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STUDY OF INHERITANCE NATURE OF MOTOR AND SPATIAL VISUALIZATOIN ABILITIES IN THE FAMILIES INHABITING IN VARIOUS REGIONS OF THE REPUBLIC OF ARMENIA

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Evaluation of the role of genetic factors in the inheritance and the explanation of the inheritance patterns of above mentioned abilities become important connected with learning objectives. This paper refers the patterns of inheritance of motor and spatial visualization abilities. Test systems for the assessment of spatial visualization and motor abilities were studied by us attempting to figure out the patterns of inheritance of above mentioned abilities by implementation of spatial visualization and motor ability tests.

***Keywords*:** spatial visualization abilities, motor abilities.

Introduction. The sex differences in spatial visualization abilities are traditionally related to sexual division of labor (hunting, gathering) or ability to cross new areas by men and its consequences [1–3]. In order to confirm the mentioned above hypothesis, parallels are drawn from the works related to the studies on spatial visualization abilities of ferrets and their behavior [4]. According to R. Stafford, spatial abilities are transmitted from mother to daughter, but can never be transmitted from father to son [5]. In accordance with Goodenough and co-authors, there are different indicators of spatial abilities which are distinct according to their mode of inheritance [6].

In connection with learning objectives, the evaluation of the role of genetic factors in the inheritance and the explanation of the inheritance patterns of above mentioned abilities become important. Test systems for the assessment of spatial visualization and motor abilities were studied by us [7–10] and an attempt was made to figure out the patterns of inheritance of above mentioned abilities by the implementation of spatial visualization ability tests. In spite of having such a small number of data it is evident that visualization spatial abilities are linked to sex.

Experimental Part. In order to figure out the patterns of inheritance of spatial visualization abilities test systems designed for determination of visualization spatial and motor abilities of deifferent age groups were studied. Based upon the mentioned above test systems the spatial visualization abilities evaluation and motor abilities evaluation typing tests consist of 50 items and proposed for the age group older than 16 were chosen, corrected and completed. For the estimation of

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spatial visualization and motor abilities, families with children older than 16 and parents younger then 60, inhabiting in various regions of RA were tested.

The following hypotheses related to the patterns of spatial visualiztion ability were verified:

1) the scores calculated for the daughters' spatial visualization abilities are closer to the scores calculated for the fathers' abilities;

2) the scores calculated for the sons' spatial visualization abilities are closer to the scores calculated for the mothers' abilities;

3) the scores of children's spatial visualization abilities have no relation with the scores of parents' the same abilities;

4) the children's spatial visualization abilities are inherited through maternal line.

An attempt was made to study the mode of inheritance for distinct groups (girls and their parents). The scores of mentioned above abilities of parental pair also were compared. For successful implementation proposed by us visualization spatial ability test the following features are necessary: attention-focusing, separation of the primary and ignoring the secondary, imagination and the ability to manipulate objects in space mentally. For each correctly resolved task designed for testing, 4 points are awarded, therefore, the total score for 50 correct answers will be 200 points within a time limit of 30 *min*. As it is shown in Fig. 1, test scores for members of different families lie within the interval 8–144.

From Fig. 1 and Tab. 1 it is apparent, that there is a certain relationship between mother–son and father–daughter indicators of spatial visualization abilities (the mean deviation was calculated).

Table 1

The spatial visualization ability scores for different members of families

Family	Spatial visualization ability scores				Mean of a data set, X	Mean squared deviation, s	Range of variation	Variation/ correlation coefficient, %
	mother	father	daughter	son				
1	40	36	34	44	38.5	4.434636	10	12
2	116	68	20	144	87	54.58938	124	63
3	32	28	28	52	35	11.48913	24	33
4	44	8	24	108	46	43.87862	100	95
5	28	28	24	24	26	2.308679	4	9
6	20	28	40	24	28	8.640602	20	31
7	24	32	44	24	31	9.451455	20	31
8	16	32	28	12	22	9.521554	20	43
9	20	124	52	20	54	49.04416	104	91

The mean squared deviation for small groups is calculated according to the formula: $s = \pm\sqrt{\frac{\sum (X_{mn} - X)^2}{n-1}}$, where s is the mean squared deviation, X_{mn} is the mean, n is the capacity of the group. The range of variation (the difference between the highest and the lowest values) and the coefficient of correlation are estimated by the $V = s / X_{mn}$ formula (it is considered, that if the value of the coefficient of variation is less than 33%, the group is homogeneous). In the case of comparison of the data of two studied groups it is possible to estimate the reliability of the group mean difference scores (which is known as Student t-distribution). The Student's

t_d (t-distribution) is calculated using the formula $t_d = X_{mn_1} – X_{mn_2}$, where $X_{mn_1} – X_{mn_2}$ is the group mean difference. The difference can be considered reliable, if t_d (factual) < t_d (table), t_d =1.98.

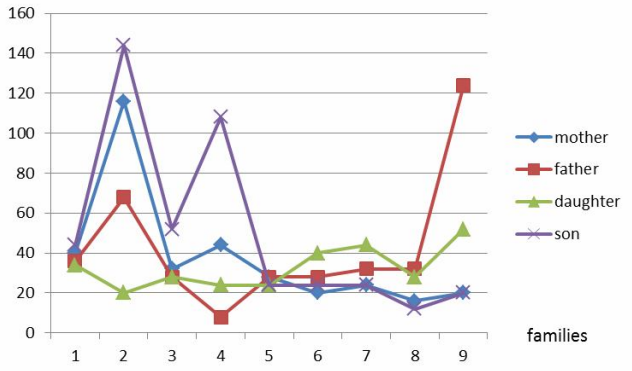

Fig. 1. Test scores for the different members of families.

No correlation is observed between the spatial visualization abilities of family spouses, which is presented in Fig. 2.

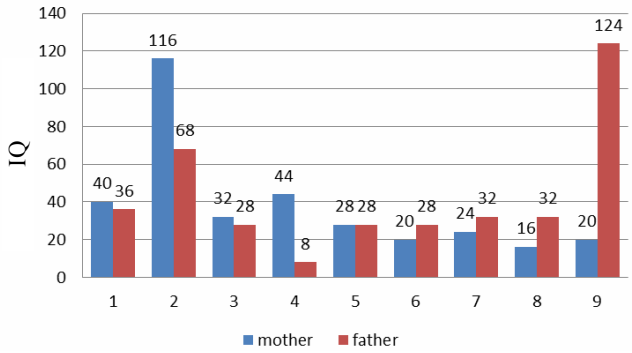

Fig. 2. Values of spatial visualization abilities of parents.

Table 2

The comparison of daughter-mother and daughter-father motor abilities

	Daughter			Mother			Father		
	A*	B	C	A	B	C	A	B	C
Arithmetical mean, X	18.55	27.53	19.06	18.91	26.11	17.97	19.24	26.43	18.82
Mean squared deviation, s	7.71	6.29	6.1	6.28	6.77	6.14	8.4	8.24	6.99
Change coefficient, C_v, %	41.56	22.84	32	33.19	25.93	34.16	43.69	31.17	37.13
Arithmetical mean error, m_x	1.41	1.15	1.11	1.146	1.236	1.12	1.53	1.5	1.28
Student's distribution, t_d			0.33	0.33	0.33	0.692	0.33	0.59	0.14

* A is normal rate with the right hand; B is fast rate with the right hand; C is normal rate with the left hand.

One of the tests to identify the inheritance patterns is the typing test, which makes it possible to estimate the natural rate (which is normal for test participant)

and the highest speed of striking paper with a pencil (usually during the 10 *s*, diameter of circle is 8 *cm*).

Conclusion. Based on the results, we have come to the following conclusions:

1. The scores calculated for daughters' spatial visualization abilities are closer to the scores calculated for fathers' abilities.

2. The scores calculated for sons' spatial visualization abilities are closer to the scores calculated for mothers' abilities (variation coefficient is 33–95%).

3. The scores of children's spatial visualization abilities are related to the scores of parents's the same abilities and inherited linked to *x*-chromosome.

4. The speed values estimated for parents' motor abilities are insignificantly different from t_d=1.98, however, there is no observed correlation between the values of mentioned abilities of family spouses.

5. The study group of motor abilities consists of daughters however the scores estimated for their motor abilities are not significantly different from the scores estimated for parents' motor abilities (Tab. 2).

The discussed above interpersonal defferences between certain abilities as well as the concept of a reaction norm have a definite practical interest both for phsichologists and pedagogists. Each genotype responds to the same environmental conditions in a specific way, therefore, placing children under the standard environmental conditions (for example teaching in the same classroom) we cannot expect the same result from all of them. Each child will respond in a specific way and will be characterized according to the achieved levels of his/her norm of reaction. Each one of us is genetically unique and it is necessary to take this into account, when dealing with the practice of teaching and education and create, at the same time, maximum diversity of environmental conditions for development.

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