

Left-handedness preferences, functions and dependence on neurotic behavior limited by specific social dimensions

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Abstract

Studies show that 10 to 12 percent of the population in every culture worldwide is left-handed. Our main motivation was to seek general and specific knowledge of this lateral phenomena, left-handedness, mainly in terms of Psychology and Neuropsychology. We concentrated on lateral preference, function relations and investigation; their dependence on emotional lability, that is instability and possible dependency on personality characteristics. Chosen methods were strictly divided into two independent areas: lateral preferences and social characteristics of personality. For detection of lateral and preferential conditions the Test for Measuring Lateral Preferences and the Questionnaire of Social Perspectives were used. Neurotic symptoms were examined through Eysenck's Questionnaire B-JEPI, and for the more complex view and incidence of neuroticism the computerized form of Bourdon's Test was used, applied in the distraction conditions aimed at confirming, respectively the act of a disproving personality and social variables.

Introduction

The majority population of the planet is right-handed, which is commonly known as a right-oriented society. The existence of left-handedness dates back in the history. During the Stone Age people executed their tools both for the right as well as the left hand. Since the Bronze Age specifically differentiated tools have been found.

The above mentioned phenomenon can be the most markedly seen during the

process found in grapho-motoric habits or writing. Considering the fact that genotypic left-handed dispositions are not in accordance with right-sided tendencies of significant numbers of people, but the form of left-hand preference may be of pathological character as well. The first years of left-hand mentoring are probably becoming the most prominent ones, and in disorders such as dysgraphia, dyslexia, dyscalculia, they have wide etiology or cause of inception or

beginning to happen. It is known that the influence of non-crystallized left-hand lateral preference is not insignificant. Several empirical studies suggest have proven that left-handed children being strongly forced to a right-sided behavior and/or environment encounter higher incidences of neurotic symptoms.

Which hand is or will be used for writing? This problem of left-handed preference with an enhancing solution cannot be completed just by answering this question because the problem is considerably deeper; not just remaining within the preference of the upper limb arms and hands, but involving the entire body – respectively the twin body parts. The term pair functions can be understood as functions occurring in the body in pairs, and having the same functional focusing, generating quantitatively and with subtle differences qualitatively different activities. Mental functions arising under such pair-mating activities are therefore, in their core, having base-pair characteristics (I. Papousek, G. Schuller 2006). Lateral preference can be included among pair-based features. The unevenness of pair functions can be seen in Physiological and Psychological context (Smith 2007) which is expressed by relatively better performance of one of the paired organs in neuro-psychical regulation of behavior. It depends on which function is the leading one and which is the cooperative one (ocular dominance, footedness, handedness...). Every single individual has a part of the paired organ developed differently; i.e. a visual analyzer tends to be greater in its dimensionality than the other side: further one upper limb tends to be stronger; blood vessels in one hand are more branched than in the second hand; similarly, we can talk about facial mimic muscles.

During 1960s and 1970s there was significantly increased work done on laterality. One of the most important monographs

in Czechoslovakia was M. Sovák's research entitled *Laterality As A Pedagogical Problem* (1962) with summarized findings of earlier perception of laterality derived from observations in Psychology, Anthropology, Science and Medicine and further compared with classical concepts of left-handedness. According to M. Sovák, the 1960s, 15% of non-practiced genotypic left-handers and 85% of phenotypic right-handers were found; 50% were inborn and 35% were left-handers but genotypically practiced as righties.

Various recent global statistics record the left-handed population at about 10%. In 2007, Scientists identified LRRTM1; a gene whose occurrence increases likelihood of left-handedness; however, inheritance of lateral preference remains questionable. S. Ekaldi (1999) points out that if both parents are with left hand dominance, they give their child a chance also to be left-handed (about 26%). Concerning that, it should be pointed out that the right-handed environment is appropriate for any level of right-handedness. Inborn right-handedness is supported from early childhood by education and personal development. On the contrary, we distinguish between natural (or genetic) left-handers and taught left-handers, identified by Giannini (1984) on the basis of right hemisphere preference related to speech and language. The trained left-handers usually write with their left hand (usually poorly) and have dual hemispheric activation with tasks aimed at speaking verbal processes.

Research, Methods, Results

Professor D. Kováč, from the Institute of Experimental Psychology of the Slovak Academy of Sciences, created a team of Slovak Experimental Researchers G. Horkovič, I. Ruisel, K. Jariabková, L. Arbeit J. Stempelová, I. Brezina etc., and Czech collaborators – experts, headed by A. Kučera

and M. Sovák, who devoted more than ten years of research to left-handed preference. However, this lateral preference is not well understood in society due to social and other problems. That is the reason we want to follow the experiments launched by D. Kováč and G. Horkovič where their starting point was a construction of a Questionnaire based on their evident experience and furthermore individual awareness of several lateral-preference issues where individuals know about them and are able to talk about them. There is no doubt that lateral preferences are manifested not only in real life performance, but also in the experiential realm, and therefore can be further explored based on own personal statements about it.

We collected and processed data using a combination of M.B. Denckla's (1998) Neuro-motor Test for Children (6-15 years) and D. Kováč and G. Horkovič's (1969) Test on Orientation of Individual and Overall Lateral Preference. Next the revised version of the B-JEPI Personality Questionnaire of the Eysenck Questionnaire E.P.Q Junior (HJ Eysenck, Eysenck JGB, arr. J. Senka 1994) and the Bourdon BOPR Test computer program made on the basis of the original Test were used. During the BHD testing respondents had to record two different sounds (250 Hz and 650Hz) randomly applied from the speakers. The two mentioned Tests gave us data on possible neurotic behavior which recently can be recognized as a major conflict factor and can be applied on a reactive basis with various disposals and higher nerve activity.

The experimental sample was limited to the school-age period. Conflicts and arising neuroticism have more reasons to occur during this developmental period; mainly grouped in the school environment as a primary problem of this age. Part of the conflicts arise primarily between an Educator and a child especially if at least one of them is a less adaptable person. Quite often we

also encounter conflicts between a Teacher and a child that arise through a parent. Another conflict occurs through a reduced intellectual capacity level bound with school demands and a child's ability. The impact of a team, where a child directly belongs or is forced to go, plays an important role in conflict and subsequent neuroticism. Important dispositions for creating conflicts that lead to neurotic symptoms and to neurosis are bound with inappropriate education; general fatigue; behavioral dispositions (partial psychic infantilism); encephalopathy (especially perinatal) which are important and not to be forgotten. In response to these mentioned conflicts some neurotic symptoms occur: children process problems in different ways depending on the dimension of the conflict and the overall mental development of each individual (Ručková 2013)

If it was possible to see noticeable personal qualities of a child before, then they are strongly emphasized under the loading influence. Loading compensation in school age is bound with the so-called level of imagination and at the same time directly related to reality. M. Vágnerová (2000) says that with more complex cases under long-term stressful situations in the school environment come character deformations.

Our research cohort consisted of 578 respondents; 291 boys and 287 girls aged 10 to 15.5 years. Included were pupils of basic schools from 5th to 9th grade. The respondents were examined in twenty-five groups; each group keeping order for maintaining the tests and their administration (Ručková, 2013).

Measurement of Lateral Preferences – Side Preference Questionnaire (DSP)

Results from the DSP (the Questionnaire which is aimed at finding a general lateral preference, subjectively evaluated

by the individual) verify the general lateral preferential conditions of an individual in his or her organism, we decided to divide the Questionnaire score into three equal intervals, which gave us the following lateral-preferential groupings:

1st Group – group with the most significant lateral-preferential relations (VL-PV)

2nd Group – group with moderately significant lateral-preferential relations (SVL-PV)

3rd Group – group with the least-significant lateral-preferential relations (NVL-PV)

Lateral-preferential conditions are specifically manifested with boys and girls. It would be ineffective to analyze individual lateral-preference groups, regardless of sex. Therefore, we divided each group into sub-groups of boys and girls. (Table No.1)

The incidence of respondents after their division into different lateral-preference groups was:

Finally, we formed a separate group of lefthanders consisting of 34 students – 5.88% of the total respondents.

Totally, we can say that our experimental groups can be characterized by lateral-preference ratios, whilst the sub-groups will be characterized by sex and age.

The relationship of DSP Lateral reference Questionnaire to sex and age (age = grade) is in Graph No.1. The independent variable in this case is age from the fifth to the ninth grade of Elementary School (10 to 15.5 years). The dependent variables are the scores achieved in these grades. The achieved scores and appropriate deviations of the DSP Questionnaire are mentioned in Table No. 2.

As it is visible from Graph No.1, the clear-cut lateral-preference cases of boys and girls has an analogous development. The girl's curve has a higher overall score of the general lateral preference which indicates a higher degree of lateral-preference.

Table No. 1

| | 1st Group VL-PV | 2nd Group SVL-PV | 3rd Group NVL-PV |
|-------|---|---|---|
| Boys | 138-47.42% Of total amount of boys | 119-4.89% Of total amount of boys | 15-5.15% Of total amount of boys |
| Girls | 129-44.95% Of total amount of girls | 126-43.90% Of total amount of girls | 16-5.57% Of total amount of girls |
| Total | 267-46.19% Of total amount of respondents | 245-42.39% Of total amount of respondents | 32-5.53% Of total amount of respondents |

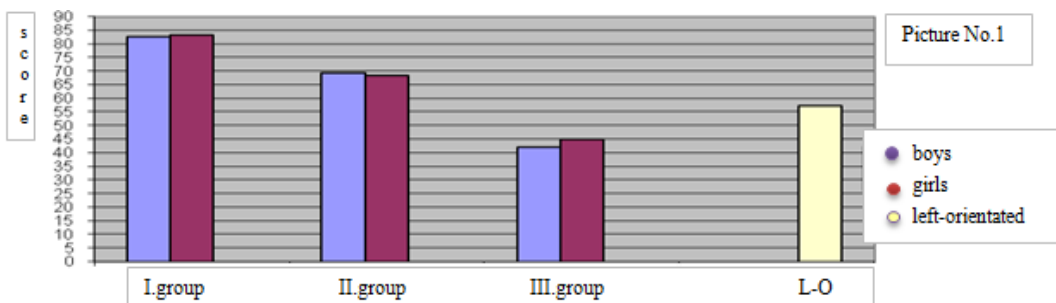
Table No.2

| | | V Grade | VI Grade | VII Grade | VIII Grade | IX Grade |
|--------------|----|----------------|-----------------|------------------|-------------------|-----------------|
| Boys | AM | 81.41 | 73.26 | 75.28 | 75.62 | 73.59 |
| | Ѓ | 13.5 | 14.79 | 9.75 | 9.77 | 9.21 |
| Girls | AM | 86.9 | 83.21 | 85.57 | 85.43 | 82.7 |
| | Ѓ | 11.83 | 15.18 | 15.88 | 15.29 | 13.87 |

Graph No. 1 The general lateral preference (DSP), depending on age and sex

Presented results come from the occurrence of DSP score in each of the lateral-preference groups. The average score of general lateral preference (measured by DSP Questionnaire) are based on subsets of boys and girls selection given in picture No.1.

Picture No. 1 DSP-Average value score in the individual lateral-preference groups



The cross-sex differences which are visible in the Graph strongly retain their size with each grade (only mitigating differences are in the fifth grade). Both with girls and with boys it is seen in a down-warding of the clear-cut of lateral preference. This finding must be taken from the aspect of general lateral-preference relations, because the DSP-Questionnaire has a more or less general lateral preference aim.

Considering that “n” respondents in the individual subgroups are not mentioned in the pictures we comment them in the text. In the first group, and with the most prominent lateral-preference relations, are 143 boys and 135 girls. In the second group with moderately well-defined lateral-preference relations are 24 boys and 131 girls. In the third group with the least-significant lateral preference relations are 15 boys and 17 girls.

Achieved scores as well as the standard deviations of DSP Questionnaire and the subgroups of boys and girls in each lateral-preference groups are mentioned in

It is not important to state much to the scores distribution of DSP-Questionnaire in each lateral-preference groups because it is artificially constructed. The average incidence of DSP- Questionnaire score is slightly higher in the subgroup of girls than in the boys subgroups. The exception creates the group with moderately significant lateral-preference relations. The cross-sex differences cannot be mentioned at all (Table No. 4). Highly distinctive differences are seen in the inter-group relations. It is not important to add any comment to

this data as we mentioned earlier that the lateral-preference groups were built precisely according to the traced reference score of DSP Questionnaire.

Table No.3

| | | I Group | II Group | III Group | Left-oriented | |
|-------|----|---------|----------|-----------|---------------|-------|
| | | | | | AM | B |
| Boys | AM | 82.68 | 69.52 | 42.01 | 57.35 | 17.65 |
| | B | 4.87 | 5.72 | 8.29 | | |
| Girls | AM | 83.1 | 68.46 | 45.03 | | |
| | B | 4.68 | 6.64 | 6.63 | | |

| | B I Group | B II Group | B III Group | G I Group | G II Group | GIII Group |
|-------------|------------|------------|-------------|------------|------------|------------|
| B I Group | – | 19.375*** | 33.023*** | 0.513 | – | – |
| B II Group | -19.375*** | – | 20.084*** | – | 0.859 | – |
| B III Group | -33.023*** | -20.084*** | – | – | – | 0.467 |
| G I Group | -0.513 | – | – | – | 22.542*** | 29.269*** |
| G II Group | – | -0.859 | – | 22.524*** | – | 16.458*** |
| G III Group | – | – | -0.467 | -29.269*** | -16.458*** | – |

Neurotic Symptoms Measurement B-JEPI

As was already mentioned, the lateral preference conditions affect the personal characteristics of an individual. We would like to deal in the following pages with the results of neuroticism, as one of the personal characteristics, its curves and dependence on age and relationship of neuroticism to the lateral-preference ratio.

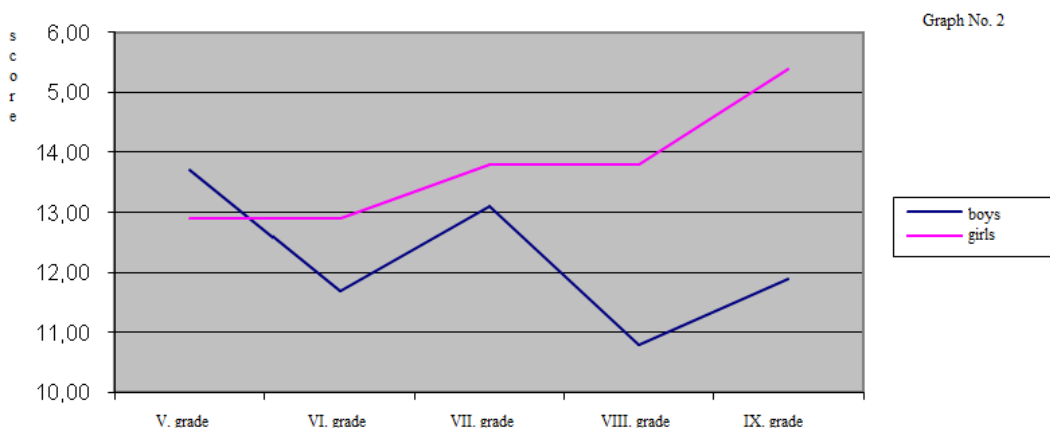
Relevant neuroticism score and its standard deviation can be seen in **Table No.5**.

Graph No.2 shows neuroticism dependence by sex and age of examined samples.

This graph visualizes the extensive sex differences. Development of the neurotic average score, connected with age has the so called scissor character that means that the average incidence of neurotic score with girls increases significantly with age, on the contrary with boys it decreases. This finding could be possibly justified by the statement that the requirements and demands on the child are generally increasing with age. Boys are more adjustable; the loading does

| | | V grade | VI grade | VII grade | VIII grade | IX grade |
|-------|----|---------|----------|-----------|------------|----------|
| Boys | AM | 13.70 | 11.70 | 13.10 | 10.80 | 11.90 |
| | Б | 4.02 | 4.03 | 3.92 | 3.83 | 4.16 |
| Girls | AM | 12.90 | 12.90 | 13.80 | 13.80 | 15.40 |
| | Б | 3.82 | 3.96 | 3.96 | 3.90 | 3.48 |

Graph No.2 shows neuroticism dependence by sex and age of examined samples.



not play such a role as for girls who are able to cope with the requirements, but the outcome can be marked by neuroticism.

Remarkable results were gained in the analysis of neurotic symptoms and their occurrence in each lateral-preference groups.

Picture No. 2 shows the average neurotic scores of age subsets of boys and girls from the examined sample. Relevant neuroticism score of a particular group of boys or girls is shown in the picture as well as in Table No. 6.

and disadvantaged, and even in that case, when they are not adapting they remain the extreme cases for the rest of population.

Further as it is seen from the picture, differences between subgroups of boys and girls in individual lateral-preference groups are important (Matrix t-distribution neuroticism Table No.7). Less important (at the border with meaning importance) are only differences in less-defined lateral-preference cases (Third Group). Regarding the

Picture No. 2 Neuroticism – average score in individual lateral preference groups

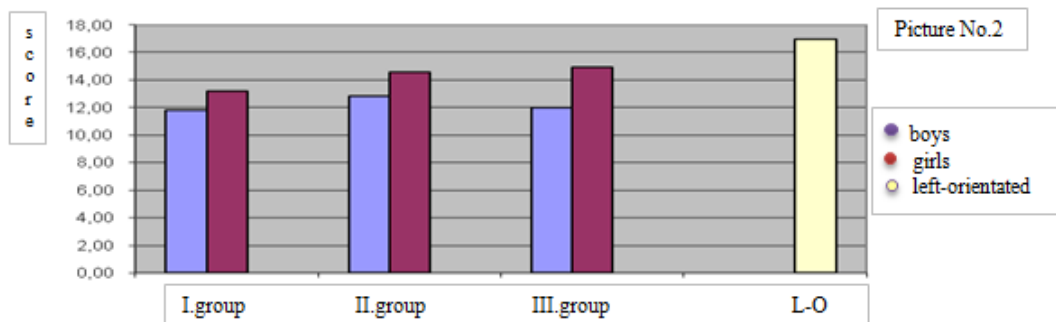


Table No. 6

| | | I. group | II. group | III. group | Left-oriented | |
|-------|----|----------|-----------|------------|---------------|------|
| | | | | | AM | B |
| boys | AM | 11,84 | 12,84 | 12,00 | 17,00 | 2,48 |
| | B | 4,25 | 4,37 | 4,64 | | |
| girls | AM | 13,17 | 14,58 | 14,94 | | |
| | B | 4,89 | 4,12 | 4,16 | | |

The picture shows, that the group with the highest well-defined lateral-preference relations (Group 1) scores with low levels of neuroticism.

Left-oriented respondents, as an independent group gain the highest average scores for neuroticism. This fact is probably bound with the influence of the right-hand oriented environment that handicaps left-oriented individuals to such an extent that they are marked by neurotic symptoms. Considering the fact that they are forced to adapt it is assumed that they are frustrated

cross-group differences, important is the occurrence between groups with high and medium significantly prominent lateral-preferential relations.

The left-oriented group have not undergone the t-test because it is a less numerous group and it is rather than orientation in comparison with the other lateral-preference groups. Distinctions of left-oriented compared with the other groups is expected from Picture No 2 which expresses the occurrence of neuroticism in the groups who achieved high scores and with relatively

Table No. 7

| | B I Group | B II Group | B III Group | G I Group | G II Group | G III Group |
|-------------|-----------|------------|-------------|-----------|------------|-------------|
| B I Group | – | 2,070* | 0,268 | 2,738** | – | – |
| B II Group | -2,070* | – | 0,914 | – | 2,953** | – |
| B III Group | -0,268 | -0,914 | – | – | – | 2,101* |
| G I Group | -2,738** | – | – | – | 2,191* | 1,363 |
| G II Group | – | -2,953** | – | -2,191* | – | 0,420 |
| G III Group | – | – | -2,101* | -1,363 | -0,420 | – |

low standard deviations. (Table No 6).

Based on further results during the correlation matrixes analysis we present boys and girls subgroups with the highest well-defined lateral-preference relations in the group with moderately well-defined lateral-preference relations and the important positive correlation between neuroticism and the load tolerance. Furthermore, also was found ($p < 0.05$) a positive correlation between neuroticism and anxiety which is on the border of importance. The group with the least-significant lateral preference relations (III group) stands independently. The boys from this group gain important positive correlation of neuroticism with anxiety ($p < 0.05$). In the subgroup of girls there is not an important correlation relation with anxiety while there is positive correlation only with the grade.

BDN – Bourdon test

We involved the second diagnostic sensitive test for neuroticism – Bourdon Test – into our experiment for concentration and burden. We do not state our assumption that the test will be diagnostically sensitive to neuroticism to such an extent that it will become its specific indicator. The differences between the Test and re-Test will try to find out more about the loading tolerance as one of the primary forms of neurotic symptoms. The Graph No. 3 shows dependence of the Bourdon Test Score (loading tolerance) by age and sex of the selected sample. The score of independent variables gained in this test are given in Table No.8 together with the respective standard deviations.

As it is seen from the graph both boys and girls have generally increasing score

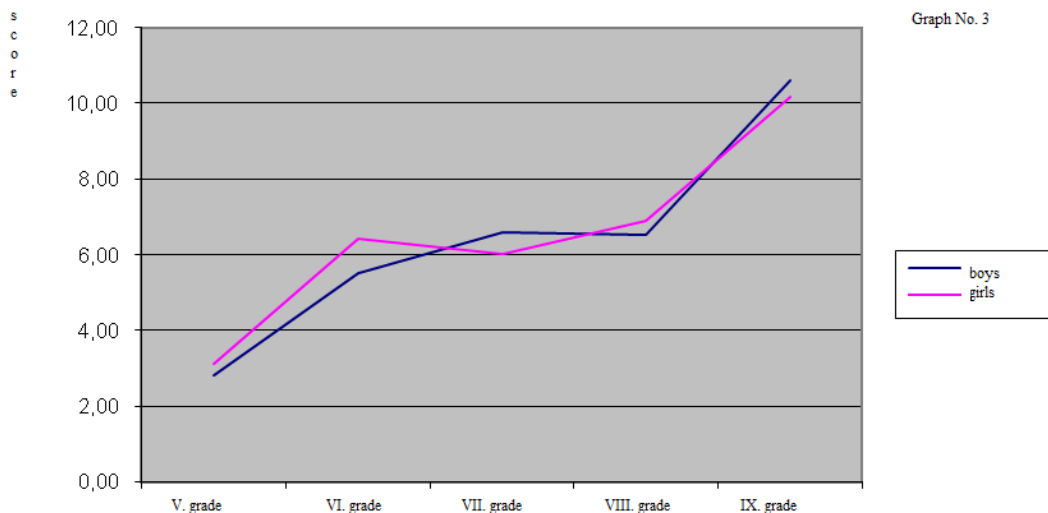
Graph No. 3 Tolerance to burden dependet in sex and age

Table No. 8

| | | V Grade | VI Grade | VII Grade | VIII Grade | IX Grade |
|-------|----|---------|----------|-----------|------------|----------|
| Boys | AM | 2.83 | 5.53 | 6.61 | 6.54 | 10.62 |
| | Б | 1.32 | 2.36 | 2.64 | 2.52 | 3.47 |
| Girls | AM | 3.11 | 6.41 | 6.00 | 6.91 | 10.17 |
| | Б | 1.08 | 3.21 | 2.71 | 2.73 | 4.11 |

Table No. 9

| | | I Group | II Group | III Group | Left-oriented | |
|-------|----|---------|----------|-----------|---------------|-------|
| | | | | | AM | Б |
| Boys | AM | 22.61 | 22.47 | 21.24 | 28.08 | 10.75 |
| | Б | 8.63 | 8.49 | 7.61 | | |
| Girls | AM | 22.60 | 24.47 | 24.82 | | |
| | Б | 8.48 | 8.71 | 8.40 | | |

characteristics of load tolerance. Both sexes score in this test without major cross-sex differences and almost with the same trend. Some cross-sex differences occur between the sixth and seventh grades when the girls score decreases so that in the seventh grade it is slightly lower than with boys scores. From the seventh to eighth grade the score falls just with boys while the girls' score rises until the ninth grade. After the eighth grade the boys load tolerance continue with rising characteristic which was kept up till the seventh grade.

It is visible that the girls have an analogous course of load tolerance changing with age development of neuroticism level. With boys the load tolerance decreases with the stage of lateral-preference groups. From the findings we can assume that the sensitivity of this test to neurotic symptoms is greater with girls.

It should be also noted that important cross-sex and cross-group differences are not present in the whole sample (matrix t-distribution of the load tolerance, Table No.10).

Similarly as with neuroticism the most important load tolerance score is gained by

left-oriented individuals. Connected with them, it is important to mention relatively high standard deviations, however these occur at the examined personality traits with the other groups, too.

Furthermore, in the experiment we evaluated the correlation matrices of individual lateral-preference groups. We provide the results as illustration. In the first group (with significant lateral-preference relations) with subset girls as well as with subset boys we report expected positive correlations to the load tolerance and also positively important correlations with neuroticism and anxiety ($p < 0.01$). In the boys subgroup with moderately-defined lateral-preference relations the load tolerance gains positively important correlations with neuroticism and anxiety. In this group it is also important to mention a significantly negative relationship with extraversion ($p < 0.05$). In the second lateral-preference subset girls the load tolerance correlates positively with neuroticism and the grade as the age representative ($p < 0,01$). In the third group (the least-defined lateral-preference relations) were not found any important correlation.

Picture No. 3 is the average score load tolerance measured by the Bourdon Test with the subsets of boys and girls of the examined sample. Individual Test Scores are together with the standard deviations mentioned in Table No.9.

Picture No. 3 Load tolerance average score in individual lateral preference groups

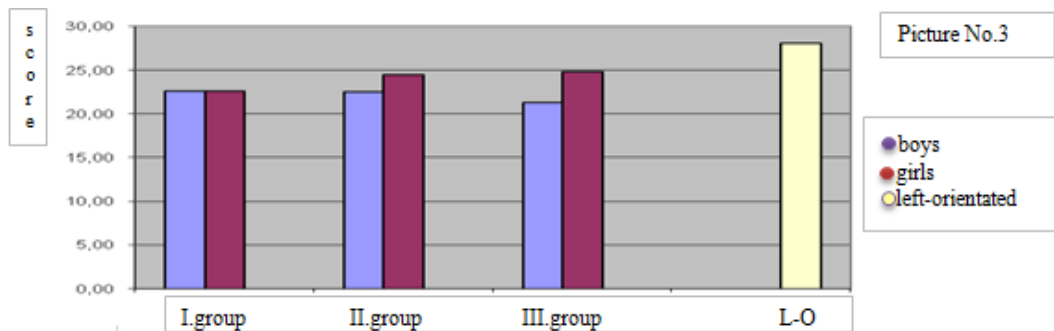


Table No. 10

| | B I Group | B II Group | B III Group | G I Group | G II Group | G III Group |
|-------------|-----------|------------|-------------|-----------|------------|-------------|
| B I Group | - | 0.095 | 0.653 | 0.270 | - | - |
| B II Group | -0.095 | - | 0.730 | - | 1.734 | - |
| B III Group | -0.53 | -0.730 | - | - | - | 1.443 |
| G I Group | -0.270 | - | - | - | 1.607 | 0.923 |
| G II Group | - | -1.734 | - | -1.607 | - | 0.152 |
| G III Group | - | - | -1.443 | -0.923 | -0.152 | - |

Conclusion

One of the main assumptions which was verified by our work was that the right-oriented civilization condition the neurotic symptoms with generally left-oriented individuals and it becomes sub-optimal for them. Based on contemporary knowledge of genetics there are more individuals of this type than in the phenotypic manifestation. D. Kováč, G. Horkovič (1967) as well as Bishop (1990) state that the prevalence of genotypic left-handedness was very slowly created during the development of mankind, while the right-sided civilization developed rapidly and almost exclusively. The following results can deduced from our social inquiry: Allow optimal conditions for development of left-handed individuals and lateral-preference orientation.

These conditions should be related not only to school education (acquiring writing habits) but also in daily activities of the children. Here appeals can be made to Industrial and Engineering Psychologists to take the lateral-preference of the clear-cut staff into account. As we found out, these results cannot just be applied to 5-12% of left-handed population, but, they also concern other common people in many varying degrees with not clear lateral-preference. We can say, these not clear individuals with certain personality characteristics are more disadvantaged than left-oriented individuals. In our opinion this reality comes from the fact that these people have no clear lateral-preference neither expressly left-oriented nor optimally right-oriented, which means that they have no sufficiently strong

personality profile of their lateral preference which is obviously necessary for over-bridging disadvantageous positions. These facts suggest that it is necessary to pay as much attention to the individuals with weak lateral-preferences as to the left-oriented although it can be expected that their number may decrease with age. Lateral issue relates to a broader range of Professionals, especially Psychologists, Psychiatrists, Neurologists and Defectologists. It is a multi-disciplined problem so insisting on one apparent scientific approach to the problem can lead to failure and error. The results of our work are therefore only a small contribution to examination and detection of optimal lateral-preference relations of an individual in society.

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