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Factors Supporting the Child's Prosodic Development

SUMMARY

Speech prosody is an important factor stimulating the development of the child's speech. The ability to perceive and interpret prosodic phenomena is the first stage in the acquisition of phonological competence by the child. It first of all enables segmentation by the child of the speech sequence, owing to which it is possible to distinguish linguistic units in it. The degree of prosodic competence acquisition in the early stages of speech ontogeny influences the pace of speech development, while in school-age children it is associated with the level of fluent reading with comprehension.

The present paper discusses the problems related to the acquisition of prosodic competence and skills in speech ontogeny. It presents biological and social determinants of prosody development and describes in greater detail the environmental factors that develop the child's prosodic competence and skills. It also discusses the stages of prosodic development, taking into account the dominant functions of speech prosody in them.

Key words: speech prosody, prosodic competence, prosodic development

INTRODUCTION

The use of prosodic structure in speech is possible owing to the acquisition of prosodic competence and skills. Prosodic competence is the ability to perceive and interpret suprasegmental features and phenomena. Prosodic skills are the expression of prosodic phenomena, appropriate to the semantic content and structure of the utterance and the situation of its use.

Prosodic competence is partly within the scope of phonological competence (when we speak of the linguistic functions of prosody)[1], but it also goes beyond it,

[1] The following are regarded as linguistic functions of prosody: 1) segmentation of the speech sequence, associated first of all with the delimitation and culmination functions of lexical stress and

which is connected with the paralinguistic and extralinguistic functions of suprasegmental phenomena.[2]

Determinants of the development of prosodic competence and skills can be divided into biological and social.

The biological determinants that permit the development of prosodic competence are:

a) efficient auditory perception (physiological hearing, the ability to differentiate sound pitch, volume, duration and quality, auditory memory, association of speech sounds, auditory self-control)[3],

b) efficient cognitive functions enabling accurate interpretation of prosodic behaviours in the speech of the environment, and control of one's own prosodic behaviours and adjusting them to a communication situation.

The working together of the foregoing factors in the process of perceiving prosodic phenomena is termed prosodic hearing.

Moreover, among the biological factors determining the acquisition of prosodic production skills, the following should be named:

b) the normal structure of the speech apparatus, in particular the larynx, as the voice-producing organ, resonators (the oral cavity and throat, nasal cavities and sinuses) and the articulatory organs,

c) the normal functioning of the speech apparatus: absence of muscular tone disorders (within respiratory, phonatory, and articulatory muscles), and normal motor coordination (respiratory-phonatory-articulatory).

A very important function in the acquisition of prosodic competence and skills is also performed by external, environmental determinants discussed further in the paper, which include:

a) stimulation of the development of auditory functions determining the development of prosodic hearing; it involves the use – in interactions with a baby/toddler – the features of prosodic phenomena that are characteristic of child-directed speech together with exercises in prosodic hearing,

b) appropriate prosodic patterns in the speech of the environment,

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intonation structures and with pause length, 2) grammatical, syntactic function consisting in the indication by intonation structures, of sentence types (complete/incomplete, simple/compound), 3) semantic function, mainly related to assigning the information contour to particular types of utterance 4) signaling by the position of sentence stress the information (thematic-rhematic) structure of utterance, and 5) discursive function ensuring text coherence determined on the suprasegmental level by the appropriate sequence of intonation contours, occurrence of sentence stress, and by speech rhythm (cf. Wysocka, 2012).

[2] Paralinguistic function involves coding of emotions and modalities by the sender in prosodic structures. Extra-linguistic function is often termed as identificational. It is connected with the features specific to many population members (e.g. voice pitch characterizing sex or age) or individual traits (specific voice quality characterizing a speaker).

[3] The division of auditory functions adopted after Z. M. Kurkowski (1998; 2002).

c) attention to proper expression of prosodic phenomena in the child's speech, to the efficiency of his/her voice organ, and the clarity and esthetics of speech.

STAGES OF PROSODIC DEVELOPMENT

When analyzing the results of studies on the development of prosodic competence and skills (cf. a survey of research: Wysocka 2012; 2013), it can be said that prosodic competence is one of the first communicative competences acquired by children.

The analysis of prosodic features is the type of skills that appears very early, both in speech perception and expression. In the early stages of the child's development, prosodic structures present in the speech of his/her environment enable him/her, due to their segmentation function, to distinguish language elements (phrases and then words) out of the speech sequence, and provide information about their structure and meaning.

Studies devoted to prosodic development suggest the distinction of the following stages in it:

1. prenatal stage, in which the ability to perceive prosody begins to develop,
2. infancy and early childhood stage, in which an immense role is played by the prosodic features of child-directed speech, owing to which the child acquires the prosody characteristic of the language in which s/he grows up and begins to perceive the functions of prosodic phenomena in communication,
3. pre-operational stage characterized by the intensely developing, unconscious prosodic competence and growing realization skills,
4. the stage of operational thinking, in which the awareness of prosodic phenomena and their function considerably increases (cf. *inter alia* Rymarczyk 2003, Wysocka 2012)

Prenatal stage

During this stage, the developing hearing organ enables the fetus to perceive prosodic features and phenomena present in maternal speech and then in the speech of his/her mother's environment. At the beginning of speech ontogeny the child is mainly sensitive to changes in voice pitch and the temporal organization of speech. During the prenatal period, motor reactions of the fetus to sounds of particular volume and frequency (usually with high parameters) were reported. The adjustment of the fetus's motor activity and physiological processes (e.g. breathing rhythm and work of the heart) to the character of prosodic phenomena perceived by the child, mainly the speech rhythm were also reported (after: Kurkowski 2013).

The prosody perception ability, developing in the prenatal stage, is evidenced by its numerous manifestations observed in infants, who show strong reactions to suprasegmental phenomena present in the speech of the environment. They are able to identify prosodic structures known to them from their mother's speech from those in which acoustic parameters have been changed. A far greater activity of the infant's brain was reported in response to natural, unmodified prosody (Sambeth et al. 2008). Furthermore, it was observed that the crying of infants imitates intonation structures characteristic of their mother's language **(**Mampe et al. 2009). In his/her speech perception, the infant thus activates experiences acquired in the mother's womb.

Infancy and early childhood stage

During the infancy period, speech prosody plays an important role in the child's communication with his/her mother. At first, paralinguistic functions of prosody predominate in interaction. By connecting prosodic structures realized by the mother with her behaviour, the child reads her emotions and intentions (Bouvet 1996). Then, speech prosody begins to enable the child to perceive linguistic elements. A special role in speech acquisition by the child is fulfilled by intonation, which segments a speech sequence into sections. The first section distinguished by the child is a phrase, whose end is marked in speech with a distinct change in voice pitch (rising or falling contours). The distinction of a phrase as an entity with a specific meaning is an important step in acquiring phonological competence. The next stages of its development will involve the ability to perceive smaller and smaller elements of the language system: a word, syllable, or a sound.

Newborns and infants strongly react to intonation, mainly to rising contours. Such reactions were already observed in the second month of the child's life (Sullivan and Horovitz 1983). The ability to perceive intonation structures influences the fast developing capability to express them, combined with the process of intonation semanticization. In interactions of mothers with their ten-to-thirteen-week old children, as many as seven functional intonation contours appear, mutually imitated by mother and child or repeated by one of the interaction partners (Gratier and Devouche 2011).

The results of the acoustic analysis of utterances by infants of this age confirm that they use diverse intonation contours. Presented below is the intonogram and spectrogram of the segment of a three-month-old girl's speech sequence recorded during her interaction with her mother.

On the basis of the analysis of the present intonogram it can be said that the child uses voice pitch fairly well. The intonation is strongly modulated. The range of basic frequency is wide (from 183 to 528 Hz, mean basic frequency being 336 Hz). It should be emphasized that the voice pitch contour is discontinuous (despite

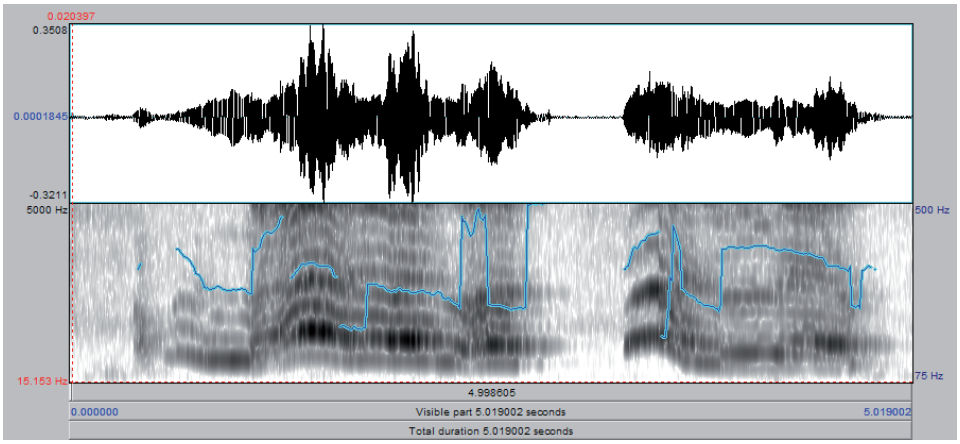

Fig. 1. Spectrogram and intonogram of the segment of a three-month-old girl's speech (PRAAT edition window (Boersma, Wenink 2006). Source: own study.

the lack of consonantal elements), which may be attributed to the still weakly developed respiratory-phonatory coordination. A tendency for rising contours characteristic of the speech of children at that age is also discernible.[4]

In the later infancy period, speech prosody no longer functions exclusively as an interaction-regulating factor. The importance of linguistic functions of prosody increases: they enable the child to segment the speech sequence they hear and distinguish linguistic units in it. Six-month-old infants pay attention to specific prosodic features in the language they hear in their environment, and ignore non-specific ones (Seidl and Cristià 2008). They clearly respond to the stress structures characteristic of the language in which they are brought up (Weber et al. 2004). Owing to the developed ability to identify the stressed syllable, they distinguish rhythmical units in the speech sequence, composed of a stressed syllable and unstressed syllables, which allows them to perceive words (Höhle et al. 2009). They also distinguish between prosodically correct utterances and incorrect ones (Nazzi et al. 2000).

At the age of two, children have fairly well developed prosodic competences and draw a lot of information from prosodic structures. This information is connected with the paralinguistic functions of prosody, but also largely with its linguistic functions. There appears the ability, very important for linguistic communication, to perceive and be aware of the function of rhematic stress associated with communicating and emphasizing new information to the receiver (Grass-

[4] Rising contours in communication signify the absence of closing. They are used to emphasize the willingness to continue the interaction. They are characteristic of unfinished questions and utterances.

mann and Tomasello 2010). Moreover, the awareness of the meaning of the rising and falling contours as markers of continuity and finality also develops.

Thanks to the vocal activity in his/her first year of life: cooing and babbling, the child's realization abilities related to expressing speech prosody, first of all intonation, increase considerably and as early as in the second year of life they are already well developed. An illustration of this statement can be the intonogram below, made on the basis of the recorded segment of a thirteen-month-old child's speech.

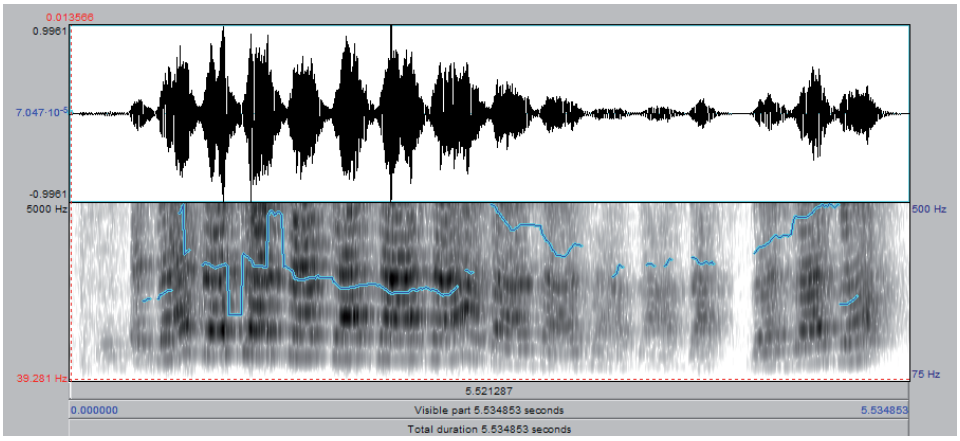

Fig. 2. Spectrogram and intonogram of a thirteen-month-old boy's utterance. Source: own study.

The presented intonogram shows an increase, in comparison with the abilities of a three-month-old child, in the continuity of intonation contours: this is connected with the growing efficiency of the speech apparatus. The intonation structures are also characterized by the uniform character of changes. A consistently realized rise or fall of voice pitch is discernible in them, which suggests their conscious and purposeful use, and the awareness of the existence of intonation structures as organized units that perform definite functions in communication.

Further stages of prosody development (preoperational and operational periods)

During the preoperational period the ability to perceive and express the features of prosodic units still intensively develops. The improving auditory functions, growing phonatory skills and vocal range, more efficient respiratory-phonatory-articulatory coordination enable the development of prosodic skills and competence. Initially, these processes are not conscious, but with time the child can consciously differentiate and modify the features of prosodic phenomena.

The interpretation of basic functions of speech prosody and the conscious use of prosodic structures take place as late as at the age of six (cf. Wysocka 2012). A significant fact for the preoperational period is that the level of development of prosody in the emotional function is higher than the level of development of its linguistic functions (Rymarczyk 2003; Wysocka 2012), which shows the significant role, noticeable from the beginning of speech ontogeny, of suprasegmental structures in the process of communicating emotions in the child's interaction with the environment. The results of studies suggest that the full understanding of linguistic and paralinguistic functions of prosody develops until the end of the eleventh or even thirteenth year of the child's life (Cohen et al. 1990; Rymarczyk 2003; Wells et al. 2004).

In school-age children the degree of acquisition of prosodic competence may significantly influence the teaching process because it is an important factor relating to the ability to read with comprehension (Whalley and Hansen 2006). Scholars come to the conclusion that the fact that the child uses a wide repertoire of features of suprasegmental units indicates well-learned competences relating to the reading process (Miller and Schwanenflugel 2006). A high diversity of features of prosodic units characterizes vocal realizations of more difficult reading texts. The children use this device in order to better understand them[5] (Benjamin and Schwanenflugel 2010). Considerable phonetic contrasts influence achieving of the clear-cut segmentation of text and the clarity of its information structure through realizing rhematic and logical accents.

Furthermore, the effect of rhythmic skills on the ability to read fluently is emphasized. It was proved that the high level of phonological skills and ability to read shows a strong relationship with the level of perception competences in musical rhythm and speech rhythm (Holliman, Wood and Sheehy 2010), while reading difficulties are related to weakened sensitivity to rhythmic structures (*inter alia* Goswami et al. 2002, Richardson et al. 2004).

STIMULATION OF THE DEVELOPMENT OF PROSODY

In view of the fact that prosodic competences determine the development of many functions crucial to linguistic communication, it appears that the measures contributing to their acquisition by the child cannot be marginalized when stimulating speech development. They should take into account both the development of the skills in perceiving and interpreting prosodic phenomena and the ability to use a complete repertoire of prosodic features and phenomena appropriate for communication situations.

[5] Therefore they apply the strategy utilized by those taking care of a little baby, who use high contrasts of prosodic features in speech in order to facilitate its perception by the child.

The role of prosodic specificity of child-directed speech

In the early stages of the child's speech development (infancy and early childhood period) a special role is played by prosody in the speech of his/her environment, especially in maternal speech. Child-directed speech is characterized by large phonetic contrasts, by many and substantial changes in voice pitch and volume, speech rate and duration of segments, by the higher average of voice pitch and by bright voice quality (cf. *inter alia* Kempe et al. 2010). The outcome of the use of those devices are: a great diversity of intonation contours and their broad range, long pauses, pronounced lexical and phrasal stress, and the slowed down rate of speech.

This specificity of prosodic structures serves several important functions in communication with the child. It focuses the child's attention on the utterance or its particular elements. It enables distinct segmentation of the utterance, thus allowing the child to distinguish a phrase, syntactic structures, and smaller and smaller elements of the language system. It also introduces the child to the semantic structure of the utterance (for example, by emphasizing the features of logical stress which indicates an important element of the utterance or by exactly defining the intonation contour related to a particular type of utterance: declarative, imperative or interrogative). Finally, thanks to great contrasts of the features of suprasegmental units it is possible to clearly communicate emotions, initially those of the carers, the mother in particular, and then of the child, who, having acquired the features of prosodic units related to the emotive function of prosody, learns to express them, thus communicating his/her emotional states.

It is worth noting that the prosodic features of child-directed speech are universal, regardless of the language used by the child's carers. They (features) are present both in the speech of women and men.[6] The result of the absence of the prosodic features in child-directed speech may be a slower process of their acquisition by the child (D'Odorico and Jacob 2006). The lack of significant contrasts of the features of prosodic units makes it difficult for the child to segment the speech sequence s/he hears, which leads to disorders in the development of phonological competence, and to ensuing difficulties in learning other language subsystems.

[6] Some scholars, however, point out that there are some differences between the prosodic features of child-directed speech spoken by women and men. In women's speech, longer sound duration is observable, especially fricatives: it is probably used to produce the impression of gentleness and calm (Kempe 2009). In the case of women a strong correlation between the expressiveness of prosodic features and high empathic abilities was reported, while the utterances of highly empathic men have a prosodic profile very close to adult-directed speech (Kempe 2009). It was also observed that the experience of maternity enhances the prosodic features characteristic of child-directed speech, also in utterances directed to children other than the parent's own and heightens the features of emotional prosody (Kempe et al. 2010).

How far the features of intonation structures in child-directed speech are modified is evidenced by the intonogram below, the fragment of a man's utterance during his talk with his four-month-old son.

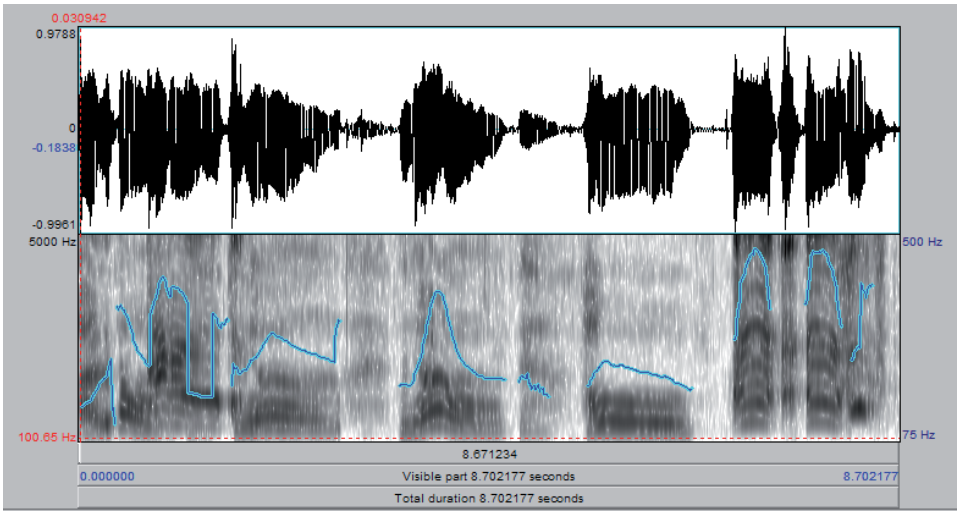

Fig. 3. Spectrogram and intonogram of a man's utterance recorded during his talk with his four-month-old son. Source: own study.

The present recording draws attention to very high values of basic frequency. The mean F_0 value is 255 Hz and greatly exceeds the mean F_0 value characteristic of men's speech.[7] Differences in the basic frequency in the presented fragment of speech sequence are as much as 360 Hz (from 118 Hz to 478 Hz), which produces a very broad range of intonation contours which are, moreover, highly diverse and short, owing to which the child perceives them more easily.

In the later stages of development of prosodic competence and prosodic realization skills, when there is further improvement in the abilities to perceive and express smaller and smaller differences in the features of prosodic units, and to interpret the function of prosody in communication, it is of great importance to provide an appropriate model of prosodic phenomena in the speech of the child's environment. This applies first of all to the speech of the child's parents, carers, and teachers. In developing correct prosodic habits a great role is also played by the attention of carers to the quality of prosodic structures in the child's speech. It becomes particularly important when the child tends to imitate distorted prosodic

[7] Mean values of basic frequency in European languages are ca. 120 Hz for men (ranging from 50 Hz to 250 Hz) and 220 Hz for women (ranging from 120 Hz to 480 Hz) (cited after: Laver 1994, p. 451).

factors present in his peer group members or in the speech of persons who are significant to him.

The further development of expressive capacities in prosody is also influenced by the hygiene of the child's voice and production exercises that the child performs. The two factors ensure the efficiency of the voice organ, on which the expression of prosodic features largely depends (cf. Kowalska 1989; Schön et al. 2004).

Prosodic hearing exercises and prosody expression exercises

In view of the fact that musical structures show great similarity to prosodic structures, prosodic hearing exercises can be combined with musical hearing exercises. Many publications indicate the relationship between the two processes (*inter alia* Anvari et al. 2002; Kowalska-Pińczak 1985; Palmer, Jungers and Jusczyk, 2001; Saffran et al. 1999; Wysocka 2007; 2011; 2012). Exercises using music teach children to differentiate sound features and train the perception of melody (intonation), stress, tempo and rhythm, both in music and in speech (cf. *inter alia* Magne, Schön and Besson 2006; Schön et al. 2004). They can be auditory exercises and auditory/production exercises consisting in imitation of specific sound parameters and musical and prosodic structures (cf. *inter alia* Kowalska 1989), as well as auditory-motor exercises using gross motor skills. In particular, the last form is regarded as valuable because thanks to involving the child's gross motor skills it is possible for him/her to experience musical and prosodic phenomena through movement, which is conducive to perceiving and understanding them. Moreover, musical-motor exercises, particularly those that use songs and rhythmicized text, increase the efficiency of the speech apparatus, thus improving respiratory-phonatory-articulatory coordination. Their asset is also that they are attractive and use the child's natural tendency to move. The method that serves the foregoing purposes is logorhythmics, used in Polish speech therapy for years (see Kilińska-Ewertowska 1978 and subsequent editions).

Prosodic hearing exercises and prosody expression exercises may be also independent of musical exercises. They usually consist in differentiation, imitation, and in independent expression of intonation structures, lexical and logical stress, and emotional coloring coded in prosodic structures (cf. Wysocka 2011; 2012). Particularly valuable are systematized exercises administered as part of a therapy program taking into account the level of prosodic development in children at specific ages (Hargrove and McGarr, 1993; Rothstein, 2013). The results of training prosodic skills have of course to be consolidated in daily communication by involving people in the child's immediate environment in this process.

RECAPITULATION

Because of the important role of prosodic phenomena in the communication process it is necessary to attend to the development of the child's prosodic competence and skills, both in preventive measures and in treatment. Stimulation of their development and appropriate prosodic behaviours present in the speech of the child's environment may speed up the process of speech acquisition by the child. These measures are particularly important in the earlier stages of ontogeny, in which, owing to prosodic structures, the child perceives increasingly minute language elements in the speech sequence and gains information about their meaning. In the later periods of the child's development, the correctly acquired prosodic competence makes it easier for him/her to acquire the ability to read fluently with comprehension. Important factors enabling the child's prosodic development are special features of prosodic phenomena that are characteristic of child-directed speech, and proper prosodic models in the speech of his/her environment. In making the child sensitive to prosodic features and phenomena an important role is also played by auditory exercises that develop prosodic hearing and consolidate the correct realization of prosodic structures.

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