Dependability, vol. 18 no.1, 2018 Original article
DOI: 10.21683/1729-2646-2018-18-1-38-45

Possible ways of improving the reliability of professional psychological selection of air traffic controllers

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Abstract.Aim. *The paper examines one of the possible ways of improving the reliability of professional psychological selection of air traffic controllers using diagnostic methods based on not subjective, but rather objective principles.* **Methods.** *The research used the following: Tobii REX fixed eye tracker and a specialized computer product developed by the All-Russian Scientific Research Institute of Radio Equipment and intended for the analysis of various aspects of eye movements in the process of exercise, as well as a range of psychodiagnostic methods: level of subjective control identification test, Buss-Durkee Hostility Inventory, MM-1 socionic test, H.J. Eysenck's intelligence test, H.J. Eysenck's personality inventory test, MMYa-1 general mode test, K. Thomas' conflict mode questionnaire and the Prognoz questionnaire for neuropsychicstability evaluation of experimental subjects. Statistical processing of the findings was done using the Bravais-Pearson correlation coefficient and Pearson's chi-squared test.* **Results.** *The experiment involved 48 third year students of the Saint Petersburg State University of Civil Aviation (SPBGU GA) majoring in Organization of Airspace Management. In terms of its psychological characteristics, the group is quite typical for this major of SPBGU GA. The results of psychodiagnostics do not correlate well with the results of this experiment, while among each other, in general, they match the theoretical assumption. The lower the neurotism which characterizes the balance of the nervous system, the better is the neuropsychicstability. The better is the neuropsychicstability, the higher the internality of any kind, especially general internality and internality for failure. People with good neuropsychicstability are also less inclined to aggressive behaviour, both in general as regards all of its kinds, and especially self-aggression. As expected, subjects with high levels of general internality turned out to be positively not inclined to such type of behaviour in conflict as "avoidance" that is the quintessence of irresponsibility. Also, people with high internality turned out to be not inclined to aggressive behaviour. The experiment exposed quite contradictory patterns of eye movement in the subjects.* **Conclusions.** *All the findings are of certain interest. Therefore, despite them being somewhat contradictory, it appears to be advisable to continue the research using the Tobii REX eye tracker. The identified shortcomings in the experiment organization allowed making corrections to the plan of further research based on the use of the Tobii REX eye tracker and aimed at improving the reliability of professional psychological selection.*

Keywords: *professional psychological selection, air traffic controller, dependability, eye tracker, neuropsychicstability, intelligence quotient, temperament.*

For citation: Arinicheva OV, Gerasimenkova AE, Malishevsky AV, Chepik MG. Possible ways of improving the reliability of professional psychological selection of air traffic controllers. Dependability 2018;18(1): 38-45. DOI: 10.21683/1729-2646-2018-18-1-38-45

Introduction. The efficiency of an air traffic management system is determined by its sophistication, dependability and reliability of technical facilities as well as organization, discipline and professional training of dispatchers and maintenance staff. The efficiency depends on the performance indicators of the components, i.e. accuracy, dependability and completeness of displayed information on the state of airspace, performed tasks, etc. [1].

The human factor is the main negative factor that reduces air traffic safety. Every year, a number of dangerous incidents related to the air traffic management (ATM) occur around the world. For example, on August 2, 2016 there was a hazardous proximity between two IndiGo airline planes in India. The planes passed so close to each other that four passengers and two flight attendants required medical aid due to the shock. As of July 10, 2016 in India alone 17 similar situations were registered in 2016, 25 in 2015, 31 in 2014 [2]. In Russia 24 incidents related to violation of the aircraft separation interval occurred in 2015 (35 such incidents occurred in 2014) [3]. Among the causes of incidents related to violations of the aircraft separation interval those related to ATM personnel are predominant. 9 incidents related to violations of aircraft separation interval occurred in the first half of the 2016 (6 incidents occurred in the same period in 2015). Seven of the incidents in 2016 were the result of ATM personnel errors, two incidents were due to aircraft crew errors. Moreover, in the first half of 2016 there were 17 cases of airborne collision avoidance systems or proximity warning systems actuations in situations not directly related to violation of separation intervals [4]. The Interstate Aviation Committee also identifies "Permission to fly and perform air traffic control (ATC) granted to flying personnel and dispatchers without the necessary experience and training" as one of the typical problems [5].

Aim of the study. There are various ways of gradually reducing the negative impact of the human factor on air traffic safety [6-9]. One of them is further improvement of the professional psychological selection (PPS) of air traffic controllers. Correct organization of aviation specialists PPS, including selection of air traffic controllers, is highly important for further improvement of flights safety. Essentially, it is the first barrier that prevents people who for various reasons are not suitable for work in aviation from joining. "PPS is a set of measures aimed at ensuring quality personnel selection based on assessing the compliance of psycho-physiological (individual) qualities and personal characteristics with the professional activity requirements" [10]. The existing PPS of pilots and ATC dispatchers [11], according to the authors of [12], has a number of major drawbacks and needs to be improved. These issues were addressed in [12, 13] and in other papers. In particular, the article [12] considered the shortcomings of such tests as the "personality questionnaire" used in aviation specialists PPS. It should be noted that tests like the "personality questionnaire" are generally not very reliable. The main problems of these tests are the possibility of falsification of answers as well as the decrease in data validity due to the respondents' attitudes or different understanding of questions [14]. Falsification of answers, which should be kept in mind when conducting certain surveys (in particular, PPS – *authors' note*), is only typical for some of the diagnostic situations. It is more complicated with the attitudes that are implemented when respondents answer the questionnaire [14]. In addition to the attitudinal factors, the reliability of the answers is significantly influenced by the respondents' intellectual appraisal of the questions (different understanding of the questions). It was shown that the ambiguity, difficulty of the questions lead to the variability of answers during a repeated survey, which indicates low *reliability*. At the same time, it appears that the questions, the answers to which remain constant in the repeated survey, often have low discriminatory power [14]. Therefore, a way of improving the reliability of ATC dispatchers PPS could be the wider use of diagnostics methods based on not subjective, but rather objective principles.

Methods. In order to explore such possibilities A.E. Gerasimenkova, I.Yu. Girenko, A.A. Dibrov, E.Yu. Lysanova and M.G. Chepik under the supervision of A.V. Malishevsky and O.V. Arinicheva conducted the following experiment using Tobii REX fixed eye tracker in November 2016. Data analysis and processing was carried out with the aid of a specialized computer product (developed by A.P. Plyasovskikh, All-Russian Scientific Research Institute of Radio Equipment) intended for the analysis of various aspects of eye movements during the exercise. The results of the experiment were partially described by the authors in [15-17].

Results and discussion. 48 third year students of the Saint Petersburg State University of Civil Aviation (SPBGU GA) majoring in Organization of Airspace Management participated in the experiment. In the first session of the exercise participants had to keep their eyes fixed on a green square that moved around the screen. In the second session the task remained the same but other squares of different colors appeared, creating distraction. It was assumed that the characteristics of attention distribution and switching in the second session would be worse. The differences in the characteristics of attention were then compared with the results of psychodiagnostics of the same sample of students.

A special computer program determined the time that the gaze was in each of the four areas of the screen. Ideally, the gaze should be fixated in each area for 25% of the total time of the exercise. Afterwards, we calculated sums of squared deviations from the ideal time spent by the gaze in each area in both sessions (Σ_A and Σ_B), as well as the total sum (Σ_Σ) and the difference between those two sums (R_Z).

$$\Sigma_\Sigma = \Sigma_B + \Sigma_A;\ R_Z = \Sigma_B - \Sigma_A,$$

where: $\Sigma_A = t_{A1}^2 + t_{A2}^2 + t_{A3}^2 + t_{A4}^2;$

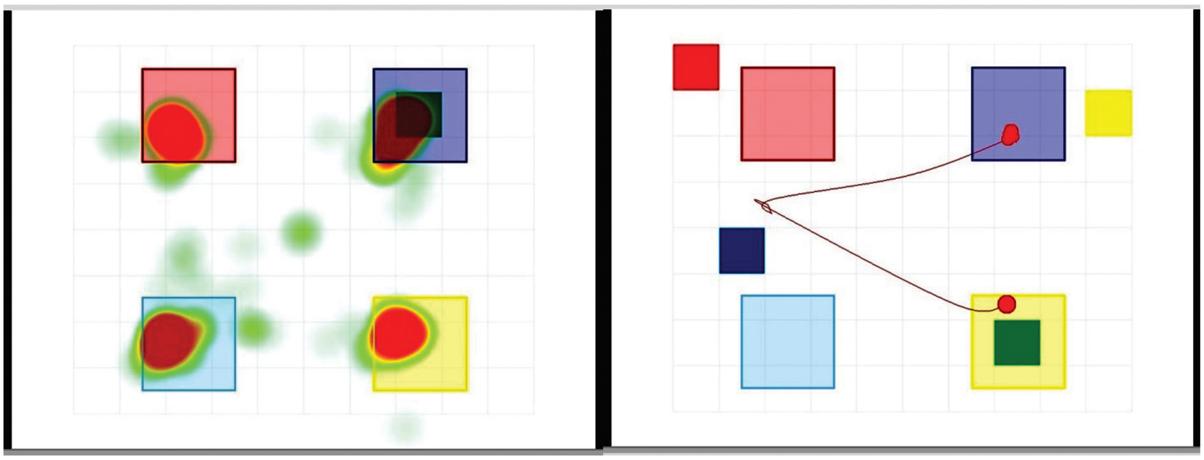
$$\Sigma_B = t_{B1}^2 + t_{B2}^2 + t_{B3}^2 + t_{B4}^2;$$

$$t_{A1} = \left|25\text{-}T_{A1}\right|;\ t_{A2} = \left|25\text{-}T_{A2}\right|;$$

$$t_{A3} = \left|25\text{-}T_{A3}\right|;\ t_{A4} = \left|25\text{-}T_{A4}\right|;$$

$$t_{B1} = \left|25\text{-}T_{B1}\right|;\ t_{B2} = \left|25\text{-}T_{B2}\right|;$$

$$t_{B3} = \left|25\text{-}T_{B3}\right|;\ t_{B4} = \left|25\text{-}T_{B4}\right|;$$



a) b)

Figure 1. Fragments of the subject's gaze visual display example of the subject's gaze heat map; b) example of an initially wrong gaze path (the top left position is area 1, then the numbering is clockwise).

T_{A1}, T_{A2}, T_{A3}, T_{A4} is the time spend by the gaze (%) in area 1, area 2, area 3 and area 4 accordingly (in the first session, i.e. with no distraction);

T_{B1}, T_{B2}, T_{B3}, T_{B4} is the time spend by the gaze (%) in area 1, area 2, area 3 and area 4 accordingly (in the second session, with distraction).

The gaze heat map (e.g. Fig. 1(a)) shows that the subjects fixated gaze within the given areas rather successfully. However the results were somewhat contradictory since a significant number of participants (22 of 48) performed a more difficult task more successfully. Although, the gaze path in Fig. 1(b) clearly shows that the subjects reacted to the distraction on many occasions.

In addition, 8 of the results were obviously incorrect. Possible reasons are: either the participants turned their heads, or the device was poorly calibrated for the subjects. After incorrect data was excluded, the results on the remaining 40 subjects were as shown below (Table 1). The correlations between the sum of sums of squared deviations from the ideal time spent by the gaze in each area in each session (Σ_Σ) and the sums of squared deviations in each session (Σ_A and Σ_B) are practically the same.

However, this sum of sums (Σ_Σ) practically does not depend on the deviations from the ideal time spent by the gaze in the upper areas (t_{A1}, t_{A2}, t_{B1}, t_{B2}) and very significantly depends on similar deviations in the lower areas (t_{A3}, t_{A4}, t_{B3}, t_{B4}). The correlation between the absolute value of the difference of the sums of squared deviations from the ideal time spent by the gaze in each area in each session ($|R_Z|$) and the sum of squared deviations in the first session (Σ_A) is practically non-existent, but the correlation with the sum of squared deviations in the second session (Σ_B) is very strong and very highly significant. Interestingly, the bottom left area (t_{B4}) makes the main contribution to this result. It is difficult to say what this means. It is quite possible that the correlation data is associated with the computer monitor being placed too low relative to the eyes of the subjects.

In addition to the above exercise, all subjects underwent a fairly extensive psychodiagnostic examination with the use of 8 different tests:

Table 1. Intercorrelations between results of the experiment

	Σ_Σ	$\|R_Z\|$	Σ_A	t_{A1}	t_{A2}	t_{A3}	t_{A4}	Σ_B	t_{B1}	t_{B2}	t_{B3}	t_{B4}
Σ_Σ		+0.5784	+0.9089	-0.0163	+0.1334	+0.6403	+0.5747	+0.9039	+0.0070	-0.0580	+0.6382	+0.5316
$\|R_Z\|$	$P \geq 0.999$		+0.2983	+0.0802	-0.1759	+0.1577	+0.3072	+0.7562	-0.1007	+0.0857	+0.3582	+0.6460
Σ_A	$P \geq 0.999$	$P < 0.95$		+0.0567	+0.2312	+0.7171	+0.5232	+0.6432	-0.0244	-0.1171	+0.5691	+0.2834
t_{A1}	$P < 0.95$	$P < 0.95$	$P < 0.95$		+0.2001	-0.1919	-0.2994	-0.0880	+0.3520	+0.1288	-0.1801	-0.2010
t_{A2}	$P < 0.95$	$P < 0.95$	$P < 0.95$	$P < 0.95$		-0.0570	-0.2142	+0.0077	+0.3872	-0.2141	+0.0677	-0.1154
t_{A3}	$P \geq 0.999$	$P < 0.95$	$P \geq 0.999$	$P < 0.95$	$P < 0.95$		+0.2250	+0.4402	-0.2644	-0.0459	+0.5434	+0.1563
t_{A4}	$P \geq 0.999$	$P < 0.95$	$P \geq 0.999$	$P < 0.95$	$P < 0.95$	$P < 0.95$		+0.5186	+0.0046	+0.0879	+0.1764	+0.4682
Σ_B	$P \geq 0.999$	$P \geq 0.999$	$P \geq 0.999$	$P < 0.95$	$P < 0.95$	$P \geq 0.99$	$P \geq 0.999$		+0.0378	+0.0137	+0.5881	+0.6854
t_{B1}	$P < 0.95$	$P < 0.95$	$P < 0.95$	$P \geq 0.95$	$P \geq 0.95$	$P < 0.95$	$P < 0.95$	$P < 0.95$		+0.2495	-0.2519	-0.3923
t_{B2}	$P < 0.95$	$P < 0.95$	$P < 0.95$	$P < 0.95$	$P < 0.95$	$P < 0.95$	$P < 0.95$	$P < 0.95$	$P < 0.95$		-0.1235	-0.2223
t_{B3}	$P \geq 0.999$	$P \geq 0.95$	$P \geq 0.999$	$P < 0.95$	$P < 0.95$	$P \geq 0.999$	$P < 0.95$	$P \geq 0.999$	$P < 0.95$	$P < 0.95$		+0.2352
t_{B4}	$P \geq 0.999$	$P \geq 0.999$	$P < 0.95$	$P < 0.95$	$P < 0.95$	$P < 0.95$	$P \geq 0.99$	$P \geq 0.999$	$P \geq 0.95$	$P < 0.95$	$P < 0.95$	

Table 2.Correlations obtained during psychodiagnostic examination in the group of participants of the experiment

First value	Second value	r_{corr}	Correlation strength	Significance of correlation	
N_{NPS}	n	+0.4923	moderate	$P \geq 0.999$	very highly significant
N_{NPS}	I_{Gen}	-0.4395	moderate	$P \geq 0.99$	highly significant
N_{NPS}	I_A	-0.3778	moderate	$P \geq 0.99$	highly significant
N_{NPS}	I_F	-0.4594	moderate	$P \geq 0.999$	very highly significant
N_{NPS}	I_{FR}	-0.4042	moderate	$P \geq 0.99$	highly significant
N_{NPS}	I_I	-0.3506	moderate	$P \geq 0.95$	significant
N_{NPS}	A_I	+0.4171	moderate	$P \geq 0.99$	highly significant
N_{NPS}	A_{Ir}	+0.3868	moderate	$P \geq 0.99$	highly significant
N_{NPS}	A_G	+0.4270	moderate	$P \geq 0.99$	highly significant
N_{NPS}	A_{Gen}	+0.4067	moderate	$P \geq 0.99$	highly significant
E	A_R	-0.3086	moderate	$P \geq 0.95$	significant
E	β_{Com}	+0.3468	moderate	$P \geq 0.95$	significant
E	$S_{E/I}$	+0.4654	moderate	$P \geq 0.999$	very highly significant
n	A_I	+0.4135	moderate	$P \geq 0.99$	highly significant
n	A_{Ir}	+0.3416	moderate	$P \geq 0.95$	significant
n	A_R	+0.3736	moderate	$P \geq 0.99$	highly significant
n	A_G	+0.4669	moderate	$P \geq 0.999$	very highly significant
I_{Gen}	β_{Av}	-0.4333	moderate	$P \geq 0.99$	highly significant
I_{Gen}	S_{LIE}	+0.3419	moderate	$P \geq 0.95$	significant
I_{Gen}	$S_{R/I}$	+0.3314	moderate	$P \geq 0.95$	significant
I_A	α_S	-0.3213	moderate	$P \geq 0.95$	significant
I_A	α_T	+0.3763	moderate	$P \geq 0.99$	highly significant
I_A	A_A	-0.3514	moderate	$P \geq 0.95$	significant
I_A	A_R	-0.3257	moderate	$P \geq 0.95$	significant
I_A	A_{Gen}	-0.3616	moderate	$P \geq 0.95$	significant
I_A	β_{Av}	-0.3457	moderate	$P \geq 0.95$	significant
I_F	A_A	-0.3018	moderate	$P \geq 0.95$	significant
I_F	A_{Ir}	-0.3436	moderate	$P \geq 0.95$	significant
I_F	A_S	-0.3246	moderate	$P \geq 0.95$	significant
I_F	A_{Gen}	-0.4214	moderate	$P \geq 0.99$	highly significant
I_F	β_{Av}	-0.3038	moderate	$P \geq 0.95$	significant
I_{FR}	A_{Gen}	-0.4144	moderate	$P \geq 0.99$	highly significant
I_P	β_{Av}	-0.4597	moderate	$P \geq 0.999$	very highly significant
I_I	A_{Gen}	-0.4772	moderate	$P \geq 0.999$	very highly significant
α_S	S_{LIE}	+0.3379	moderate	$P \geq 0.95$	significant
α_P	S_{LSE}	-0.4059	moderate	$P \geq 0.99$	highly significant
r	A_{Gen}	+0.3082	moderate	$P \geq 0.95$	significant
r	S_{LSE}	+0.4196	moderate	$P \geq 0.99$	highly significant
A_{Gen}	β_{Ac}	-0.4425	moderate	$P \geq 0.99$	highly significant

• Eysenck's Personality Inventory for temperament appraisal (E – extraversion, n – neuroticism) [14];

• the Prognoz questionnaire for neuropsychic stability (NPS) evaluation (N_{NPS} – NPS score, E_{NPS} – evaluation of NPS) [18];

• Buss-Durkee Hostility Inventory for identifying inclinations to various forms of aggressive behaviour (A_{Gen}, A_A, A_I, A_{Ir}, A_N, A_R, A_S, A_V, A_G) [14];

• level of subjective control identification test for evaluating general and specific aspects of internality (I_{Gen}, General internality; I_A, Achievement; I_F, Failure; I_{FR}, Family relations; I_P, Working relations; I_I, Interpersonal relationships; I_H, Relation to health and disease) [14];

• MMYa-1 general mode test (α_S, self-orientation; α_P, people-orientation; α_T, task-orientation; r, distance from the "ideal" point on the grid μ_2 [8]);

• K. Thomas' conflict mode questionnaire (β_{Com}, Competing; β_{Col}, Collaborating; β_{Compr}, Compromising; β_{Av}, Avoiding; β_{Ac}, Accommodating) [14];

• MM-1 socionic test [19] for determining the components of a person's socionic model S_{IEI}, S_{ESE}, S_{SEE}, S_{ESI}, S_{SEI}, S_{LSE}, S_{SLE}, S_{LSI}, S_{SLI}, S_{LII}, S_{EII}, S_{LIE}, S_{ILE}, S_{EIE}, S_{ILI}, S_{IEE}), the specific dichotomies characteristics ($S_{E/I}$, $S_{L/E}$, $S_{S/I}$, $S_{R/I}$) and integral fitness indicator by socionic criteria (ξ);

• H.J. Eysenck's intelligence test [20] (IQ – intelligence quotient).

Clear correlations (Table 2) were obtained for neuropsychic stability (N_{NPS}, neuropsychic stability in scores, the more the score the worse is the NPS evaluation (E_{NPS})). The lower the neuroticism (n), which characterizes the balance of the nervous system, the better is the NPS. The better is the NPS evaluation, the higher the internality of any kind, especially general internality (I_{Gen}) and internality for failure (I_F). People with good neuropsychic stability are inclined to show higher social responsibility. People with good NPS are also less inclined to aggressive behaviour, both in general (A_{Gen}), and especially self-aggression (A_G, guilt, remorse). This is quite important, since, having made a mistake in the work, it is necessary to think urgently about ways to correct it, and not to engage in self-reflection, which can only lead to additional errors.

As expected, subjects with high levels of general internality turned out to be positively not inclined to such type of behaviour in conflict as "avoidance" (β_{Av}) that is the quintessence of irresponsibility. Also, people with high internality turned out to be not inclined to aggressive behaviour. The highest general internality (I_{Gen}) was discovered in people with a relative predominance in their socionic model of such sociotype as logical intuitive extrovert (S_{LSE}), these people also had the highest self-orientation (α_S).

The most unfit mode of behaviour in terms of the integral indicator (r) was typical for people with a relative predominance in their socionic model of such sociotype as logical sensory extrovert (S_{LSE}).

Individuals with high extraversion (E) were more inclined to such behaviour in conflict as "competing" (β_{Com}). People with higher general aggression (A_{Gen}) were less inclined to such behaviour in conflict as "accommodating" (β_{Ac}).

Due to the fact that the results of the computer exercise in this experiment correlate with the results of psychodiagnostics rather insignificantly, the question was raised whether there is a reliable difference in a number of characteristics between the individual groups of participants.

Table 3. Distribution of psychodiagnostics results by gender

Distribution of NPS evaluations(E_{NPS}) by gender										
E_{NPS}	1	2	3	4	5	6	7	8	9	10
Females	0	0	1	3	3	5	4	3	1	1
Males	0	0	0	3	3	8	8	3	1	1

Distribution of intelligencequotient(IQ) by gender					
IQ	very low < 70	low 70-100	medium 101-110	high 111-130	very high > 130
Females	0	1	3	9	8
Males	0	5	11	6	5

Distribution oftemperament types and neuroticism (n) by gender				
Females	sanguine	phlegmatic	choleric	melancholic
	8	3	8.5	1.5
	n < 12		n > 12	
	11		10	
Males	sanguine	phlegmatic	choleric	melancholic
	18	3.5	5	0.5
	n < 12		n > 12	
	21.5		5.5	

Table 4. Comparisonofexperimentalfindingswithrespecttocriterionχ^2

Distribution of positive and negative differences between the sums of squared deviations from the ideal time spent by the gaze in each area in both sessions (R_Z) by gender		
	$R_Z < 0$	$R_Z > 0$
Females	12	9
Males	10	17

Distribution of the sum of sums of squared deviations from the ideal time spent by the gaze in each area in each session (Σ_Σ)by gender				
	$\Sigma_\Sigma < 10.4$	$10.4 \le \Sigma_\Sigma < 19.1$	$19.1 \le \Sigma_\Sigma < 30$	$\Sigma_\Sigma \ge 30$
Females	4	6	5	6
Males	8	6	7	6

Distribution of the sum of sums of squared deviations from the ideal time spent by the gaze in each area in each session (Σ_Σ) by positive or negative differences between the sums of squared deviations from the ideal time spent by the gaze in each area in both sessions (R_Z)				
	$\Sigma_\Sigma < 10.4$	$10.4 \le \Sigma_\Sigma < 19.1$	$19.1 \le \Sigma_\Sigma < 30$	$\Sigma_\Sigma \ge 30$
$R_Z < 0$	4	5	6	7
$R_Z > 0$	8	7	6	6

Distribution of neuropsychic stability evaluations (E_{NPS}) by positive or negative differences between the sums of squared deviations from the ideal time spent by the gaze in each area in both sessions (R_Z)										
E_{NPS}	1	2	3	4	5	6	7	8	9	10
$R_Z < 0$	0	0	1	1	3	5	8	2	1	1
$R_Z > 0$	0	0	0	5	3	8	4	4	1	1

First of all, since the sample group had almost equal number of male and female participants (27 males and 21 females), a significant difference between gender groups test was conducted. Table 3 shows the distribution of NPS evaluations (E_{NPS}), intelligence quotient (IQ) and temperament among male and female participants.

In general, all participants have NPS not lower than satisfactory, however the dispersion is quite significant, from 3 to 10. According to the SPBGU GA data the typical dispersion is from 4 to 8, large deviations are rare. 3 points is low enough. It is the minimal score that still allows the prognosis for operator activity to be favorable. There is no significant difference in NPS evaluations (E_{NPS}) of males and females by the Pearson's chi-squared test [21] ($\chi^2 = 0.7385 < \chi^2_{crit.0.95} = 5.991$ for $\nu = 2$ [21]).

The distribution of IQ it the group is quite unusual. 13 people had very high IQ. The dispersion is striking compared to the data in [22]. IQ varies from 87 (70 is considered to be the boundary for mental retardation) to 171 (A. Einstein's IQ was 160-180 (although measured indirectly, he did not actually take the test) [23]). There was significant difference in IQ level between the groups of males and females by the Pearson's chi-squared test [21] ($\chi^2_{crit.0.99} = 9.210 > \chi^2 = 7.8652 > \chi^2_{crit.0.95} = 5.991$ for $\nu = 2$ [21]). Females clearly had higher IQ than males. These results on male and female dispatchers are congruent with the data from [22, 24].

According to the SPBGU GA data the findings regarding temperament are unusual as well. The number of sanguine people is typically large, 25. However there are many choleric people as well, 12 participants (25%), which is a lot for groups of flight personnel and dispatchers. There are only 6 phlegmatic participants (12.5%), usually this percentage is a little higher. There is even one melancholic person, that is, a person with a weak type of nervous system. This type of temperament is very rare among flight personnel and dispatchers. 4 people have mixed temperaments, i.e. not one distinct type. In Table 3, mixed types were included as 0.5 of a person added to each of the 4 main types. There is a significant difference in neuroticism (n) between males and females by the Pearson's chi-squared test [21] ($\chi^2_{crit.0.99} = 3.841 > \chi^2 = 4.0114 > \chi^2_{crit.0.95} = 6.635$ for $\nu = 1$ [21]). Females clearly have higher neuroticism (larger portion of melancholic and choleric types of temperament), in other words, their nervous system is less balanced.

Another considered factor is the fact that respondents had positive (26 people) and negative (22 people) differences between the sums of squared deviations from the ideal time spent by the gaze in each area in both sessions (R_Z). As mentioned above, it was assumed, that the characteristics of attention distribution and switching in the second session would be worse than in the first. However, a significant number of participants (22 people) performed a more difficult task better. The results of these and some other distributions are given in Table 4.

The data from Table 4 shows that although there is a significant difference in some psychodiagnostic results between the two genders, there is no such difference in the experiment results.

There is no significant difference in distribution of positive and negative differences between the sums of squared deviations from the ideal time spent by the gaze in each area in both sessions (R_Z) between male and female participants (Table 4) by the Pearson's chi-squared test [21] ($\chi^2 = 2.025 < \chi^2_{crit.0.95} = 3.841$ for $\nu = 1$ [21]).

There is no significant difference in distribution of the sum of sums of squared deviations from the ideal time spend by the gaze in each area in both sessions (Σ_Σ) between male and female participants (Table 4) by the Pearson's chi-squared test [21] ($\chi^2 = 0.9312 < \chi^2_{crit.0,95} = 7{,}815$ for $\nu = 3$ [21]).

There is no significant difference in distribution of the sum of sums of squared deviations from the ideal time spent by the gaze in each area in both sessions (Σ_Σ) between the groups of subjects with positive and negative differences between the sums of squared deviations from the ideal time spent by the gaze in each area in both sessions (R_Z) (Table 4) by the Pearson's chi-squared test [21] ($\chi^2 = 1.6783 < \chi^2_{crit.0.95} = 7.815$ for $\nu = 3$ [21]).

There is no significant difference in neuropsychic stability evaluations (E_{NPS}) between the groups of subjects with positive and negative differences between the sums of squared deviations from the ideal time spent by the gaze in each area in both sessions (R_Z) (Table 4) by the Pearson's chi-squared test [21] ($\chi^2 = 1.2417 < \chi^2_{crit.0.95} = 5.991$ for $\nu = 2$ [21]).

Conclusions. It is well known that "the impact of psychological factors on the reliability of the operator's work is determined by such indicators as safety, timeliness, restorability, availability and psychophysiological stress" [25]. Since "safety is the ability of the operator to maintain performance for a certain time before making a mistake" [25], and the operator's restorability depends on the strength of the nervous system, i.e. on such characteristic as temperament, this experiment covered in one way or another all aspects that determine the reliability of the operator (in this case, the ATC dispatcher). All the findings are of certain interest. Despite the obtained results being somewhat contradictory, this experiment proved to be quite useful, since it also highlighted some shortcomings in the experiment organization. This allowed making corrections to the plan of further research based on the use of the Tobii REX eye tracker and aimed at improving the reliability of professional psychological selection.

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Received on 10.11.2017