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THE EMOTIONAL INTELLIGENCE AND EMOTIONAL RESPONSIVENESS IN CHILDREN WITH DIFFERENT LATERAL PREFERENCES

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Abstract

The purpose of this study – to examine the particularities of emotional intelligence (EI) and emotional responsiveness in 7-8-year-old children who have diverse manifestations of lateral preferences. 150 primary schoolchildren were surveyed (86 boys and 64 girls). To describe a laterality, the probe set most frequently encountered in the literature was used. To describe EI the Nguen procedure to assess a child's emotional intelligence was used. To assess heart rate variability, the OMEGA-M Software and Hardware Package was employed. To elicit emotional responses in the children, a questionnaire aimed at evoking a child's description of how they perceive the methods of punishment and reward in their family was used. The highest values for the level of EI were detected in children with a right type of profile, and the lowest in children with a left profile. It was found that the more right attributes a child has, the higher the values for EI. It was established that EI is a regulation parameter of the internal emotional state. It was found that in 7-8-year-old children, the higher the level of all the parameters of EI that were investigated, the more effective the autonomic regulation of the heart rate in the course of recalling situations of reward and punishment. The parameter of emotional intelligence can be used to forecast how effective a child will be in an emotional situation and how successful the vegetative support of his emotional behaviour will be.

Keywords: Emotional intelligence, laterality, emotional responsiveness, children, profile of sensorimotor asymmetry.

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1. Introduction

Emotional intelligence allows a person to assess one's own and others' emotions and also to control one's own emotional behaviour (Goleman, 1998). It is therefore assumed that a high level of emotional intelligence should correspond to low parameters for changes in the sympathetic nervous system in emotional situations.

2. Problem Statement

It is known that the developmental level of emotional intelligence varies among adults. In fact, it differs in people with different lateral preferences: it is higher in those who have more right parameters in the sensorimotor spheres (Nikolaeva & Borisenkova, 2009).

There is also an extremely wide range of variation in emotional responsiveness, and, to a significant degree, it is genetically determined (Bless et al., 2015; Vergunov et al., 2018), in particular by the nature of the lateral preference. It is known that in adult trial subjects the intensity of emotional responses correlates to an increase in the number of left parameters in the sensorimotor spheres (Nikolaeva et al., 1993; 1995).

A preference for the left or right side in the sensorimotor spheres is described as a profile of sensorimotor asymmetry. It has been proven that people with a left profile adapt more readily to a natural environment, while those with a right profile find it easier to adjust to a social environment (Nikolaeva, 2015). Applying themselves more effectively under pressure, people with a right profile are more likely to suffer from cardiovascular disease (Nikolaeva et al., 1993). But there is evidence that stressful conditions in left-handers are more apt to cause neurotic reactions (Goldberg et al., 2013).

There are, however, no findings for children, and it is not known how early the links between lateral preferences and emotional responsiveness emerge, likewise between emotional intelligence and emotional responsiveness. The presence of such correlations is important for first-graders, who need to adapt to school, and the effectiveness of their adaptation will determine the effectiveness of their education (Mavroveli & Sanchez-Ruiz, 2011).

According to a hypothesis that explains the differences in the reactions of the cardiovascular system to stress, people with a left profile have two centres of vegetative regulation, one in the left and another in the right hemisphere of the brain, while people with a right profile have only one, located in the right hemisphere. In this case, when a person is under stress or involved in the process of adaptation, the activated right hemisphere, which is presently thought to be responsible for the adaptive processes in the body, puts an additional burden on the right-brain centre of vegetative regulation, which leads to a greater likelihood of cardiovascular disorders (Nikolaeva & Leutin, 2011).

Recent research into the psycho-physiological mechanisms of emotional regulation is extremely contradictory, due to the complexity of emotional phenomena themselves and also to the diversity of the methodological approaches to their analysis (Nikolaeva & Leutin, 2011). The most valid method of assessing a person's emotional sphere is a description of their heart rate variability (Myrtek, 2004), which is the collaborative effect of different levels of hierarchical regulation on a person's cardiac function. This regulation includes multi-faceted, nonlinear, intra-layer and inter-layer, forward and backward links (Foster et al., 2011; Kang et al., 2015). The multileveled nature of the regulation makes it possible to use

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heart rate variability as the key parameter of a person's adaptation to complex, predominantly emotional, conditions, and to discover the particular characteristics of the basic influence connected with a person's emotional activity, both conscious and unconscious. An analysis of the heart rate variability in transitional conditions, when the inclusion of different levels of regulation, above all those connected with emotional pain, is most noticeable, produces the maximum effect (Brauer &Smith, 2015).

3. Research Questions

How is the mechanism that controls behaviour formed? And does it function in children, or is the connection between emotional intelligence and control over emotional responses something that gradually emerges in proportion to the maturing of cognitive control?

4. Purpose of the Study

All of these considerations determined the purpose of this study – to examine the particularities of emotional intelligence and emotional responsiveness in 7-8-year-old children who have diverse manifestations of lateral preferences.

5. Research Methods

The following procedures were used to carry out our purpose.

To describe handedness and functional sensorimotor asymmetry profiles (FSMA), the probe set most frequently encountered in the literature was used (Nikolaeva & Borisenkova, 2009); it includes elicitation of handedness, footedness, eyeness, earness and the aggregate parameter – FSMA.

To describe emotional intelligence (EI) in the children, the Nguen procedure to assess a child's emotional intelligence (Nguen, 2008) was used. To assess heart rate variability, the OMEGA-M Software and Hardware Package, developed by the Dinamika Biomedical Research Centre, was employed. To elicit emotional responses in the children, a questionnaire aimed at evoking a child's description of how they perceive the methods of punishment and reward in their family was used (Nikolaeva & Merenkova, 2017).

Investigation of the trial subjects was conducted on the premises of a public school. First- and second-graders took part in the study, and they were 7-8 years of age.

In all, 150 primary schoolchildren were surveyed. Of these, 86 were boys (the mean age was 7.27±0.45), and 64 were girls (the mean age was 7.19±0.39). The children all obtained parental permission to take part in the study.

To record their heart rates, electrodes were laid over the children's wrists. All of them were seated and at rest.

To assess heart rate variability, 300 RR intervals were recorded three times. The first recording was done with the child at rest; the second, after the child has recalled a situation in their family involving reward; and the third, after they have recalled a situation associated with punishment.

To analyze the findings, the SPSS Statistics program was used.

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6. Findings

6.1. A breakdown of the children according to their handedness and profiles

Assessment of the lateral parameters in the sensorimotor spheres made it possible to classify the children according to their FSMA profile and their handedness (Table 1).

Table 01. A breakdown of the children according to their handedness and profiles (%)

Profile of FSMA		
left	**mixed**	**Right**
22.0	30.7	47.3
Handedness		
Left	**Mixed**	**Right**
23.3	45.3	31.3

It can be seen in the table that the analysis set is typical for this region, where children with mixed handedness are more frequently encountered and where left-handers account for one-fifth of all children. More often than not, however, right profiles can be noted, i.e., when all of the parameters in the sensorimotor sphere are taken together, it is related to the right side.

6.2. The Specifics of Emotional Intelligence in 7-8-Year-Old Children

Next, an analysis of the emotional intelligence (EI) in children with diverse profiles was carried out.

Table 02. The EI level in children with diverse profiles (mean and standard deviation, scores)

FSMA profiles		
left	**mixed**	**Right**
0.73±0.67	1.00±0.76	1.46±0.69$^{\bullet\bullet}$**

Notes: $^{\bullet\bullet}$- differences between children with right ad mixed profiles, p≤0,01 (Students test); ** - differences between children with right and left profiles, p≤0.01.

It was clear that the EI level was much more highly developed in children with a right profile than in those who were found to have a mixed or left profile. This was confirmed by a regression analysis, whereby the influence of the independent variable – the FSMA profile – on the dependent variable – EI – in 7-8-year-old children was considerable, when p=0.000, R=0.394, R^2=0.155, β=0.683.

Since it was a linear regression analysis that was carried out, R corresponds to the correlation coefficient, R^2 is the the percentage of variance of the dependent variable, explained by a change in the independent variable and p is the level of significance. A positive linear regression coefficient proves that the more pronounced the right attributes, the higher a child's EI level.

Table 03. The influence of the parameters of the FSMA profile on the EI level in children

Independent variable	**R**	**R^2**	**P**
leading ear	0.377	0.142	0,000
leading eye	0.272	0.074	0,001

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It was found that the independent variables the "leading ear" ($R=0.377$ $R^2=0.142$, $p=0.000$) and the "leading eye" ($R=0.272$, $R^2=0.074$, $p=0.001$) have an influence on the dependent variable EI. A positive linear regression coefficient for these parameters shows that the more right attributes a child has, the higher their EI level.

It is worth emphasizing that an influence on EI was detected only for lateral parameters related to the sensory, and not the motor, sphere.

It can be assumed that the link between EI intensity parameters of lateral attributes in the sensory sphere can be accounted for by the more precise description of inflowing information. Moreover, EI is associated to a greater extent with the activity of the left, and not the right, hemisphere. And a leading right ear is possibly associated to a greater extent with the speech centre.

The distinct role played by the sensory and motor parameters of the FSMA profile in assessing a person's psychological characteristics is frequently underscored in the works of Bezrukhich, 2003.

It is fair to assume that the differences in the EI levels of children with diverse lateral preferences in the sensory sphere can be explained by the different rates at which the brain structures mature in children with lateral attributes of differing intensities. The most accepted theory explaining the presence of lateral preferences is considered to be that which associates left-handedness with slower myelogenesis, above all in the structures of the left hemisphere (Goldberg, 2013).

6.3. The Connection Between Emotional Intelligence and the Specifics of Heart Rate Variability in Children

The next step in the study was to examine the correlation between the parameters of heart rate variability and the components of EI in the children.

Emotional responsiveness is a causal phenomenon, a response of the individual and their past apperceptive experience in its entirety, including both physiological and psychical levels of control and regulation related to all of the substructures and aspects of the personality (Christou-Champi, Farrow & Webb, 2014). For this reason, we believe it possible to single out EI as a freestanding parameter reflecting the ability of the individual to regulate their own emotional state.

It seemed essential to assess whether or not EI has an effect on a child's response in an emotional situation. The answer to this question is not only of practical but also theoretical importance. If EI does have an effect on a child's ability to respond in an emotional situation, then it can be supposed that it is an independent construct, the development of which actually leads to intelligent control of their state. If there is no such evidence, then it can be supposed that singling out EI as an independent parameter is unfounded.

The particularities of central regulation of the heart rate can be described to the fullest extent in transitional and in emotional states. To lead a child into an emotional state, they were asked questions from Nikolaeva's questionnaire, aimed at inducing them to describe the methods of punishment and reward that are used in their family (Nikolaeva, 2006). It was not of concern in this study to come up with a real picture of parents' pedagogical impact on their children, since both parents and children tend to describe these emotional situations in a way that distorts them, but to create an emotional backdrop with different valences without traumatizing a child. As a matter of fact, children from well-to-do

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families took part in the study, and, as the children's responses confirmed, corporal punishment was not used.

It emerged that the consolidated parameter of EI is unrelated to the parameters of heart rate variability. Certain of its components, however, are related in a significant way.

Low heart rate frequencies (LF) reflect a sympathetic effect on the heart rate. Apparently, in children with a high level of EI a change in the inclusion of the sympathetic nervous system can be observed during regulation of the heart rate: when they are recalling moments of reward, the intensity of sympathetic control decreases, and when they are recollecting moments of punishment, it increases. In children with a low level of EI, we see the reverse picture. When they are thinking back to moments of reward, the intensity of sympathetic control rises, and when they are remembering moments of punishment, it falls.

Table 04. LF in 3 experimental situations in children with different EI (mean and standard deviation)

Parameter		**Levels of EI**		
		low	**Middle**	**high**
Low frequency ритма (LF), ms^2	0	1595.60±1625.67	1737.87±2157.24	2085.23±2498.20
	+	2052.48±2448.88	1558.79±1671.42	1820.11±1805.61
	-	1398.36±1199.16*	1661.66±1473.79	2196.59±2144.70

Notes: 0- background record, «+» - recalling moments of reward, «-» - recalling moments of punishments; *- differences between children with high and low EI, $p \leq 0.05$; ** - $p \leq 0.01$.

It is possible to conjecture that a high level of EI allows a child to make a more precise assessment of their emotional situation and therefore to be more discriminating in their response. It is possible, or course, to challenge this claim, since in families of children found to have a low level of EI, the methods of punishment and reward are different than in those where children have a high value for this parameter. In their stories about rewards and punishment, however, the children told about situations that were typical of that age. In instances when they were being rewarded, they were spoken to in a pleasant manner, caressed or given presents. In instances when they were being punished, they were usually deprived of something desirable. We did not find any differences in the disciplinary approaches between the groups.

What is more, the knowledge that a low EI is manifested in children with pronounced left-sided preferences in the sensory sphere, combined with data on less discriminating responses to emotional situations in children with a low EI, regardless of the lateral parameters, favors to a greater extent the hypothesis promoting the psychophysiological peculiarities of these children. If we take into account the current view that the intensity of left attributes is due to slower maturation of the brain structures, above all in the left hemisphere, then it can be assumed that a lower EI is a temporary development having to do with the specifics of how the brain matures. And a child's EI is indeed associated with their understanding of emotional events and control over their own emotions, since children with a higher EI respond more precisely to changes in an emotional situation.

These data are consistent with earlier results, according to which, when valid methods of punishment and reward are used, and when 7-8-year-old children are recalling situations of punishment, there is an increase in sympathetic activation (Nikolaeva, 2006).

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Consequently, our findings attest to the significance of EI in the regulation of emotional responses in the recall of emotional events. They confirm the value of EI as a parameter in the assessment of emotional situations and in the control of one's emotions.

6.4. The Connection Between Emotional Intelligence and the Specifics of Heart Rate Variability in Children

A regression analysis revealed the influence of the independent variable FSMA profile on LF ($p=0.000$, $R=0.166$, $R^2=0.028$).

Regulation of the heart rate has a hierarchical systems organization. A decrease in heart rate variability is non-specific relative to the means of forming the load (Bakhchina et al., 2014). Our findings are consistent with earlier evidence that in 7-8-year-old children, during regulation of the heart rate, there is intensification of the summary neurohumoral effects, the activity of the autonomous circuit of regulation, represented by HF and LF waves, increases, likewise the central circuit, which is measured by analyzing the super slow-acting waves. Gradually, up to the age of 8, a decrease in the power of high-frequency waves and an increase in the power of low-frequency components of the spectrum can be observed, which indicates a decrease in the activity of the parasympathetic effect on the heart rate an enhancement of the role played by the central regulatory effects on heart function. In addition, a shift in the vegetative balance, toward a strengthening of the sympathetic effects on the heart rate, can be detected, and this corresponds to data for high activity of the sympathetic branch in regulation of the heart rate in 8-year-old children (Christou-Champi, Farrow, Webb, 2014).

According to our findings, these changes are more pronounced in children with a right profile. It seems as if the maturation of an adult type of cardiovascular system response occurs earlier in them than in left-handed children. This corresponds to all other notions of left-handedness as an attribute that speeds up maturation of the nervous system (Goldberg, 2013).

7. Conclusion

Based on our findings, the following conclusions were made:

1. In a group of 7-8-year-old children, a right profile of sensorimotor asymmetry is more often encountered (47.3 percent), a mixed type of profile is found in 30.7 percent, and a left profile in 22 percent. Every fifth child in a sample selection is left-handed. There are no differences in profile and handedness between boys and girls. Our findings attest to a growth in the number of children with left attributes at the present time compared to figures from more than 20 years ago.

2. The highest values for the level of EI, and also for some of its components, were detected in children with a right type of profile, and the lowest in children with a left profile. It was found that the more right attributes a child has, the higher the values for EI.

3. It was established that EI is a regulation parameter of the internal emotional state. It was found that in 7-8-year-old children, the higher the level of all the parameters of EI that were investigated, the more effective the autonomic regulation of the heart rate in the course of recalling situations of reward and punishment. In children with a high level of EI, gradual changes in heart rate variability were observed, from background to a positively colored emotional state and then to a negatively colored state.

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4. In the 7-8-year-old children, in all three situations used in the experiment (quiet rest, conversation about methods of punishment and about methods of reward), changes in the parameters of the heart rate were manifested. When going from a state of rest to a state of emotional tension, the activity of the sympathetic branch of the vegetative nervous system on the heart rate rises. These changes are different in left- and right-handed children. Changes in the heart rate of left-handed children fall within the limits of their adaptive resources, while changes in the heart rate of right-handed children go beyond the limits of their resources, and the distribution of the RR interval is of a multimodal nature.

5. The parameter of EI can be used to forecast how effective a child will be in an emotional situation and how successful the vegetative support of his emotional behavior will be.

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