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The study of event-related brain potentials and psychometric intelligence of twins

Event-related brain potentials and psychometric intelligence was registred in 53 pairs of twins. Recording of the event-related potentials was carried out in three variants: on classical procedure «oddball» and with actualization at the participants of motivation of aspiration to success or avoidances of failure. Diagnostics of psychometric intelligence was carried out with application of R. Cattell's test of fluide intelligence (GFT 2) and J. Raven's Progressive Matrices, for diagnostics of achievement motivation A.Mehrabian's questionnaire was used.

Actualization of motivation of avoiding of failure in conditions psychophysiological experiment is connected with reduction of amplitude of component N200 at participantss with prevalence of motivation of avoiding of failure, increase in amplitude of components N200 and P300 frontal areas of a brain at participantss with prevalence of motivation of achievement of success.

It is revealed common genetic determination of a level of psychometric intelligence and amplitude and latency endogenous components of the event-related potentials.

Key words: *event-related brain potentials, amplitude, latency, heritability, common environment, shared environment, intelligence, achievement motivation, twins.*

Record of the event-related caused potentials is a non-invasive electrophysiological research technique [8; 10]. The term «event-related potentials» use for their unit cognitive aspect from naturally caused potentials which reflect, in a greater degree, sensory processing [8; 13].

There are various theoretical models of psychometric intelligence [6], however the certain intellectual level yet does not guarantee to the individual of real achievements in educational or labour activity. Real achievements in many respects are determined by a level of motivation and, in particular, motivations of achievements. The theory of achievement motivation postulates, that at the individual the motivation of an avoidance of failure or motivation of aspiration to success can prevail or to miss the expressed motivation of achievements [2; 9], also the degree of

comprehension of achievement motivation with the individual can differ [20]. H.Hekhauzen for the first time has offered «addition» model, explaining a relation of an intellectual level and achievement motivation [9].

Behavioral genetics investigations of intelligence it is shown, that heritability of the general intelligence makes about 50 % and the others 50 % of variabilities on intelligence are caused by activity of factors of environment, and also interaction of factors of a heredity and environment [7; 17]. It is shown also, that latent period P300 negatively correlates with IQ, i.e. subjects with a high parameter of intelligence are characterized by reduction of the latent period [15]. At the same time there are not clear features of psychophysiological mechanisms providing interaction of intelligence and achievement motivation, for their studying in our work has been used the technique of registration of the event-related potentials.

It is known, that twins method in its classical variant (comparison of intrapair correlations monozygotic (MZ) and unisex dizygotic (DZ) twins) allows to gain an estimation of components variances of studied attributes [14].

The purpose of the given research consisted in definition a genotype-heritability of determination phenotype variabilities of parameters of psychometric intelligence, and also an estimation of a degree of a generality of genetic determination of amplitude and latency of event-related brain potentials and parameters of psychometric intelligence depending on actualization of motivation of achievements at participantss.

The primary tasks of the given work were:

1. To reveal zone differences in brain activity depending on actualization at the participants during experiment of motivation of aspiration to success or avoidances of failure.
2. To define quantity of genetic correlations between a level of psychometric intelligence and its separate abilities and parameters of event-related potentials.

In our work in conditions of psychophysiological experiment three situations have been simulated: a situation of the decision cognitive task connected with recognition of significant acoustical stimulus; a situation in which alongside with the decision of a former task at participantss staticized motivation of aspiration to success; a situation in which at participantss staticized motivation of avoiding of failure.

53 pairs of twins have shared in our investigation, from them 27 monozygotic pairs (MZ) and 16 unisex dizygotic pairs (DZ), 10 pairs heterosexual dizygotic twins. An age of 8-27 years. A male - 28, female-78. All participants are practically healthy, signed the voluntary consent to

participation in work, right-handed persons, with normal hearing. For twins zygosity definition was used the method polysymptom similarities was used [18]; pairs with not clear diagnostics in research did not join.

Record EEG was spent under the international standard 10x20; for recording cerebral waves we used 21 electrode (Fp1, Fp2, Fpz, F3, F4, Fz, F7, F8, C3, C4, Cz, P3, P4, Pz, T3, T4, T5, T6, O1, O2, Oz), under the plan monopolar with the carried reviewer, (electroencephalograph «Encefalan», the version "Elite" manufactures by "Medicom" Russia) was used. Recording was carried out in the isolated room. EEG electrode impedances were maintained < 10 kΩ.

During examination of the event-related brain potentials three assays were carried out. In the first assay (oddball) it was necessary for participants to react to significant sound stimulus (stimulus-purpose), allowing the motor answer (to press the button). Significant stimulus - duration of tone 50 мс, power of tone - 80 Db, frequency of filling-2000 Hz. Probability of presentation of significant stimulus-20 %. Insignificant stimulus - duration of tone 50 mc, power of tone - 80 Db, frequency of filling-1000 Hz. Probability of presentation of insignificant stimulus-80 %. Significant and insignificant stimulus moved binaurally, in the casual order for prophylaxis of a monotonia. Duration of a pause between stimulus - 1000 mc.

In the second assay (AS) before recording of the event-related potentials, the experimenter gave the instruction on actualization at the participants of motivation of achievement of success (the material compensation). Further record of the event-related potentials transited as well as in the first case.

In the third assay (AF) before recording of the event-related potentials, the experimenter gave the instruction on actualization of motivation of an avoidance of failure (threat of shock by a current in case of fulfilment by the participants of an error during recognition of significant and insignificant stimulus). Further record of the event-related potentials transited on a procedure of recording «oddball».

For tracking and suppression of artefacts were used registration EMG, vertical EOG, electrocardiograms, after a filtration in a range of 0,5-70 Hz event-related potentials were averaged. In total in each test carried out 20-30 averagings. The quantity amount of averagings in three tests for each participant was identical. The event-related potentials on significant and insignificant stimulus were separately averaged. The epoch of the analysis made 1000 mc. Amplitude of the event-related potentials measured from a zero line.

Definition of achievement motivation of twins was carried out with

application of a questionnaire of A.Mehrabian [1]. For definition of a level of psychometric intelligence were used: test J. Raven (5 series on 12 tasks) and «Test of Fluide Intelligence» by R.Cattell (GFT 2) [19].

Program STATISTICA 6 was applied to statistical processing. For an estimation of heritability and environmental influences it was used Ignatyev's heritabilities factor, the estimation of genetic correlations of investigated attributes also was made [7].

After recording the event-related potentials the analysis of the average value of amplitude and latency performances of P300 and N200 on all abductions for assays of test «oddball», a variant with actualization of motivation of aspiration to success and a variant with actualization of motivation of an avoidance of failure has been lead.

At actualization of motivation of avoiding of failure at the participants having a high level of development of achievement motivation, the increase in absolute amplitude of component P300 in frontal and temporal assignments was observed: Fp2, F3, F4, F8, T5, thus the amplitude of component N200 in assignments F4, Cz increased. Actualization of motivation of aspiration to success at the same participants is connected to increase in the latent period of component P300 in back – temporal right assignment T6 (tables 1, 2, 3). In tables characteristics of the event-related potentials for those assignment in which significant distinctions in tests AS or AF in comparison about the breakdown have been received, lead on a technique "oddball" are resulted.

Actualization of motivation of avoiding of failure at the examinees having a low level of development of motivation of achievement, is connected to reduction of amplitude of component N200 in frontal assignments: Fp1, Fp2, F3, Fz, F4, F8 (table 2).

Actualization of motivation of avoiding of failure at the participants having not expressed motivation of achievement, is connected to reduction of the latent period of component N200 in assignment Oz, actualization of motivation of aspiration to success - with reduction latency of component P300 in assignment O2 (table 3).

Thus, at actualization of motivation of avoiding of failure at participants with registered motivation of aspiration to success the increase in amplitude of positive potential P300 and negative N200 in frontal assignments, and at examinees with registered motivation of avoiding of failure - decrease in amplitude of negative component N200 also in face-to-face assignments was observed. As a whole actualization at participants of motivation of avoiding of failure (a negative reinforcement) has caused the big reactance of endogenous components of the event-related potentials, than actualization of motivation of aspiration to success (a positive

Table 1

The average values of absolute amplitudes of component P300 (* – $p < 0,05$, ** – $p < 0,001$)

Assign-ment	Expressiveness of motivation of achievement according to A. Mehrabian's questionnaire								
	Aspiration to success			Avoiding of failure			Not expressed motivation		
	Oddball	AS	AF	Oddball	AS	AF	Oddball	AS	AF
Fp2-A2	4,85 ± 0,52	6,1 ± 0,51	7,7** ± 0,98	8,1 ± 0,98	7,22 ± 0,81	7,17 ± 0,8	7,05 ± 0,8	6,82 ± 0,7	7,7 ± 1
F3-A1	6,46 ± 0,64	7,1 ± 0,81	9,75* ± 1,4	9,61 ± 1,2	10 ± 1,2	8,68 ± 1	9,4 ± 0,93	8,17 ± 0,6	9,5 ± 1,4
F4-A2	6,44 ± 0,64	8,31 ± 0,98	10,3* ± 1,4	10,4 ± 1,3	10 ± 1	9,65 ± 1,6	10,15 ± 1,1	8,76 ± 0,7	9,69 ± 0,2
F8-A2	5,37 ± 0,51	5,48 ± 0,65	7,7* ± 0,85	7,16 ± 0,9	7,87 ± 0,83	6,86 ± 0,8	6,77 ± 0,67	6,53 ± 0,6	6,6 ± 0,95
T5-A1	5,05 ± 0,38	4,81 ± 0,63	6,71* ± 0,7	7,52 ± 0,7	7,99 ± 0,86	8,51 ± 1	7,65 ± 0,75	8,66 ± 0,8	8,21 ± 1,2

Table 2

The average values of absolute amplitudes of component N200 (* – $p < 0,05$, ** – $p < 0,001$)

Assign-ment	Expressiveness of motivation of achievement according to A. Mehrabian's questionnaire								
	Aspiration to success			Avoiding of failure			Not expressed motivation		
	Oddball	AS	AF	Oddball	AS	AF	Oddball	AS	AF
Fp1-A1	–5,36 ± 0,67	–5,95 ± 0,68	–6,89 ± 1,13	–9,21 ± 1,17	–8,63 ± 1,3	–6,1** ± 0,9	–6,82 ± 0,63	–7,13 ± 0,75	–6,95 ± 0,8
Fp2-A2	–5,67 ± 0,62	–4,74 ± 0,54	–7,15 ± 0,88	–8,76 ± 1,1	–6,99 ± 0,9	–6,47* ± 0,9	–6,03 ± ± 0,6	–6,63 ± 0,85	–7,68 ± 0,9
F3-A1	–6,65 ± 0,73	–5,87 ± 0,57	–9,6 ± 1,64	–11,6 ± 1,5	–10 ± 1,63	–6,74** ± 0,8	–8,65 ± 0,94	–9,61 ± 1,13	–9,65 ± 0,9
Fz-A1	–7,2 ± 0,68	–7 ± 0,58	–9,67 ± 1,45	–12,5 ± 1,3	–10,8 ± 1,53	–7,6** ± 0,99	–9,79 ± 1,07	–10,1 ± 1,08	–11,8 ± 1,6
F4-A2	–6,1 ± 0,49	–6,12 ± 0,58	–8,32 ± 1*	–12,8 ± 1,3	–9,94 ± 1,35	–8,28** ± 0,98	–9,44 ± 1,03	–9,56 ± 0,9	–10,9 ± 1,4
F8-A2	–5,09 ± 0,74	–5,28 ± 0,72	–6,61 ± 0,75	–9,12 ± 1,1	–7,06 ± 0,97	–6,22* ± 0,89	–6,22 ± 0,65	–5,92 ± 0,56	–7,66 ± 0,8
Cz-A2	–5,74 ± 0,74	–7,74 ± 0,79	–9,13** ± 1	–10,9 ± 1,4	–10,1 ± 1,52	–10,1 ± 1,35	–8,82 ± 0,85	–9,81 ± 0,96	–11,7 ± 1,3

Table 3

The average values of time characteristics (the latent period) component P300 (* – $p < 0,05$, ** – $p < 0,001$)

Assign-ment	Expressiveness of motivation of achievement according to A. Mehrabian's questionnaire								
	Aspiration to success			Avoiding of failure			Not expressed motivation		
	Oddball	AS	AF	Oddball	AS	AF	Oddball	AS	AF
T6-A2	367 ± 12,35	422* ± 21,9	394 ± 24,32	405 ± 21,06	431 ± 20,42	398 ± 19,06	407 ± 18,18	390 ± 13,14	394 ± 15,42
O2-A2	414 ± 31,16	423 ± 22,29	394 ± 26,03	407 ± 21,47	404 ± 21,47	383 ± 19,95	431 ± 18,59	383* ± 14,75	393 ± 16,63

reinforcement). At people with prevalence of motivation of aspiration to success possible application in experimental conditions of a negative reinforcement is connected to increase in absolute amplitudes of component P300 in the frontal and central assignments. It can be interpreted in such a manner that in similar conditions intensity of excitation of the brain zones involved for the decision of cognitive task increases. It is known, that at reaction to relevant stimulus the amplitude of component P300 is higher, than on irrelevant [8]. People to prevalence of motivation of avoiding of failure in a similar situation have reduction of amplitude of component N200 in frontal and central assignments that can be regarded as reduction of intensity perceptive synthesis. Amplitude and latency of component N200 are connected to a phase of an identification of stimulus, amplitude and latency of component P300 are connected to a phase of decision-making [8].

At the same time it is necessary to note, that at participants with prevalence of motivation of avoiding of failure the amplitude of components N200 and P300 is higher in all three tests, than at at whom the motivation of aspiration to success prevails. Thus, even before actualization at them motivation of achievements in experiment, in the first test at people with prevalence motivation avoiding of failure were higher than value of absolute amplitudes, than at people with the expressed motivation of aspiration to success.

Comparison of characteristics endogenous components of the event-related potentials with use of the statistical criterion Freedman, received for three tests, has allowed to reveal significant distinctions between the average values of amplitude characteristics of component N200 in assignment T4 ($p < 0.05$) and Oz ($p < 0.05$), and on latency - in assignment F7 ($p < 0.01$) and P3 ($p < 0.05$).

In assignment Cz of distinction between the average values of amplitude characteristics of component P300, received for three tests, come nearer to a significance value ($p < 0.09$). On latency P300 significant distinctions for assignments T4 ($p < 0.01$) both Oz and Cz ($p < 0.05$) are received.

Under J. Raven's test the share of a genetic component in phenotypical varies variabilities for various subtests from 0 up to 0,72. At an estimation of intrapair similarity on intelligence high heritability of series D of Raven's test has been found out (table 4). The given series is made according to a principle of a reorganization / regrouping of figures in a matrix; the decision demands to track natural sequence of figures and alternation of figures in complete structure. Thus, it is possible to assume, that abilities to catch quantitative and qualitative changes have inherited character. A series B has high enough degree of inheritance, which assumes

a presence of analogy between two pairs figures, that allows to speak about inheritance of ability of linear differentiation and conclusion on the basis of linear interrelations. As a whole IQ on Raven's test it is determined by environmental factors. Apparently from table 3, series A and C also have a genetic component of a dispersion though it is low expressed.

Table 4

Estimation of MZ and DZ intrapair similarity, contribution genetic (h^2), common environment (c^2) and shared environment (e^2) components in phenotypical dispersion under Raven's test (* p <0.05, ** p <0.01)

Raven's test	*rMZ**	*rDZ*	h^2	c^2	e^2
Series A	0.35	0.27	0.16	0.19	0.65
Series B	0.59*	0.23	(0.59)	0	(0.41)
Series C	0.53*	0.44	0.18	0.35	0.47
Series D	0.72*	0.4	0.64	0.08	0.28
Series E	0.07	0.59*	0	-	-
IQ	0.79**	0.79**	0	0.79	0.21

*Designations: rMZ - correlation monozygotic twins; rDZ - correlation dizygotic twins.

Further for an estimation of structure of genetic connections, characteristic for psychometric intelligence (appreciated with application of Raven's and Cattell's tests) and amplitudes and латентности components P300 and N200 have been made calculation of genetic correlations.

In tables 5 and 6 values of genetic correlations between parameters of psychometric intelligence under R. Cattell's and Raven's tests and amplitude and latency components of event-related brain potentials.

The analysis of table 5 shows, that at a genetic level intelligence under Raven's test correlates (especially, the mental faculties diagnosed by tasks of series A, B, C) with amplitude of component N200. At actualization of motivation of avoiding of failure value of genetic correlation of Raven's test (it is especial, series A, B, C) and latency of component P300. For series E of Raven's test at actualization of motivation of aspiration to success in experimental conditions high direct genetic correlations with amplitude and latency component P300 and high negative (return) correlation with amplitude of component N200 are found out.

Table 5

Genetic correlations between psychometric intelligence (Raven's test) and amplitude and latency components of event-related brain potentials

		Series of Raven's test						
		A	*B*	*C*	*D*	*E*	*Total*	*IQ*
«Odd-ball»	P300 amp.	-0,5	-0,57	-0,51	-0,5	-0,31	-0,35	-0,29
	P300 lat.	-0,56	0,29	-0,05	0,34	-0,51	-0,04	-0,05
	N200 amp.	0,88	0,65	0,71	0,36	0,2	0,44	0,39
	N200 lat.	-0,66	-0,1	-0,31	-0,03	-0,88	-0,22	-0,22
AS	P300 amp.	0,31	-0,06	0,06	-0,04	0,95	0,09	0,2
	P300 lat.	0,06	0,82	0,46	-0,12	0,74	0,27	0,26
	N200 amp.	-0,47	0,02	-0,03	-	-0,91	-0,15	-0,25
	N200 лат.	-0,59	0,52	0,11	-0,19	-0,53	0,17	0,18
AF	P300 amp.	-0,06	-0,35	-0,17	-0,2	-0,64	0,02	0,04
	P300 lat.	0,94	0,65	0,77	0,32	0,25	0,98	0,91
	N200 amp.	-0,28	-0,27	-0,1	-0,21	-0,86	-0,3	-0,34
	N200 lat.	0,4	0,99	0,59	-0,13	0,37	0,34	0,41

At actualization of motivation of avoiding of failure negative high genetic connection between amplitude of component N200 and results of participants typed in series E of Raven's test is found out. In test "oddball" results on series E have high negative genetic correlation with latency by component N200.

Taking into account, that tasks of series A, B and C by Raven's test reveal ability to differentiation of basic elements of structure and disclosing of connections between them, and to its checking with the submitted samples, ability to an establishment of analogy by gradual differentiation of elements, ability to catch difficult changes of figures according to a principle of their continuous development, enrichment on a vertical and a horizontal, it is possible to conclude identification of a missing part of structure, that the given abilities at a genetic level are supervised generally by the same genes which determine amplitude of component N200. At actualization of motivation of avoiding of failure value of genetic correlation under the given subtests with latency of component P300 grows. Tasks of series E of Raven's test allow to estimate analitic-synthetic power of thinking. According to the received data, in many respects the same genes which promote increase in parameters of analitic-synthetic abilities, reduce latency of component N200.

The analysis of table 6 shows presence positive genetic correlation between a parameter of psychometric intelligence under R.Kettell's test and amplitude of component P300 in test AF (0,31), and also amplitude of component N200 in the first test (0,71) and amplitude of component N200 in test AS (0,5). Thus, there is a general genetic determination as level IQ diagnosed under R.Kettell's test, and amplitude characteristics of component P300 in test with actualization of motivation of avoiding of failure.

Table 6

Genetic correlations between psychometric intelligence (R.Kettell's test) and amplitude and latency components of event-related brain potentials

Tests		Subtests of R.Kettell's test				Total	IQ
		«Series»	«Classifications»	«Matrices»	«Conditions»		
«Odd-ball»	P300 amp.	-0,57	-0,71	-0,35	-0,75	-0,67	-0,62
	P300 lat.	-0,3	0,28	0,23	0,15	0,08	-0,06
	N200 amp.	0,87	0,91	0,7	0,82	0,69	0,71
	N200 lat.	-0,81	-0,65	-0,19	-0,16	-0,19	-0,38
AS	P300 амп.	-0,55	-0,61	-0,62	-0,86	-0,5	-0,42
	P300 lat.	-0,41	-0,22	-0,32	-0,14	0,1	0,09
	N200 amp.	0,62	0,73	0,45	0,85	0,73	0,5
	N200 lat.	-0,71	-0,2	0,01	-0,48	-0,27	-0,29
AF	P300 amp.	0,53	-0,26	0,57	-0,22	0,22	0,31
	P300 lat.	-0,48	-0,09	-0,23	-0,32	-0,48	-0,26
	N200 amp.	-0,8	-0,26	-0,74	0,24	-0,35	-0,39
	N200 lat.	-0,37	-0,18	-0,27	-0,5	-0,78	-0,87

Negative genetic correlations between a level psychometric IQ by Cattell's test and latency of component N200 (-0,38) (and value of negative genetic correlation grows at actualization of motivation of avoiding of failure (0,87)), and also amplitude of component P300 both in test "oddball" (-0,62), and at actualization at examinees of motivation of aspiration to success (-0,42). 38 % of the common genes adjust as growth of a level psychometric IQ by R.Kettell's test, and reduction latency of component N200, especially are established, at actualization of motivation of avoiding of failure (in this case the estimation of a generality of genetic determination of both parameters increases up to 87 %). Reduction of amplitude of component P300 in test oddball and increase psychometric IQ

by R.Kettell's test 62 % of the common genes, in conditions of actualization of motivation of aspiration to success - 42 % of common genes are determined, and in conditions of actualization of motivation of avoiding of failure genetic correlation changes a sign on positive.

Genetic correlations of separate subtests by R.Kettell's test with characteristics of components of event-related brain potentials, submitted in table 6, testify that the maximal value of genetic correlations of all four subtests was observed with amplitude of component N200 in test "oddball" (0,7-0,91) and at actualization at examinees of motivation of aspiration to success (0,45-0,85).

For amplitude of component P300 the expressed negative genetic correlations with efficiency of the decision participants of all four subtests as for test oddball (-0,35 - (-0,75)), and for conditions with actualization of motivation of aspiration to success (-0,55-(-0,86)) were observed. Actualization in experimental conditions motivation of avoiding of failure differently influences genetic correlations with amplitude of component P300 of different subtests of R.Kettell's test: for subtests 2 ("Classifications") and 4 ("Conditions") value of genetic correlation remains negative, but essentially decreases on absolute size (from 71 % up to 26 % for the subtest 2 and from 75 % up to 22 % for the subtest 4); and for the subtest 1 ("Series") and the subtest 3 ("Matrices") genetic correlation changes a sign on positive and accepts rather high values (53 % for 1 subtest and 57 % for 3 subtests).

As a whole under R.Kettell's and Raven's tests the analysis of genetic correlations with characteristics of components of event-related brain potentials has shown, that there is a general genetic determination both psychometric intelligence, and amplitudes of component N200, the quantity of the common genes participating in determination of these parameters changes from 39 up to 71 %.

There are distinctions in genetic determination of amplitude and latency of components of event-related brain potentials and level IQ under under R.Kettell's and Raven's tests. For Raven's test at transition from test oddball to conditions of actualization of motivation of avoiding of failure the share of the common genetic determination with latency of component P300 and N200 increases, and for R.Kettell's test genetic correlation in both cases has negative value. I.e. one common genes determine as increase in parameters IQ under Raven's tests, and increase latency of components P300 and N200, and other common genes determine as increase in parameters IQ under R.Kettell's test, and reduction latency of components P300 and N200.

Success of cognitive activity is determined not only resources of the subject with which he can involve for its realization, but also and substantially by an anticipation of an end result, image of "success" or "failure" which develops at the subject and determines his motivational strategy.

The analysis of the average values of amplitude and latency characteristics by endogenous components of the event-related potentials has shown, that at participants with prevalence of motivation of avoiding of failure the amplitude of components P300 and N200 is higher, than at participants with prevalence of motivation of aspiration to success. It can be connected by that «avoiding failures» it is required to show the big intensity of the nervous answer for the decision cognitive tasks, than «aspiring to success». Actualization at participants of motivation of avoiding of failure promotes the greater reactance of parameters endogenous components of the event-related potentials, than actualization of motivation of aspiration to success. At people with prevalence of motivation of aspiration to success in the event that in experiment the motivation of avoiding of failure was staticized, the increase in amplitude of component P300 in the frontal and central assignments was observed. At people with motivation of avoiding of failure in the same experimental conditions the amplitude of component N200 in the frontal and central assignments decreased. It is possible to assume, that people, with prevailing motivation of aspiration to success in stressful conditions (what, undoubtedly, the conditions menacing with impact by a current) were intensified the cognitive activity. In the same conditions people with prevalence of motivation of avoiding of failure reduced the touch synthesis connected with cognitive task, being afraid of impact by a current.

It agrees to the data received Carrillo-de-la-Peña M.T. and Cadaveira F., introduction of the additional motivating instruction promotes increase in amplitude of component P300 and its reduction of latency [4]. In E.A.Kostandov's works it has been shown, that actualization during experiment of additional motivation at the individual, conterminous with actual for him in vital conditions, promotes "simplification" of formation of wave P300 (reduction by the latent period and to increase in amplitude) [13].

Donchin E., Coles M.G.H. consider, that P300 reflects the nervous activity reflecting change of representation [5]. Latency P300 then corresponds to speed of cognitive processings, and the amplitude shows accommodation of brain power resources [12]. Amplitude P300 also depends on expectation of stimulus, from relevance of a task [21], from

selectivity of attention [11] and from an emotional reinforcement and motivation [4].

The positive genetic correlation found out by us between efficiency of the decision of subtests 1-4 by R.Kettell's tests and amplitude of component N200 testifies that there is a genetic generality in maintenance as growth of intellectual efficiency in the decision of intellectual tasks on addition, exception superfluous, detection of laws to various attributes, the analysis of spatial - topological laws, and intensifications of process of touch synthesis of the information.

Negative genetic correlations between efficiency of the decision of subtests 1-4 by R.Kettell's tests and amplitude of component P300 can be explained if to take into account, that the given component is connected to decision-making and, hence, it is possible to tell, that the common genes determine growth of intellectual efficiency and reduction of amplitude of component P300.

Despite of seeming external similarity of stimulus a material of both tests (R.Kettell's and J.Raven's), including the nonverbal tasks, the found out distinctions in a generality of genetic determination of level IQ by two techniques and parameters of amplitude and latency of event-related brain potentials can be explained by heterogeneity of structure of both tests and nonidentity of mental faculties diagnosed by the given tests. So, subtest E of Raven's test (analitic capasity) has other structure of genetic correlations with characteristics of components of event-related potentials, rather than subtests A, B, C, Д.

Creation in our experiment psychophysiological model by achievement motivation action on the decision of partisipant's of cognitive tasks of distinction of significant and insignificant stimulus has shown, that actualization of achievement motivation of promotes changes in an estimation of a generality of the genetic determination determining both parameters of psychometric intelligence, and parameters by endogenous components of the event-related potentials. It agrees to the data of genetic psychophysiology, action of stress promotes expression of the certain sites of genotype [17]. The received data can find an explanation within the framework of the concept about stress, as about the internal mechanism of regulation of hereditary variability and evolutionary process. According to the given concept confirmed with a number of experimental data, action of stress promotes change and integration of activity of functional systems of an organism on genic, endocrin, nervous and mental levels [3]. It can be caused by influence of hormones of a bark of adrenal glands (corticosteroid complex), and also steroids on activity genes [16]. The stress affects by genotyp's activity by means of neiroendocrin regulation.

In an experimental research the psychophysiological model reflecting interrelation of intelligence and achievement motivation has been constructed. Application twins method has allowed to reveal components of phenotypical dispersions of intelligence, and also to make an estimation of a degree of a generality of genetic determination amplitude and latency of event-related brain potentials and parameters of psychometric intelligence depending on actualization of motivation of achievements at partisipants.

The revealed high heritability of separate subtests of Raven's test (series B and D) testifies that abilities to catch quantitative and qualitative changes, and also abilities of linear differentiation and conclusion on the basis of linear interrelations are highly is hereditary caused.

Estimations of the common genetic determination both psychometric intelligence are received, and amplitudes of component N200, the quantity of the common genes participating in determination of these parameters is estimated in limits from 39 up to 71 %.

Actualization of motivation of avoiding of failure in experimental conditions is connected to reduction of amplitude of component N200 at partisipants with prevalence of motivation of avoiding of failure, increase in amplitude of components N200 and P300 in frontal areas of a brain at partisipants with prevalence of motivation of achievement of success.

The literature

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