Intonation of early two-word utterances in Dutch

Aoju Chen[a] *& Paula Fikkert*[b]

[a]Max Planck Institute for Psycholinguistics; [b]Radboud Univeristy Nijmegen
aoju.chen@mpi.nl; p.fikkert@let.ru.nl

ABSTRACT

We analysed intonation contours of two-word utterances from three monolingual Dutch children aged between 1;4 and 2;1 in the autosegmental-metrical framework. Our data show that children have mastered the inventory of the boundary tones and nuclear pitch accent types (except for L*HL and L*!HL) at the 160-word level, and the set of non-downstepped pre-nuclear pitch accents (except for L*) at the 230-word level, contra previous claims on the mastery of adult-like intonation contours before or at the onset of first words. Further, there is evidence that intonational development is correlated with an increase in vocabulary size. Moreover, we found that children show a preference for falling contours, as predicted on the basis of universal production mechanisms. In addition, the utterances are mostly spoken with both words accented independent of semantic relations expressed and information status of each word across developmental stages, contra prior work. Our study suggests a number of topics for further research.

Keywords: pitch accent types, nuclear contours, accent placement, two-word speech, child Dutch

1. INTRODUCTION

Languages differ significantly in intonation. Cross-linguistic differences may be most obvious in the inventory of phonologically distinct intonation contours [9]. In order to sound like a native speaker of a language, children must learn the language-specific inventory of distinct intonation contours. A large body of evidence has emerged from previous studies suggesting very early mastery of adult-like intonation contours in English-acquiring children (see [14] for a literature review). In these studies, intonation contours are analysed from a holistic perspective, whereby the whole utterance is the unit of analysis and the contour is described in terms of its overall shape. In monosyllabic utterances, nuclear contours are operationalised as whole-utterance contours. By and large, these studies have argued that most children have acquired the adult types of intonation contours considerably before the onset of the two-word stage.

While the holistic approach has proved useful in describing contour shapes in babbling and one-word utterances, it sheds little light on the internal structure of contours realised on multi-word utterances. Specifically, a whole-utterance based description does not indicate where the sentence accent is placed. For example, when a two-word utterance (e.g. *cat cry*) is spoken with a fall, the fall can either be realised on the first word or on the second word, depending on which word receives the sentence accent. Further, it does not distinguish between a complex contour (e.g. rise-fall) and a sequence of simple contours (e.g. a rise followed by a fall). It thus remains to be seen whether the early mastery of adult-like intonation contours still holds when children's intonation contours are analysed in an internal-structure oriented framework, such as the autosegmental-metrical (AM) framework [12,9] (See Section 2.4).

A second issue that has received considerable attention in the literature is the distribution of different contour types in early child language. Prior work (e.g. [1, 15]) has shown a high proportion of falling contours for normally developing children below the age of 3. For example, in a case-study on the prosodic and syntactic organisation of a German-acquiring child's two-word utterances, Behrens and Gut [1] analysed the intonation of the child's two-word utterances produced over a period of three months. They observed that the falling contours are most frequent across all types of utterances (classified in terms of syntactic categories of the words, e.g. Determiner+Noun, Noun+Verb) and developmental points, and that rising contours are rarely used. The predominance of falls is usually accounted for by a universal production mechanism, as stated in Lieberman's breath group theory [11], where a fall is the natural result of a decrease in the subglottal air pressure towards the end of a breath group. There are, however, language-specific differences. For example, it has been found that at about 18 months, French-acquiring children produce more rises than falls, while Japanese-acquiring children produce more falls than rises in their disyllabic vocalisations (both babbling and words) [8]. This result was interpreted to reflect the difference in continuation intonation at the utterance-

final position between French and Japanese. In Dutch, continuation can be signalled by rise and fall-rise [16]. As language-specific influences are present as early as the babbling stage, distributional patterns of contour types in two-word speech in Dutch may thus reflect a language-specific preference for rises, rather than a universal preference for falls.

A third issue that has been investigated in early two-word speech is the placement of sentence accent. Two-word utterances consisting of the same syntactic categories can express different semantic relations and consequently may differ in accent placement. For example, in German and Dutch, a Noun+Verb combination can express either an Object-Verb relation (e.g. *ijs eten* 'ice-cream eat') or a Subject-Predicate relation (*poes huilen* 'cat cry'). According to Wieman [17], accent placement in early two-word speech is governed by the semantic relations expressed rather than the syntactic categories of the utterances. For example, she observed that in Verb-Locative utterances, the accent is almost always assigned to the locative, which can be realised by different syntactic categories, such as noun (e.g. *play museum*), prolocative (e.g. *goes here*), and preposition (e.g. *coming up*). Exceptions to the general pattern can be explained in terms of information status of the words. For example, the utterance *play museum* can be said with the accent on *play* rather than on *museum* when *play* carries new information but *museum* repeats given information. As Wieman's analysis of accent placement was based on auditory impression only and her data set was small, it is not clear whether her results can be generalised to other semantic relations and children learning a different language, for example, Dutch.

Against this background, we studied the intonational properties of two-word utterances in Dutch in the AM framework. This study is the first investigation into early intonational development in Dutch-acquiring children. Specifically, we addressed three questions: (1) Is the inventory of intonation contours in Dutch children's two-word utterances adult-like? (2) Do Dutch children show a preference for either the fall or the rise across different types of utterances and at different developmental stages? (3) Is accent placement in two-word utterances in Dutch governed by the semantic relations they express?

2. METHOD

2.1. Participants and data collection

This study is based on longitudinal data of three typically-developing monolingual Dutch children (aged 1;4-2;1), Eva, Jarmo and Robin, taken from the CLPF database [6,10]. The children were recorded every other week for a one-year period during natural play sessions at their home. Each play session lasted about 30-45 minutes. During each session, the child interacted with one parent and an experimenter. The typical activities included reading a picture book and playing with toys together with the interlocutor(s).

2.2. Materials

Research on early word combinations has made use of prosodic features, such as pauses and word stress etc. to distinguish successive single word utterances from 'real' two-word utterances. However, these studies have shown controversial findings on whether and how these features differ in the two types of two-word utterances [1].

In this study, we operate on the criterion of semantic coherence as perceived by adult native speakers of Dutch. We collected the first and subsequent combinations of two words that were annotated as semantically coherent units by adult native speakers of Dutch in the CLPF database until the vocabulary size of 200 unique recorded words was reached. Both Eva and Jarmo produced their first two-word utterance at the ±50-word level; Robin produced his first two-word utterance at the 20-word level. For the sake of the homogeneity of the data, we included all and only two-word utterances produced from the 40-word level to the 230-word level into our analyses. In total, the three children produced 396 two-word utterances in this period. A small percentage (28%) of utterances was excluded because of poor sound quality. The total number of usable two-word utterances amounted to 325.

As two-word utterances expressing a semantic relation start to be produced with increasing frequency at the 100-word level [5] and the children in our study began to produce a substantially larger number of two-word utterances after reaching the 160-word level, we divided the period from the 40-word level to the 230-word level into three development stages: (1) Stage 1: 40-100 words; (2) Stage 2: 101-160 words, and (3) Stage 3: 161-230 words. This allowed us to find out whether there are any changes in the inventory of intonation contours over time. The children differed slightly (< 3 months) in age in each developmental stage.

2.3. Syntactic analysis

We furthered classified the 325 usable utterances by the syntactic categories of the words and word order [1]. The three most frequent combinations are given in (1)-(3):

(1) Noun + Verb (N=48): *banaan eten* 'banana eat'
(2) Particle + Verb (N=32): *dicht doen* 'close do'
(3) Noun + Noun (N=23): *eendje water* 'duck water'

As these combinations were produced by every child in one or more stages, they were considered representative of the two-word speech of these children and were subjected to subsequent syntactic and intonational analysis. Table 1 shows the distribution of the three combinations in each developmental stage.

Table 1. The distribution of the three types of utterances in the three developmental stages

	stage 1 40w-100w	stage 2 101w-160w	stage 3 161w-230w	total
Noun+Verb	0	17	31	48
Particle+Verb	0	6	26	32
Noun+Noun	2	12	9	23
total	2	35	66	103

The second author listened to the original recordings to determine the context of each of the two-word utterances. The contextual information was used to analyse the semantic relation expressed in each utterance, the information status of each word, and to determine whether an utterance was intended as a question or a statement.

2.4. Intonational analysis

As mentioned in section 1, we conducted our intonational analysis in the AM framework [12,9]. The intonation contour of an utterance is described as a sequence of high (H) and low (L) tones. The tones are of two kinds, pitch accent and phrasal tone. Pitch accent refers to the tone(s) associated with the stressed syllable of a word. It can be either monotonal (e.g. H*, L*) or multitonal (e.g. H*L, L*HL) [7] and is perceptually prominent. The starred tone is realised on the stressed syllable. Phrasal tone refers to the tone associated with the edge of a phrase. It can be high (H) or low (L). The phrasal tone that is generally recognised in different analyses is the tone associated with the right edge of an intonational phrase (IP), demarcated with a '%' sign following the tone (e.g. H%, L%). An intonational phrase can have more than one pitch accent. The final one is referred to as the nuclear pitch accent; the non-final one(s) as the pre-nuclear pitch accent(s).

The two-word utterances were cut out of the original recordings and individually analysed for intonation by the first author without knowledge of the context. The intonation was transcribed following ToDI notation [7] and the transcription was done using Praat [2]. ToDI is designed to represent the intonational structure of adult Dutch. Recent work on intonational development [3,4] has shown that with minor adjustments, ToDI is also suitable for the transcription of intonation in child language. In this study, we included extra symbols to represent the two dimensions along which the falling pitch accent H*L can differ: the peak height in comparison to the preceding H* (if there is one) and the relative time alignment of the fall in the segments. This measure was taken because we observed clear variations in the realisation of H*L in our data. The '^' and '~' signs before H*L indicate a substantial increase and decrease in peak height (> 70 Hz), respectively. The '>' sign after H*L demarcates that the fall starts only after the stressed syllable; the '<' sign before H*L demarcates that the fall starts right at the onset of the voiced portion of the word. In addition, we included HL into our transcription. HL is perceptually and acoustically similar to H*L but unlike H*L, it is associated with a syllable unstressed in adult Dutch but arguably spoken with stress by children. The two dimensions along which H*L differs also hold for HL.

A second transcriber checked all labels and gave alternative analyses if necessary; disagreements were resolved in a second round of transcription.

3. RESULTS AND DISCUSSION

3.1. Inventory of intonation contours

In the AM framework, the inventory of intonation contours in adult Dutch include (1) eight pre-nuclear pitch accent types, H* (sustained high pitch), !H* (downstepped high pitch), H*L (fall), !H*L (downstepped fall), L* (sustained low pitch), L*H (rise), L*!HL (downstepped delayed fall), and H*LH (fall-rise); (2) eight nuclear pitch accent types, H*, H*L, !H*L, L*, L*H, L*HL (delayed fall), L*!HL, and H*!H (vocative chant); (3) three initial boundary tones, %L (mid or low pitched, default), %H (high pitched, marked) and %HL (falling pattern, highly marked), two final boundary , L% (low-pitched) and H% (high pitched), and % (absence of a boundary tone) [7]. Each nuclear pitch accent can form a nuclear contour with each final boundary specification; this amounts to 24 nuclear contours in Dutch. All the nuclear contour types are claimed to be well-formed but some nuclear contours are used in a wider range of contexts than others. Not every nuclear accent can form a double-accent tune with every pre-nuclear accent but about 33 legal double-accent tunes can be formed (Gussenhoven, PC). Deaccentuation occurs when there is no accent assigned to a word against expectation. Typically it is used to signal a change in information status from new to given.

In what follows, we will consider the inventory of intonation contours in two-word speech. The discussion on the distribution of nuclear contours is postponed till section 3.2.

3.1.1. Initial boundary tones and pre-nuclear pitch accents

In stage 1, only %L was used. In stages 2 and 3, both %H and %L occurred but %H was used only 7 times.

As regards pre-nuclear pitch accents (Figure 1), in stage 1, only a pre-nuclear H* was used. In stage 2, two utterances were spoken with only the first word accented (thus containing no pre-nuclear accent); four utterances were spoken with the first word deaccented but the second word accented; one utterance was spoken as two single-accent IPs. The other 28 utterances were spoken with four types of pre-nuclear accents, H*L, H*, L*H, and H*!H. H*L (N=14) and H* (N=11) were the two most frequent

accent types. In the group of H*L accents, four variants occurred, H*L (N=2), <H*L (N=2), H*L> (N=9), and H*L HL (N=1). Notably, the late fall, H*L>, was most frequent, as is the case in adult Dutch. In stage 3, four utterances were spoken with only the first word accented; another four utterances were spoken as two single-accent IPs. Deaccentuation occurred in pre-nuclear position in nine utterances where only the second word was accented. The other 49 utterances were spoken with three pre-nuclear accent types. Two accent types were already present in stage 2, i.e. H* and H*L. The fall-rise H*LH appeared for the first time. Further, different from stage 2, H* was clearly most frequently used (N=34), followed by H*L (H*L: 5, <H*L: 3, H*L>: 4), and H*LH (N=3).

These results indicate that at the 230-word level children have mastered the two types of initial boundary tones, the non-downstepped pre-nuclear pitch accent types (except for L*), the vocative chant H*!H, and deaccentuation. The early use of H*!H can be explained by its high frequency in typical home situations, where people are called out for attention and meals. The absence of downstepped pre-nuclear pitch accent can be explained by the lack of suitable segmental context. A downstepped accent requires a high tone (%H, H*, or H) in the preceding segment(s). In the two-word utterances, the high tone can only be realised on the first word. Consequently, a downstepped accent can only occur in the second word. If children can produce downstepped accents in the two-word stage, they will produce nuclear downstepped accents. This is indeed what we found.

3.1.2. Nuclear pitch accents

In stage 1, both H*L and !H*L were used. In stage 2, the total number of accented IPs was 35. They were spoken with six nuclear accent types (Figure 1). The two most frequently used nuclear accent types were H*L (H*L: 7, H*L>: 4, ~H*L: 1, H*L H*L: 1) and !H*L (N=10), followed by L*H (N=5), H* (N=4), L* (N=1), and H*!H (N=1). In stage 3, the total number of accented IPs were 68. Four of the accent types that occurred in stage 2 occurred again. The two most frequent nuclear accent type were !H*L (N=31) and H*L (N=28), followed by H* (N=5), and L*H (N=2), similar to the distribution of accent types in stage 2. Different from stage 2, two instances of !H*, a pre-nuclear accent in adult Dutch, were observed in two Particle+Verb utterances. We also noted five instances of the double-fall variant of H*L (H*L HL), which first appeared in stage 2. The second HL was mostly realised on the infinitive marker '-en' as in *maken* 'make', *halen* 'get' and sometimes realised on the second syllable which is not supposed to carry a word stress (e.g. *auto* 'car'). This has not been observed in adult Dutch.

Clearly, children have largely mastered the inventory of nuclear pitch accent types in adult Dutch at the 160-word level. They had no difficulty in producing downstepped accents. In fact, !H*L was highly frequent in both stages 2 and 3. The absence of the delayed fall (L*HL) and the downstepped delayed fall (L*HL) may be related to the fact that they are relatively rare in adult Dutch.

initial boundary tone	pre-nuclear	nuclear	final boundary tone
	H*	H*	
	H*L	***!H****	
%L	**H*LH**	H*L	L%
%H	L*H	!H*L	H%
	H!H*	L*	(%)
		L*H	
		H*!H	

Figure 1. Overview of pitch accents and boundary tones in Dutch two-word utterances. Accents in bold appeared first in stage 3; accents in italics are not used in adult Dutch.

3.1.3. Double-accent tunes

In stage 1, two double-accent tunes were used, H*L H*L and H*L !H*L. In stage 2, 28 utterances were spoken as a single IP with both words accented. Ten double-accent tunes occurred. The most common tune was H*L H*L (N=8) (Figure 2), followed by H*L !H*L (N=5) and H* !H*L (N=5), all ending with L%. In stage 3, 53 utterances were spoken as a single IP with both words accented. Seven tunes were used. The most common tune was H* !H*L (N=18) (Figure 2), followed by H* H*L (N=14), H*L !H*L (N=8) and H*L H*L (N=4). In four instances of H*L H*L, the tune ended with H%.

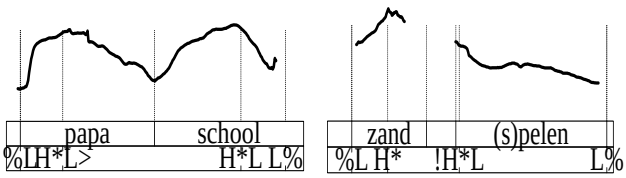

Figure 2. Examples of H*L H*L and H* !H*L.

Interestingly, in comparison to stage 2, tunes starting with H* became more common than tunes starting with H*L and tunes with a downstepped nuclear accent were more common than their non-downstepped counterparts. As the occurrence of a downstepped nuclear accent depends on the intonation of the first word, the increasing frequency of H* !HL and H*L !H*L suggests an increased

intonational integration between the two words in stage 3. Further, there is a smoother transition from pre-nuclear accent to nuclear accent in H* (!)H*L than in H*L (!)H*L.

3.2. Distribution of nuclear rises and falls

In order to address the question as to whether rises or falls are the more common nuclear contours in the two-word speech in Dutch, we examined the distribution of nuclear contours in the three most common types of utterances. 102 statements and imperatives were included into the distributional analysis of nuclear rises and falls.

We have observed instances of 14 nuclear contours, among which one contour (H* L%) was considered uncommon in adult Dutch. Nuclear falls included H* L%, !H* L%, H*L L%, H*L % and !H*L L%; nuclear rises included H* H%, H* %, !H* H%, H*L H%, !H*L H%, L* H%, L*H H%, L*H % and H*!H %. Figure 3 shows the distribution of nuclear falls and rises in each stage. As evident, falls are substantially more common across the three stages, contra the prediction based on the typical continuation contour of the ambient language. Our data thus add to the body of evidence for the predominance of falls in the two-word stage.

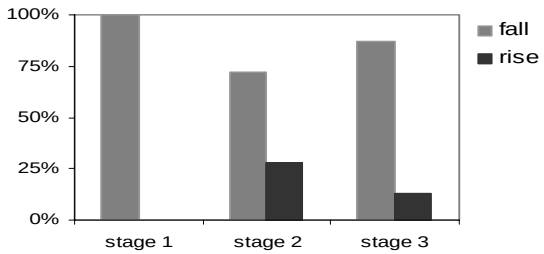

Figure 3. Distribution of nuclear falls and rises in each stage.

3.3. Semantic relation, information status and accent placement

In order to find out whether accent placement in two-word utterances is governed by the semantic relation expressed and the information status of each word, we examined the distribution of pitch accents including deaccentuation in stage 3. Because of the high variability in the semantic relations in Noun+Noun utterances, we focused on Noun+Verb utterances (N=31) and Particle+Verb utterances (N=26). The semantic relation expressed by the child and the information status of each word were determined on the basis of contextual information.

In the 31 Noun+Verb utterances, five semantic relations were identified, Object_Verb (e.g. *ijs eten*, 'ice-cream eat') (N=19), Indirect Object_Verb (e.g. *oma kijken* '(to) gramma look') (N=5), Subject_Predicate (e.g. *poes huilen*, 'cat cry') (N=4), Locative_Verb (e.g. *zand spelen* '(in) sand play') (N=1), Noun_Modifier (e.g. *poes (ge)tekend* 'cat drawn') (N=1).

The Object_Verb utterances were mostly produced with both words accented. The Object was accented 18 out of 19 times and the Verb was accented 15 times independent of information status. The object was deaccented once in a repetition of the child's own utterance while the verb was spoken with !H*L. However, repetition does not explain the deaccentuation of the object noun because repeated Object+Verb utterances were mostly spoken with both words accented. The verb was deaccented twice, once when the verb conveyed new information and once when the verb expressed old information. Thus, unlike found in Wieman [17], the given-new distinction does not account for the deaccentuation-accentuation distinction in our data. The Subject_Predicate utterances were produced with both words accented two out of four times. The predicate was always accented independent of information status; the subject was accented twice and deaccented twice independent of information status. All the Indirect Object_Verb utterances were spoken with both words accented.

Regarding the Particle+Verb utterances, they were uttered mostly either to express the intended action of the child or an action that the child wanted to be performed (typically by the interlocutor). In either case, the recipient of the action was known to both the child and the interlocutor. The semantic relations expressed in the Particle+Verb utterances were thus defined on the basis of who was supposed to perform the action: statement (if the actor was specified as the child him/herself) vs. imperative (if the actor was specified as the interlocutor or left unspecified). There were 10 imperatives and 9 statements. In all 10 imperatives, both the particle and the verb were accented. In five of the nine statements, both words were accented. In three of the other four statements, only the verb was accented; in one statement, only the particle was accented. In these cases, the absence of accentuation was not related to whether the statement was a repetition of an earlier statement or not.

Taken together, our data show that by and large two-word utterances are produced with accentuation on both words independent of the semantic relations expressed and information status. Our data thus confirm Behrens and Gut's [1] finding but provide no evidence for Wieman's [17] claims. These results suggest that children are still trying out different accent types and deaccentuation at this stage and that semantics and pragmatics have not yet come into play in accent placement.

4. CONCLUSIONS

We have analysed the intonation contours of two-word utterances produced by three monolingual Dutch children in the period from the 40-word level to the 230-word level in the autosegmental-metrical framework. Our data have shown that the inventory of the boundary tones and the inventory of nuclear pitch accent types (except for L*HL and L*!HL) are mastered at the 160-word level, and the set of non-downstepped pre-nuclear pitch accents (except for L*) are mastered at the 230-word level. Previous studies based on a holistic approach have claimed that the adult inventory of intonation contours is acquired before the onset of the two-word stage. This is not confirmed by our findings, contrary to for instance the findings in child Catalan [13]. Further, there is some evidence that intonational development is correlated with an increase in vocabulary size. Specifically, the pre-nuclear pitch accent H*LH was not yet used in stage 2 but first appeared in stage 3. Further, the two words in each utterance are more intonationally integrated in stage 3 than in stage 2.

The second issue addressed is whether early two-word utterances are mainly spoken with rises or falls. Previous cross-linguistic studies on early intonational development have shown that language-specific differences in children's preference reflect the differences in continuation intonation in the ambient language. As the predominant pattern of continuation in Dutch is rising, a predominance of rises in Dutch children's early two-word utterances is predicted. In contrast, if universally falling contour are preferred, we predict to find more falls. Our data show that falls are substantially more frequent than rises in the two-word speech in Dutch, as in English, German, and French. This result suggests that there is no clear connection between the preferred continuation contour in the ambient language and the distribution of nuclear falls and rises in early child language.

Finally, our analysis of accent placement has shown that the two-word utterances are mostly spoken with accents on both words. Accent placement is governed by neither the semantic relations expressed nor the information status of each word, contra Wieman [17].

Our study also suggests a number of topics for future research. First, three variants of H*L occurred regularly in both pre-nuclear and nuclear positions, H*L, <H*L, and H*L>, whereas in adult Dutch H*L> appears to occur more frequently in pre-nuclear position than H*L and <H*L. There seem to be systematic differences in the alignment of the pith peak of H*L in different positions between early child Dutch and adult Dutch. Second, lengthening of utterance-final syllables is generally more pronounced in two-word utterances than in adult Dutch. Children seem to lengthen the utterance-final syllable even when it is an unstressed syllable in adult speech. Third, we have noted that the accent placement and choice of accent type are not always adult-like in a given context. An informal survey of 35 utterances produced in stages 2 and 3 shows that in only one third of the cases children's intonation sounds adult-like. Future investigations into these issues will enrich our knowledge on early intonational development.

Acknowledgements: We thank Carlos Gussenhoven for feedback on intonation transcription and Marieke Hoetjes for assistance with data analysis.

5. REFERENCES

[1] Behrens, H., Gut, U. 2005. The relationship between prosodic and syntactic organization in early multiword speech. *Journal of Child Language* 32, 1-34.

[2] Boersma, P., Weenink, D. 2007. Praat. Retrieved 7-Jan-2007 from http://www.praat.org/

[3] Chen, A. 2007. Intonational realisation of topic and focus by Dutch-acquiring 4- to 5-year-olds. *Proc. 16th ICPhS Saarbrücken.*

[4] Chen, A., Fikkert, P. 2007. Dutch 3-year-olds' use of pitch accent types in marking topic and focus. To be presented at GALA 2007.

[5] D'Odorico, L., Carubbi, S. 2003. Prosodic characteristics of early multi-word utterances in Italian children. *First Language* 23(1), 97-116.

[6] Fikkert, P. 1994. *On the acquisition of prosodic structure*. PhD dissertation. University of Leiden.

[7] Gussenhoven, C. 2005. Transcription of Dutch Intonation. In S-A. Jun (ed.), *Prosodic typology and transcription: A unified approach.* Oxford: OU Press, 118-145.

[8] Hallé, P.A., de Boysson-Bardies, B., Vihman, M.M. 1991. Beginnings of prosodic organization: Intonation and duration patterns of disyllables produced by Japanese and French infants. *Language and Speech* 34(4), 299-318.

[9] Ladd, B. 1996. *Intonational phonology*. Cambridge: CU Press.

[10] Levelt, C. 1994. *On the acquisition of a place*. PhD dissertation. University of Leiden.

[11] Lieberman, P. 1967. *Intonation, perception, and language*. Cambridge, MA: MIT Press

[12] Pierrehumbert, J.B. 1980. *The Phonology and phonetics of English intonation.* PhD dissertation. MIT.

[13] Prieto, P., Vanrell, M. 2007. Early intonational development in Catalan. *Proc. 16th ICPhS Saarbrücken.*

[14] Snow, D., Balog, H.L. 2002. Do children produce the melody before the words? A review of developmental intonation research. *Lingua* 112, 1025-1058.

[15] Snow, D. 2006. Regression and reorganization of intonation between 6 and 23 months. *Child Development* 77(2), 281-296.

[16] 't Hart, J., Cohen, A. 1973. Intonation by rule: a perceptual quest. *Journal of Phonetics* 1, 309-327.

[17] Wieman, L.A. 1976. Stress patterns in early child language. *Journal of Child Language* 3, 283-286.