of acquisition of prosody in BP are also in accordance with the top-down proposal. Santos (2001) points out that in a sequence **wsw**, children delete the last **w** syllable, which is compatible with the view that they are dealing with intonational stress (which has its prominence to the right in BP) and not with word stress (which is to the left in BP when the whole word is taken into account). In addition,

Santos (2003) argues that children bootstrap the acquisition of word stress on the prominence of the utterance. Again, the prominence heard in children's early utterances is not word stress, even when such utterances are one-word size.

Another interesting related phenomenon is the reduplication process that doubles the stressed syllable of a word, as described in Santos (2001). This process takes place in children's production even when the target is a trochaic disyllabic word. Santos shows that both children change a trochaic binary target into a trisyllabic word with penultimate stress – **ws<sup>w</sup>** -.<sup>10</sup> They even reduplicate iambic disyllabic words. Contrary to the expectation that they would insert a pos-nuclear syllable, they produce a pattern **wws**.<sup>11</sup> There is no way to derive such a pattern in Demuth's proposal. However, this process is well accounted for in Scarpa's proposal. The reduplication occurs because children are filling the contour of the second strategy, which allows one or two weak syllables preceding the stressed syllable.

Finally, Komatsu and Santos (2004) show that the requirement that external sandhi rules need computation of intonational stress is always met since the beginning of the acquisition process in BP. Although children can use phonological processes different from adults' (choosing to apply elision when adults diphtongate, for example), they never apply the rule if the second vowel bears prominence on the intonational phrase. This fact shows that the child is already working with the intonational domain or at least has some familiarity with higher levels of the prosodic hierarchy before dealing with lower levels.

These studies and the data discussed in this paper pose problems for a bottom-up model of prosodic acquisition and support the top-down approach.

## 6. Concluding remarks

In this paper I discussed three strategies that children use as they move towards the adult word stress algorithm in BP: various intonational contours, structuring of a single contour, and stress templates. These strategies show that children bootstrap their acquisition of the word stress algorithm on other prosodic levels. Children make use of different strategies to mark stress prominences. These strategies can overlap in time; however, the phonological processes children use allow us to recognize the different strategies at stake. Although the strategies are not fixed, a similar order of acquisition can be perceived for both children.

It was also seen that children do not always use the same strategies. While T. overapplies one contour, R. continues using different contours. Despite this superficial difference, it was possible to show that children are working with the same prosodic unit.

These strategies were used to set some of the parameters involved in word stress algorithm: boundary, constituent, and extrametricality. Other parameter settings need additional information from other domains: sensibility to syllable quantity (Santos 1998) and domain (Santos 2001). These domains are also being acquired while children acquire word stress algorithm. It must also be said that not all strategies are responsible for parameter settings; they may also be just an artifice to mark stress prominences while the stress parameters are not set.

---

<sup>10</sup> For example, T. produces [ˈxɔ.da] as [xɔ.ˈɔ.da] 'whel'(2;0.21)

<sup>11</sup> For example, T. produces [se.go.ˈo] and [a.bi.ˈi] for [[e.ˈgo] 'arrived' and [a.ˈbri] 'open', respectively (2;0.29).

Finally, the findings about BP show that the bottom-up hypothesis for the acquisition of prosody must be re-thought. Children acquiring BP do not start using one-syllable word and go up on the hierarchy. Quite the opposite. They start from higher levels (utterance or phonological phrase) and only later work with the word level, which supports a top-down view of prosodic development. At the very least, the results reported here show that the bottom-up path of development is not universal.

## References

- Allen, G.D. and S. Hawkins, (1980). Phonological rhythm: definition and development. *Child Phonology* (G. Yeni-Konishian; J.F. Kavanagh and C.A. Ferguson, editors) vol. 1: production 227-256 NY Academic Press
- Archibald, J. (1995) The acquisition of stress. *Phonological Acquisition and Phonological Theory* (J. Archibald, editor) 81-109 L. Erlbaum Associates Hillsdale, N.J.
- Baia, M. F. (2004) In search of a trochaic bias in the acquisition of Brazilian Portuguese. *Academic Report n. 1 to FAPESP*, ms.
- Cintra, G. (1997) Distribuição de padrões acentuais no vocábulo em português, *Confluência*, 5(3): 83-92.
- Demuth, K. (1996a) The prosodic structure of early words. In *Signal to Syntax: Bootstrapping from Speech to Grammar in Early Acquisition* (J. Morgan & K. Demuth, editors), pp. 171-184. Hillsdale: Lawrence Erlbaum Associates.
- \_\_\_\_\_. (1996b) Alignment, stress and parsing in early phonological words. In *Proceedings of the UBC International Conference on Phonological Acquisition*, (B. Bernhardt; J. Gilbert & D. Ingram, editors), pp. 113-125 Cascadilla Press.
- Fikkert, P. (1994) *On the acquisition of prosodic structure*. Hague: Holland Institute of Generative Linguistics.
- Freitas, M.J. (1997) *Aquisição da Estrutura Silábica do Português Europeu*. PhD Thesis. Lisboa
- Gerken, L.A.(1994) Young children's representation of prosodic phonology: evidence from English-speakers' weak syllable productions, *Journal of Memory and Language*, 33: 19-38.
- Gebara, E.M. (1984) *The development of intonation and dialogue processes in two Brazilian children*. PhD Thesis. London: University of London.
- Hochberg, J. G. (1988a) Learning spanish stress: developmental and theoretical perspectives, *Language*, 64 (4): 683-706.
- \_\_\_\_\_. (1988b) First steps in the acquisition of spanish stress, *Journal of Child Language*, 15: 273-292.
- Komatsu, M. O. and R. S. Santos (2004) The acquisition of external sandhi rules in Brazilian Portuguese – paper presented at the 2<sup>nd</sup>. *Lisbon Meeting on Language Acquisition* (June 2004) Portugal
- Lee, S.H. (1995) *Morfologia e Fonologia Lexical do Português Brasileiro* PhD thesis UNICAMP
- Nespor, M. and I. Vogel (1986) *Prosodic Phonology* Foris Publications Dordrecht, Holland
- Pierrehumbert, J.B. (1987) *The Phonology and Phonetics of English Intonation* Indiana University Linguistics Club Bloomington, Indiana

- Rapp, C. (1994) *A Elisão de Sílabas Fracas nos Estágios Iniciais da Aquisiãõ da Fonologia do Português*. Master dissertation Universidade Federal da Bahia.
- Santos, R.S. (1998) A aquisiãõ da estrutura silábica, *Revista Letras de Hoje*, **112**:91-98.
- \_\_\_\_\_ (2001) *A aquisiãõ do acento primário no português brasileiro*. PhD Thesis UNICAMP.
- \_\_\_\_\_ (2003) Bootstapping in the acquisition of word stress in Brazilian Portuguese. *Journal of Acquisition of Brazilian Portuguese 1:1*
- Scarpa, E. M.(1999) Sons preenchedores e guardadores de lugar: relações entre fatos sintáticos e prosódicos na aquisiãõ da linguagem. In *Estudos de Prosódia* (E.M. Scarpa, editor) 253-284 Campinas: ed. Unicamp.
- \_\_\_\_\_ (2000) Filler-sounds and the acquisition of prosody, *Cahiers d'acquisition et de pathologie du langage*, **20**:83-99
- Selkirk, E.O. (1984) *Phonology and Syntax: The relation between sound and structure* The MIT Press Cambridge, MA
- Taelman, H. (2004) *Syllable omissions and additions in Dutch child language. An inquiry into the function of rhythm and the link with Universal Grammar*. Ph.Thesis, Antwerp
- Vigário, M & S. Frota (1992) Aquisiãõ da Prosódia I: uma categorizaãõ das produções sonoras de e para a crianãa, *Análise Psicológica*, **4** (X): 457-478.
- Vihman, M.M. (1996) *Phonological development – the origins of language in child* Cambridge : Blackwell Publishers.
- Wijnen, F.; E. Krikhaar & E. Den Os (1994) – “The (non)realization of unstressed elements in children’s utterances. *Journal of Child Language* vol.21 n.1 59-83 Cambridge University Press