

PERCEPTION OF FACIALLY AND VOCALLY EXPRESSED EMOTIONS IN CHILDREN WITH ADHD

Ewa Czaplewska¹, Małgorzata Lipowska²

¹ Department of Speech Therapy, University of Gdansk, Gdansk, Poland

² Institute of Psychology, University of Gdansk, Gdansk, Poland

Key words: *neurolinguistics, mimicry, prosody, nonverbal communication*

SUMMARY

Attention Deficit Hyperactivity Disorder is a diagnosis applied to children and adults who show serious cognitive problems and behavioral disturbances in essential aspects of their life. These problems can be divided into three characteristic syndromes: impulsive, hyperactive and inattentive. One of the characteristics of behavior of children with ADHD is oversensitivity, associated with inappropriate reaction to emotional situations, resulting from two different sources: incorrect interpretation of the emotions of others, and high emotional liability. Perception of the emotional aspect of the message strongly determines the interpretation of the sender's intention towards the receiver and the sense of the interaction. In our research we wanted to determine whether pupils with hyperactivity differ from their peers in their perception of facially and vocally expressed emotions.

There were 60 participants of the research – 30 pupils with ADHD aged 8-9 and control group.

The obtained data show the existence of essential differences in the level of correct perception of mimic emotion signals between hyperactive children and control group. The responses from children with ADHD were less precise, especially when concerning the mimics. The most correctly perceived were facial and vocal signals of joy and sorrow, although the children with ADHD had the smallest problem with the recognition of positive emotions.

This should be taken into consideration when planning the therapy – rewards, emotions and positive reinforcement seem to be better received by hyperactive children and can function as directions regulating behavior better than penalties.

INTRODUCTION

Communication is an expression that is used not only in professional literature, but also in colloquial speech, and so it does not possess any specific universal definition. According to Griffin (2003), communication can be considered e.g.

- in cybernetic tradition – as a flow of information;
- in semiotic tradition – as a process of sharing meaning through signs;
- in phenomenological tradition – as experiencing oneself and others by means of dialogue.

Whatever definition of communication we accept, it is obvious that communication is a process occurring between individuals in a particular context and by means of a specific code. Apart from the language code, there are two more codes which take a significant part in the process of communication: paralinguistic and nonlinguistic code, often described together as nonverbal communication (Kaczmarek, 2003). Owing to the nature of various aspects of paralinguistic code, such as prosody, it is possible to convey a great deal of information and modify the content of the utterance by means of tone, pitch, timbre, and accent. Nonlinguistic code comprises several independent sub-codes connected with expressive movement (mimic, gestures), sensory information (smell, touch, sight), eye contact, or behavioral matching of the interlocutors. The role of the nonverbal channels should not be underestimated. There is some research indicating that about 31% of meaning is assigned to the verbal channel, and the remaining 69% is included in nonverbal behavior (Głodowski, 1999). Nonverbal channels convey feelings and emotions more precisely and correctly. The emotional dimension of the message is extremely important in the process of communication, because it often determines the interpretation of the real intention of the sender towards the receiver (Frank & Ekman, 2004).

Correct recognition of the sender's intention enables the receiver to form an adequate response to the received message; in order to reply, refer, or change the subject of the conversation, or to terminate it, the receiver must know what the interlocutor really has in mind. What he must understand is not exactly the grammatical sense of the sentence, but the logical sense of the utterance (contained in the speech acts), which is not necessarily identical. One's own behavior can often be controlled, so as to react adequately to the situation and the interlocutor, only when both the verbal and nonverbal information in the message is appropriately received (Ekman & O'Sullivan, 2006).

One important indication that correct recognition of the emotional states of the participants is essential to every social interaction is the fact that this capability appears very early in ontogenesis – infants at a few months of age are already able to recognize basic emotions expressed by their parents (Paschalis et al., 1995), and eight-month-old children are able to regulate their own behavior regarding the emotions of other people (Mondloch et al.,

2003). The analysis of infants' reaction to the behavior of adults communicating with them shows that it is the face which is the main transmitter of feelings (Geldart et al., 2002). This is the reason why the notion of face priority has been developed, because the face is seen as the most important part of the body involved in transmitting emotions, which means nonverbal communication (De Haan et al., 2001). Research on children in their first months of life shows that five-month-old babies can already recognize such emotions as sorrow or joy, presented by mimicry (Caron, Caron & Myers, 1985), whereas a syntonic reaction to emotional signals sent by the parents occurs even earlier, around the third month of life (Haviland & Lelwica, 1987).

Besides mimicry, the emotional message is sent by means of prosody. Reactions to the timbre of voice seem to appear in the child's behavior in the first weeks of his life; infants probably recognize emotions in people's voices before they are able to recognize different emotional expressions of various people (Caron, Caron & MacLean, 1988). Adult speech directed to infants is extremely emotional. According to Milewski (2004), clearly punctuated intonation, raising and lowering one's voice, modulation of the melody, play a significant role here. The already classic study by Mehrabian (1981) shows that 38% of information about emotions contained in the message can be assigned to vocal signals. As Kelner and Ekman (2005) claim, numerous studies prove the occurrence of coherent and important links between the expression of one's face and other emotional signals, although attempts to provide evidence for these links encounter many difficulties.

At the end of the first year of life there takes place a process called social reference (Brzezińska, 2000), when children begin to make use of information about the emotional expression of other people to regulate their own behavior. In the process of child raising, the most important information used to assess, correct or reinforce the child's behavior is transmitted to him more by means of emotional facial expression and voice, than by the linguistic content of the parent's utterance (Hurme, 2002). Difficulties in reading and reacting to emotional information from caregivers are often the cause of conflicts within the family system or at school.

Children with attention deficit hyperactivity disorder (ADHD) belong to a group that is extremely prone to such difficulties (Barkley, 2006). This disturbance is one of the most common neurodevelopmental disorders among school-age children. It is diagnosed relatively early, most often in early school age, between the ages of six and nine (Kołakowski et al., 2007). Nevertheless, no uniform diagnostic criteria have been established which would allow an unambiguous diagnosis to be formulated, and the terminology that is used is also not uniform. When referring to hyperactivity disorder, the most common term in the literature is ADHD, taken from the classification system adopted by the American Psychiatric Association - DSM-IV-TR (APA, 2000). However, the European Union requires diagnosis according to the International Classification of Psychic Disorders, ICD-10, prepared by the World

Health Organization (WHO, 1992), where the notion "hyperkinetic syndrome" (HKD) is used. Despite the existing differences, the diagnostic criteria in both classifications are similar: ADHD is a disturbance characterized by difficulties in concentrating attention, hyperactivity, and impulsiveness, which appear in a degree hampering the child's functioning or are inconsistent with the child's development. ADHD is a neurodevelopmental disorder whose symptoms modify the child's functioning in both behavioral (impulsive and hyperactive behavior) and cognitive respects (difficulties in concentration of attention and cognitive functioning), which results in difficulties in the family and school environment, and also in relationships with peers (Wolańczyk & Pisula, 2005).

Research on the etiology of ADHD mostly points to a genetic background for the syndrome. The majority of evidence suggests a relationship between hyperkinetic disorder and dopamine genes, which, among other things, code dopamine receptor DR4, (DRD4) on chromosome 11 (sevenfold repetition of the allele); this defective gene has been found in 30% of healthy persons, but in 50%-60% of persons with ADHD (Biederman et al., 2002). Moreover, the application of neuroimaging techniques to cerebral structure and function has revealed numerous anatomical anomalies and associated specific patterns of information processing in children with ADHD (Castellanos, 2002). Atypical data processing also refers to information concerning the emotional state of the partner in social interaction. Research with the application of neuroimaging techniques shows decreased activity in the medial prefrontal and limbic (amygdala) brain regions responsible for the recognition of facial emotions in children with ADHD (Marsh & Williams, 2006). The latest research by Williams et al. (2008) concerning children with ADHD shows a substantial decrease in activity in the occipital region already in the early stage of the perception of facial emotions (120 ms), together with excessive activity connected with structure coding (120-220 ms) and subsequent decrease and sluggishness of the temporal brain activity that facilitates context processing (300-400 ms). This explains the high degree of failure in the perception of other people's emotions, or improper emotional response to situations in persons with brain damage, those afflicted with neurodegenerative diseases, and those with specific developmental disorders of the nervous system (Csukly et al., 2008; Pačalska, 2008).

The inappropriate emotional responses of hyperactive children result from two different sources: incorrect interpretation of the emotional information received from others and the childrens' own high emotional lability. One may speak here of emotional oversensitivity; a relatively small stimulus easily evokes an extremely powerful emotional reaction, in which the response is disproportionate to the stimuli and difficult for the child to handle. During differential diagnosis attention should be given to the symptoms of depression characteristic for the behavior of hyperactive children, transitory low mood and low self-esteem: these are permanent elements of the clinical picture of a child with ADHD (Wolańczyk & Pisula, 2005). Moreover, childhood depres-

sion is a disturbance which often accompanies ADHD, or is mistaken for it. The co-occurrence of depression and ADHD is estimated at 25-30%, whereas 63% of children with depression fulfill ADHD criteria. Bipolar disorder also co-exists with hyperactivity, or ADHD may somehow mask a manic disorder (Barkley, 2006). One's own mood variations definitely influence the perception of other people's mood.

Inadequate responses to the emotional signals sent by interlocutors additionally increase the impulsive behavior characteristic for hyperactivity, resulting from difficulties in concentrating attention. One of the most essential factors necessary for the creation of a communicative context is entering into and maintaining eye contact, which indicates interest and willingness to listen to the interlocutor. The attention disturbances and impulsivity cause the child to interrupt eye contact between herself and the other participants in the conversation, which can be interpreted as unwillingness to participate, or even as an attempt to break communication (Czaplewska & Kaczorowska-Bray, 2005). The communication difficulties of hyperactive children also result from the fact that they are not able to recognize and interpret correctly the interlocutor's signals (praise or censure of the message, willingness to continue or change the subject, etc.), which additionally hinders their participation in the conversation and increases the possibility of misunderstanding. They have problems in understanding the situation of the interlocutor, to estimate her knowledge and accept her perspective, and consequently they have problems in selecting expressions which will satisfy the interlocutor instead of insulting him. Their remarks are often regarded as impolite or even aggressive, so ADHD is often identified with Oppositional Defiant Disorder or with Behavior Disorder (Borkowska, 2004). Research into the social functioning of hyperactive children indicates increased demand for contact with peers. A high level of sociability, understood here as a temperamental feature, is connected with the search for reinforcement delivered by social interactions, such as the presence of other people, common activity, attention paid to the individual by others, reciprocal interaction, and initiation of social contacts. Unfortunately a reduced ability to respect the rules of functioning within the group, along with impulsive and thoughtless utterances, often causes children with ADHD to be socially isolated and feel lonely (Lipowska, 2003). Hyperactivity and impulsivity very often evoke aversion and impatience in parents, teachers and peers. Low sensitivity to the para- and non-linguistic indications contained in a message often causes the literal reading of transmitted information. Hyperactive children have significant difficulty in guessing or understanding subtexts: they demand unambiguous and directly expressed messages.

MATERIAL AND METHODS

In our research we set out to answer the question whether hyperactive pupils differ from their peers in their level of adequacy in reading emotional signals.

For this purpose we made use of an original experimental method called Emotion Recognition (Czaplewska, 2002), measuring the interpretation of emotions presented facially and vocally. The method involves two tasks. In the first task we presented photographic material containing the faces of men and women. Children were shown pairs of pictures presenting emotions expressed facially: sorrow, joy, fear, anger and repulsion. The demonstration was accompanied by questions, such as: Who is on this picture? What do you think about these persons? What can they be feeling? How do you feel when you make such faces? All the children's answers were written down in a questionnaire. In the second task, sound and picture material was used. On CD we recorded random words such as: butterfly, dog, doll, teddy bear, which were uttered by a man or a woman in such a way that the tone of their voice expressed one of the same five emotions: sorrow, anger, fear, repulsion and joy. The child's task was to listen to the recording and point at a facial picture of one of the five emotions as presented on the faces of the people in the photos.

The research was conducted on a group of 60 children: a group of 30 ADHD children aged 8-9 years, and a control group matched for age and gender. The research was done on each child individually, in a classroom at the child's school.

RESULTS AND DISCUSSION

In the first place we noticed a relatively small proportion of correct identifications of facially expressed emotions among all the children in the study population (Fig. 1).

Correct answers were those which defined the emotion precisely, whereas such answers as "he's almost crying, there is something wrong with him," were treated as incorrect. The analysis of the results confirm statistically essential differences ($p=0.041$) in the general level of identification of facial-

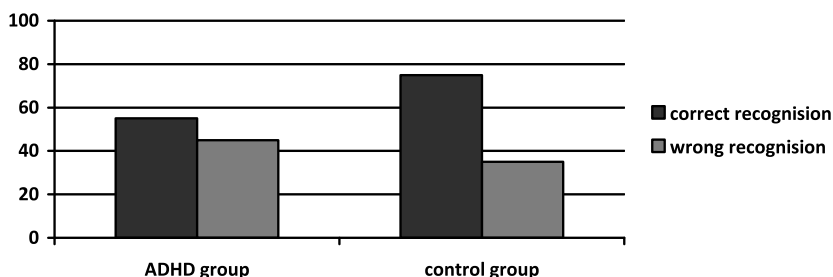


Fig. 1. Mean percent of correct and wrong recognitions of facially expressed emotions

ly expressed emotions in the two groups. Hyperactive children, when describing the emotions presented in the pictures, more often than the controls produced an inaccurate assessment, such as, "no good, seems all right, something happened"; they seemed to concentrate on the behavior and situational context rather than on the emotion itself. These data are consistent with conclusions from published research concerning the impact of the disintegrating context on the functioning, including cognitive functioning, of hyperactive children, whose cognitive style is field-dependent and associated with a tendency to refer to external direct indications, often thoughtlessly (Lipowska & Buliński, 2007). Therefore they more often interpret the verbal message literally, without considering the para- and non-linguistic context of the utterance, e.g. the comment of an irritated parent, "You might as well throw it on the floor and step on it," is treated as a simple imperative.

That is why it was interesting to follow the occurrence of possible differences in the perception of particular types of emotions (Fig. 2).

These data point to the existence of essential differences between hyperactive children and the controls in terms of correct facial recognition of emotional signals, involving all emotions except repulsion. However, the profile is convergent, i.e. in both groups the same emotions caused the largest difficulties. The results that we obtained are almost entirely consistent with those obtained by Pelc et al. (2006). The highest percentage of correct identifications concerned joy and sorrow. These two emotions constitute some kind of "specification" on the opposite ends of the primary emotional state felt by newborns, which is satisfaction/dissatisfaction (Oniszczenko, 1998). The earliest emotional reinforcements obtained from parents are connected with acceptance or non-acceptance of a certain state, and recognition of only a general emotional signal evokes the first symptoms indicating that a child is regulating her own behavior. It seems interesting, but also distressing, that there was a high discrepancy in the interpretation of joy; it is possible that positive emotions are connected with a lower level of activation than negative ones, so in the case of hyperactive children the stimulus value for joy will be lower.

Inadequacy in the identification of negative emotions seems to be another explanation for many social behaviors of children with ADHD. As a conse-

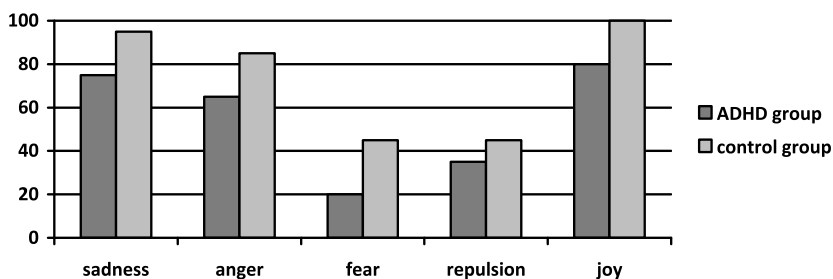


Fig. 2. Percent of correct recognitions of facially expressed emotions

quence of undesirable behavior on the part of a child, his parents, teachers and friends react emotionally, and signal this by commenting or sending non-verbal emotional signals. The problem with immediate reception of the information results in the lack of response, and then the child's behavior is adapted to the requirements. Not having identified early emotional information, a child with ADHD flounders far deeper, even intensifying her dissatisfaction, sorrow, anger and other people's disappointment. Also of concern here is the large discrepancy between the results of both groups concerning fear recognition. Children with ADHD may respond too late to their peers reacting with fear to their behavior, which, in the case of peer conflicts, may evoke or intensify their aggressive behavior. Hyperactive children seem to have difficulty in not only noticing their own mistakes, but also in reading other people's signals saying that they have made them.

Recognizing the symptoms of fear and repulsion seems to be difficult for all the children in the study population, which is consistent with information from experimental research on both healthy people (Leathers, 2007) and those with neurological problems (Singh et al., 1998; Kan et al., 2002; Pelc et al., 2006). Our subjects, when trying to recognize the emotion presented in the picture, mostly used descriptive expressions, such as sour face/look, he saw something unpleasant, he ate something bad, ugly, rather than the direct description of an emotion.

The data presented here show that almost 40% of information about the emotional content of the utterance is transmitted by means of the voice (Mehrabian, 1981). It is worth observing the efficiency with which hyperactive children identify vocal emotional signals (Fig. 3).

First of all, it is interesting that the identification of emotions expressed vocally was easier for these children ($p=0.049$) than those expressed only facially. The prosodic layer of a message conveys information with the use of the appropriate tone, timbre, audibility, tempo of speech, or accent. Such variety allows emotional information to be transmitted precisely; therefore, the regulation function is regarded as one of the main functions of prosody. Let us then analyze the configuration of correct recognitions of particular emotions (Fig. 4).

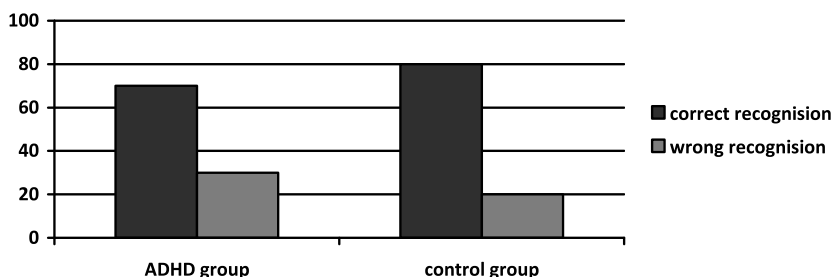


Fig. 3. Mean percent of correct and wrong recognitions of vocally expressed emotions

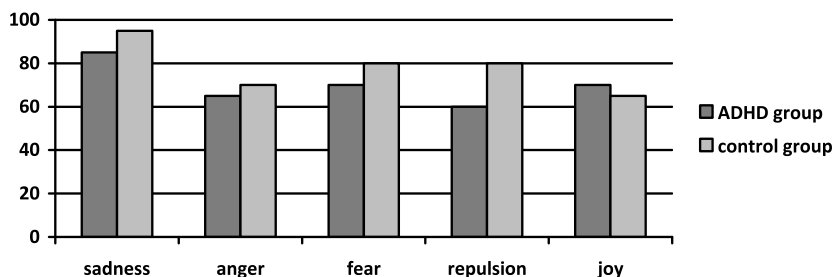


Fig. 4. Percent of correct recognitions of vocally expressed emotions

It is interesting that there appeared no significant differences between the two groups: hyperactive children seem to draw from vocally expressed emotion as much as the healthy controls (Ruffman et al., 2008). It is a sad conclusion that the emotion recognized best by all the children is sorrow, as the voice and its qualities are those which reveal our real emotions first. Is sorrow the emotion most often encountered by small children?

The analysis of adults' speech directed to children has revealed a specific character of transmission. When speaking to an infant we use higher pitch, we coo, speak more slowly and quietly (Milewski, 2004). Prosody seems to be a communication channel used already in ontogenesis. Research on changes in the identification of vocal emotional signals has pointed to reduced correctness, progressing with age; adults seem to draw more from direct language messages (Ruffman et al., 2008). Examining prosody with the use of fMRI revealed bilateral arousal of the frontal lobes while estimating the emotional states of interlocutors; moreover, in the case of children this activity occupies a wider area, especially when it involves the perception of sorrow, which can be connected with the immaturity of the prefronto-limbic connections in childhood (Wildgruber et al., 2006).

The results presented here seem to confirm a relationship between difficulties and perception of emotional states by children with ADHD, hence their worse functioning in society. The emotional function of non-verbal communication is after all connected directly with the regulation of behavior under its influence. It seems that hyperactive children, reacting inadequately to emotional signals, evoke subsequent, often extreme, emotional behavior in others; at the same time they blur or even distort the picture of the situation.

CONCLUSIONS

Attention Deficit Hyperactivity Disorder children, more often than their peers, encounter problems learning in school; despite usually sufficient skill levels, their scores are not satisfactory and very often unsteady. The disturbances in the concentration of attention which appear here cause the child to be absent-minded, to disengage from the class, and to be unwilling to under-

take tasks. Hyperactivity often contributes to obstinate, rebellious and even destructive behaviors. Because of a deficit in the area of planning, formulating and self-control, they cannot plan their utterances correctly lexically or semantically. Slowing the speed of this process considerably retards the flow of verbal communication, and makes it more susceptible to interference. Inadequate construction of their own utterances and difficulties in the reception of other people's messages, both verbal and non-verbal, increase the tendency to conflict between hyperactive children and their peers and elders. With regard to their behavior, children with ADHD experience low a socio-metric position in the peer group.

Nonverbal emotional messages of a negative character should prevent a child from acting. The message I am angry sent by a peer or a parent should stop his behavior. The problem is that such a message may be read incorrectly. Many children with ADHD have problems with understanding language (Czaplewska & Kaczorowska-Bray, 2005). When combined with difficulties in recognizing facial and vocal interpretative directions, the child may consider the message unimportant. It also cannot be ignored that adult speakers of Polish, e.g. teachers, relatively often use sarcastic expressions, such as really?, you've done great, or fantastic etc. At the same time their facial expression is adequate to the emotion they feel at that moment. In the light of our research it turns out that such messages may be received as an incentive to further action by hyperactive children. Adults will treat this as insubordination, whereas the child will feel more and more lost in a world of contradictory messages. Moreover, many studies have revealed a significant inhibition deficit in children with ADHD (Borkowska, 2008) both in the area of cognitive functioning and social behavior. Referring to the Behavioral Inhibition System model, Quay (1997) claimed that hyperactive children are characterized by lower sensitivity to punishment signals and higher reactivity to rewards. The perspective of possible negative reinforcement does not seem to result in the inhibition of unwanted behavior. This should be taken into account when planning the therapeutic process – rewards, emotions and positive reinforcement seem to be better received by hyperactive children, and they can be more efficient than penalties as directions regulating behavior.

REFERENCES

- American Psychiatric Association (2000). *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.). Washington, DC: Author.
- Barkley, R.A. (2006). *Attention-deficit/ hyperactivity disorder - A handbook for diagnosis and treatment*. New York: The Guilford Press.
- Biederman, J., Spencer, T., Wilens, T.E. & Faraone, S. V. (2002). Overview and neurobiology of Attention-Deficit/ Hyperactivity Disorder. *Journal of Clinical Psychiatry*, 63, 3-9.
- Borkowska, A. (2004). Analiza relacji między zespołem ADHD, a innymi formami zaburzeń zachowania - błędy diagnostyczne. *Psychologia Rozwojowa*, 9(4), 127-133.
- Borkowska, A.R. (2008). *Procesy uwagi i hamowania reakcji u dzieci z ADHD z perspektywy rozwojowej neuropsychologii klinicznej*. Lublin: Wydawnictwo UMCS.

- Brzezińska, A. (2000). *Spółeczna psychologia rozwoju*. Warszawa: Scholar.
- Caron, A.J., Caron, R.F. & MacLean, D.J. (1988). Infant discrimination of naturalistic emotional expression: the role of face and voice. *Child Development*, 59, 604-616.
- Caron, R.F., Caron, A.J. & Myers, R.S. (1985). Do infants see facial expression in static faces? *Child Development*, 56, 1552-1560.
- Castellanos, F.X., Lee, P.P., Sharp, W., Jeffries, N.O., Greenstein, D.K., Clasen, L.S., Blumenthal, J.D., James, R.S., Ebens, C.L., Walter, J.M., Zijdenbos, A., Evans, A.C., Giedd, J.N. & Rapoport, J.L. (2002). Developmental trajectories of brain volume abnormalities in children and adolescents with Attention-Deficit/Hyperactivity Disorder. *Journal of the American Medical Association*, 288, 1740-1748.
- Csukly, G., Czobor, P., Simon, L. & Takács, B. (2008). Basic emotions and psychological distress: association between recognition of facial expressions and Symptom Checklist-90 subscales. *Comprehensive Psychiatry*, 49(2), 177-183.
- Czaplewska, E. (2002). *Rozpoznawanie Emocji - materiały do badań*. Gdańsk: Zakład Logopedii UG.
- Czaplewska, E. & Kaczorowska-Bray, K. (2005). Zaburzenia mowy u dzieci z ADD i ADHD. In: W. Pilecka, A. Ozga & P. Kurtek (eds.), *Dziecko ze specjalnymi potrzebami edukacyjnymi w ekosystemie* (pp. 111-117). Kielce: Wydawnictwo Akademii Świętokrzyskiej.
- De Haan, M., Johnson, M., Maurer, D. & Perrett, D. (2001). Recognition of individual faces and average face prototypes by 1- and 3-month-old infants. *Cognitive Development*, 16, 659-678.
- Ekman, P. & O'Sullivan, M. (2006). From flawed self-assessment to blatant whoppers: The utility of voluntary and involuntary behavior in detection of deception. *Behavioral Sciences and the Law*, 24, 1-14.
- Frank, M. G. & Ekman, P. (2004). Appearing truthful generalizes across different deception situations. *Journal of Personality and Social Psychology*, 86, 486-495.
- Geldart, S., Mondloch, C., Maurer, D., de Schonen, S. & Brent, H. (2002). The effects of early visual deprivation on the development of face processing. *Developmental Science*, 5, 490-501.
- Godowski, W. (1999). *Bez słowa. Komunikacyjne funkcje zachowań niewerbalnych*. Warszawa: Wydawnictwo Hansa Communication.
- Griffin, E. (2003). *Podstawy komunikacji społecznej*. Gdańsk: Gdańskie Wydawnictwo Psychologiczne.
- Haviland, J.M. & Lelwica, M. (1987). The induced affect response: 10-week-old infants' response to three emotion expressions. *Developmental Psychology*, 23, 97-104.
- Hurme, H. (2002). Rozwój emocjonalny. In: B. Harwas-Napierała & J. Trempała (eds.), *Psychologia rozwoju człowieka* (pp. 45-70). Warszawa: Wydawnictwo Naukowe PWN.
- Kaczmarek, B.L.J. (2003). Rodzaje kodów komunikacyjnych. In: B. Kaczmarek & K. Markiewicz (eds.), *Komunikowanie się we współczesnym świecie* (pp. 11-26). Lublin: Wydawnictwo UMCS.
- Kan, Y., Kawamura, M., Hasegawa, Y., Mochizuki, S., Nakamura, K. (2002). Recognition of emotion from facial, prosodic and written verbal stimuli in Parkinson's disease. *Cortex*, 38(4), 623-630.
- Keltner, D. & Ekman, P. (2005). Wyrażanie emocji twarzą. In: M. Lewis & J.M. Haviland-Jones (eds.), *Psychologia emocji* (pp. 307-323). Gdańsk: Gdańskie Wydawnictwo Psychologiczne.
- Kołąkowski, A., Wolańczyk, T., Pisula, A., Skotnicka, M. & Bryńska, A. (2007). *ADHD - zespół nadpobudliwości psychoruchowej. Przewodnik dla rodziców i wychowawców*. Gdańsk: Gdańskie Wydawnictwo Psychologiczne.
- Leathers, D.G. (2007). *Komunikacja niewerbalna*. Warszawa: Wydawnictwo Naukowe PWN.
- Lipowska, M. (2003). Nadpobudliwość w oczach nauczycieli - temperament czy zaburzenie. In: B. Wojciszke & M. Plopa (eds.), *Osobowość a procesy psychiczne i zachowanie* (pp. 405-422). Kraków: Oficyna Wydawnicza Impuls.

- Lipowska, M. & Buliński, L. (2007). Cognitive style in children perceived by their teachers as hyperactive. *Acta Neuropsychologica*, 5(1-2), 34-45.
- Marsh, P.J. & Williams, J.M. (2006). ADHD and schizophrenia phenomenology: visual scan-paths to emotional faces as a potential psychophysiological marker? *Neuroscience and Biobehavioral Reviews*, 30(5), 651-665.
- Mehrabian, A. (1981). *Silent messages: implicit communication of emotions and attitudes*. Belmont, California, USA: Wadsworth.
- Milewski, S. (2004). *Mowa dorosłych kierowana do niemowląt*. Gdańsk: Wydawnictwo Uniwersytetu Gdańskiego.
- Mondloch, C., Geldart, S., Maurer, D. & Le Grand, R. (2003). Developmental changes in face processing skills. *Journal of Experimental Child Psychology*, 86, 67-84.
- Oniszczenko, W. (1998). Odziedziczalność temperamentu u dzieci w wieku 3-10 lat. *Psychologia Wychowawcza*, 41(1), 1-16.
- Pachalska, M. (2008). *Rehabilitacja neropsychologiczna*. Lublin: Wydawnictwo UMCS.
- Paschalis, O., de Schonen, S., Morton, J., Deruelle, C. & Fabre-Grent, M. (1995). Mother's face recognition by neonates: a replication and an extension. *Infant Behavior & Development*, 18, 79-95.
- Pelc, K., Kornreich, C., Foisy, M. & Dan, B. (2006). Recognition of emotional facial expressions in Attention-Deficit Hyperactivity Disorder. *Pediatric Neurology*, 35(2), 93-97.
- Quay, H.C. (1997). Inhibition and attention deficit hyperactivity disorder. *Journal of Abnormal Child Psychology*, 25, 7-13.
- Ruffman, T., Henry, J.D., Livingstone, V. & Phillips, L.H. (2008). A meta-analytic review of emotion recognition and aging: implications for neuropsychological models of aging. *Neuroscience and Biobehavioral Reviews*, 32(4), 863-881.
- Singh, S.D., Ellis, C.R., Winton, A.S.W., Singh, N.N., Leung, J.O. & Oswald, D.P. (1998). Recognition of facial expressions of emotion by children with Attention-Deficit Hyperactivity Disorder. *Behavior Modification*, 22, 128 - 142.
- Wildgruber, D., Ackermann, H., Kreifelts, B. & Ethofer, T. (2006). Cerebral processing of linguistic and emotional prosody: fMRI studies. *Progress in Brain Research*, 156, 249-268.
- Williams, L.M., Hermens, D.F., Palmer, D., Kohn, M., Clarke, S., Keage, H., Clark, C.R. & Gordon, E. (2008). Misinterpreting emotional expressions in Attention-Deficit Hyperactivity Disorder: evidence for a neural marker and stimulant effects. *Biological Psychiatry*.
- Wolańczyk, T. & Pisula, A. (2005). Zespół nadpobudliwości psychoruchowej. In: T. Wolańczyk & J. Komender (eds.), *Zaburzenia emocjonalne i behawioralne u dzieci* (pp. 215-237). Warszawa: PZWL.
- World Health Organization (1992). *The ICD-10 classification of mental and behavioral disorders: diagnostic criteria for research*. Geneva: Authors.

Address for Correspondence:

Dr. Ewa Czaplewska

Department of Speech Therapy, University of Gdansk

ul. Wita Stwosza 58, 80-952 Gdańsk, Poland. e-mail: logec@univ.gda.pl

Received: 4 June 2008

Accepted: 28 November 2008