ACTA UNIVERSITATIS CAROLINAE
KINANTHROPOLOGICA Vol. 50, 1 – 2014 Pag. 93–99

CHARLES UNIVERSITY IN PRAGUE,
FACULTY OF PHYSICAL EDUCATION AND SPORT,
DEPARTMENT OF PEDAGOGY, PSYCHOLOGY
AND DIDACTICS OF PHYSICAL EDUCATION AND SPORT

ANALYSIS OF PHYSICAL EDUCATION STUDENTS' EMOTIONAL STABILITY AND REACTABILITY

RADKA PEŘINOVÁ

ABSTRACT

This paper will aim to show the possible association between emotional stability and reaction time variability of Physical Education students. It can be stated that our study confirmed our suppositions which were based on works that have focused on similar topics. Our research sample showed the expected characteristics: primarily lower neuroticism values and higher extraversion when compared to the non-sporting population. Emotional stability which was reflected in the neuroticism dimension in EPQ-R (Eysenck Personality Questionnaire) was shown to be connected with variability of the reaction time in the test of reactability to selected visual stimulus, disregarding the reaction rate. The effect of extraversion is partly reflected by the tendency of the sanguine temperament type to react in a balanced manner (i.e. with low reaction time variability) during the reactability test. Due to the relatively low number of other temperament types in our sample, it is not possible to draw any conclusions in this regard.

Keywords: neuroticism, reaction time variability, EPQ-R

INTRODUCTION

Reactability is especially important in sports, as the sportsman's quick and correct reaction has a positive influence on their performance (Lehnert, 1994). Students of Physical Education often actively participate in sports. Our study attempts to show the possible connection between Physical Education students' reactability and their emotional stability.

The basic part of every human motoric activity is composed of several processes, each with three stages:

a) Problem identification – reception of information from the surroundings.
b) Choice of response – decision, which action should be undertaken.
c) Programming of response – the system of the motoric activity itself is organized.

These three stages are accumulated in the reaction time (RT), which may either be simple or selective (the response is selected out of a certain number of alternatives). It is

assumed that the test of selective reaction time to visual stimuli is the one that corresponds most with the complex processing of stimuli necessary in most sports (especially games). According to Stejskal (1998), stable reactability (for repeated reactions) is very closely connected with perception of space-time constituents of movement, and with attention and concentration. This leads to the question of whether stable reactability is associated with an emotionally stable personality.

Temperament reflects the characteristic features of the emotional personality of an individual and includes their perceptiveness of emotional stimulation, their usual strength and rate of response, the quality of their persisting mood, and all unusual mood fluctuations and intensities (Allport, 1961). H. J. Eysenck sees temperament as a more or less stable and prevalent system of affective behaviour. He represented it using a system of coordinates comprised of two bipolar dimensions – introversion–extraversion and stability–lability – that form four quadrants, each according to one temperament type. In our study, the term "emotionally stable" is used to describe those persons that have achieved low values in the neuroticism dimension (and are therefore considerably close to the stability pole).

PURPOSE

The purpose of this paper is to point out the possible association between emotional stability and reaction time variability. Precisely speaking, it is expected that the temperament type of the tested person, especially their neuroticism dimension value – i.e. their lability or stability, is associated with the variability of reaction time to a visual stimulus in the reactability test.

METHODS

Participants: The research sample consisted of 149 probands (57 women, 92 men) between 19 and 21 years of age. All the probands were Physical Education students in the first year of KTVS PF UJEP. The sample was therefore comprised on the basis of voluntariness and availability (Hendl, 2004). It is presumed that the sample will be sufficiently balanced as it consists of students who have successfully passed the entrance exams, both theoretical and practical, to the Physical Education Teacher programme.

Procedures: The probands were given an EPQ-R questionnaire and afterwards were individually tested on their reactability to selected visual stimulus.

Measures: Emotional stability was identified based on neuroticism levels, one of the EPQ-R dimensions. This dimension is identified by 12 items from the shortened (with 48 items altogether) and revised version of the standardized dichotomously scored questionnaire. The questionnaire was administered to the group of probands in written form before noon in a classroom and the instructions of the creator of the test were followed. The reactability testing took place individually afterwards, also before noon in a well-known room (the changing room). The software (created by the Psychosoft company) was installed on the laptop that was used during the tests. The administered colour-based form

of the test assembles colour matrices from the 8 available colours. The stimulus consists of a matrix of 4 × 4 colours. The given task is to decide as fast as possible whether the matrix contains 3 of the same colours. The computer measures the reaction time and correctness. The reaction time was measured in a series of 50 impulses for the selected visual stimulus. After discriminatory processing of the stimulus in the brain centres, the proband reacted by touching the right (meaning they saw three fields of the same colour) or left (meaning no three fields of the colour can be seen on the screen) button using the right or left hand. Each respondent had 10 trial attempts for practice before beginning the actual test. All the respondents were given verbal instructions, without any emphasis given on reaction speed or correctness.

RESULTS

Three categories of reaction time variability [VARKOEF-TERT] were defined according to the tertiles: low, medium and high variability. The tested persons were divided by the end values (rough score of the neuroticism scale) in the EPQ-R test [NEUR-KAT]. They are marked in the table (n. 1) as stable (low neuroticism) and labile (high neuroticism).

The resulting contingency (Table 1) shows that at a significance level lower than 0.05 ($p = 0.038$) the reaction time variability type is connected with the stability or lability of the tested person.

Table 1. NEUR-KAT * VARKOEF-TERT

			VARKOEF-TERT			
			Low	**Medium**	**High**	**Total**
NEUR-KAT	Stable	Count	38	25	29	92
		%	**41.3%**	27.2%	31.5%	100%
		Adjusted Residual	**2.5**	–1.5	–1.1	
	Labile	Count	12	22	23	57
		%	**21.1%**	38.6%	40.4%	100%
		Adjusted Residual	**–2.5**	1.5	1.1	
	Total	Count	50	47	52	149
		%	33.6%	31.5%	34.9%	100%

$\chi^2 = 6.54$; $p = 0.038$

By looking at the table (n. 1) it is possible to ascertain that the more stable individuals often tend to show lower reaction time variability in the reactability test (first tertile) and contrarily, labile individuals often show wider dispersion (variability) of the reaction times. Those with lower reaction time variability react significantly less (adjusted residual = −2.5).

On the basis of this data we have attempted a better description of the level of connection between temperament and reaction time variability in our research sample by performing this additional analysis:

According to the classic above mentioned coordinate system which consists of two bipolar dimensions – neuroticism and extraversion [NEUR-EXTR] – forming four quadrants, each for one temperament type, we have transformed the rough score obtained using the scales in the EPQ-R test into the following categories:

Phlegmatic – low neuroticism, low extraversion

Sanguine – low neuroticism, high extraversion

Melancholic – high neuroticism, low extraversion

Choleric – high neuroticism, high extraversion

The criterion for low neuroticism was a value under 5, for high extraversion it was a value over 8 on a 12 point scale.

The following contingency table shows the association between temperament type and categorized variability of reaction time in the reactability test ($\chi^2 = 15.3$; $p = 0.018$).

Table 2. NEUR-EXTR * VARKOEF-TERT

			VARKOEF-TERT			
			Low	**Medium**	**High**	**Total**
NEUR-EXTR	Phlegmatic	Count	10	5	15	30
		%	33.3%	**16.7%**	50.0%	100.0%
		Adjusted Residual	0	**–2.0**	1.9	
	Sanguine	Count	28	20	14	62
		%	**45.2%**	32.3%	**22.6%**	100.0%
		Adjusted Residual	**2.5**	0.2	**–2.7**	
	Melancholic	Count	7	17	14	38
		%	**18.4%**	**44.7%**	36.8%	100.0%
		Adjusted Residual	**–2.3**	**2.0**	0.3	
	Choleric	Count	5	5	9	19
		%	26.3%	26.3%	47.4%	100.0%
		Adjusted Residual	–0.7	–0.5	1.2	
Total		Count	50	47	52	149
		%	33.6%	31.5%	34.9%	100.0%

$\chi^2 = 15.3$; $p = 0.018$

The table (n. 2) presented above also shows, due to the higher values of adjusted residuals, that in our sample sanguine individuals (i.e. persons with low neuroticism value and high extraversion) have above all others displayed significantly higher tendency for reactions with lower reaction time variability (adjusted residual = 2.5) and considerably

lower tendency to react in an unstable manner, or with higher reaction time variability (adjusted residual = −2.7) in our reactability test.

DISCUSSION

The results of our study based on a sample of college students of Physical Education confirm our assumption that emotional stability is connected with balance (variability) of reaction times in the reactability test using selected visual stimuli. Our results have shown that emotionally stable individuals tend to display lower reaction time variability in the reactability test. Their reaction times were therefore more balanced during the whole test (50 reactions), regardless of their reaction rate. On the other hand, labile individuals tend to show wider dispersion (variability) of reaction times. This finding corresponds with the results of professor Stejskal (1998), who after his long-term research of sportsmen in Prešov determined their reactability level by a series of measurements of simple or disjunctive reaction times. Stejskal was also convinced that the "reactability diffusion" (i.e. wider reaction time dispersion) is genetically conditioned. The effect of genetics on reaction rate is not negligible (some authors state it is up to 85%). Nevertheless, many authors argue (Stejskal, 1998; Schweitzer, 2001; Koitka, 2003) that the ability to react can be developed outside the sensitive period as well. The fact that individuals who participated in sports during adolescence develop their reaction abilities more quickly is connected with gaining strength, improvement of technique and an increase in the anaerobic capacity of the organism. Sportsmen who undergo training for coordination and fitness have better performance and quicker reactions (Koitka, 2003).

Reactability is influenced by many external as well as internal factors, such as activation level, the already mentioned training, stimulants etc. According to the previous research, it is also influenced by intelligence (Deary, 2001; Schweitzer, 2001) and personality type (Lenzeweger, 2001). Brebner (1980) found that extroverts have faster reaction times, as did anxious personality types according to Welford (1980). The results of our study also point to the fact that temperament type (the neuroticism dimension as well as the extraversion dimension, according to Eysenck) can be also connected to the variability of reaction time to selected stimuli. It was proved that sanguine individuals (persons with low neuroticism value and high extraversion) in our sample had a significantly higher tendency to react with lower reaction time variability and considerably lower tendency to react in an unstable manner and therefore with higher reaction time variability. It is assumed that this can be explained by the levels of concentration and attentiveness which are closely connected to emotional stability.

The research of Robinson and Tamir (2005) also yields very interesting results. Their three studies, focused on reactions of college students to selected stimuli, have proven that those students who had neurotic personality types had significantly less balanced reaction times than their more stable counterparts. They state that in their sample the neuroticism values were considerably correlated with the standard deviation of selective reaction time. In our research, the coefficient of variation was used as the measure of reaction time dispersion in the reactability test. We worked with a sample consisting of students of Physical Education, and therefore of people who actively participate in

sports. Our sample has confirmed the supposition of higher extraversion values in the sporting population, which is in agreement with the relevant works in this field (Knotek, 1971; Vaněk, 1974). The average value of extraversion is 9.56 for women, in contrast with Eysenck's norm 7.6, and 10.15 for men, with Eysenck's norm being 7.42. Similarly, the supposition of lower neuroticism values in comparison with the average population was also confirmed in our experimental sample (Kirkcaldy, 1982; Lemieux, 2003). This has reached the average value of 9.56 points against Eysenck's norm of 7.6 and 10.15 points compared to Eysenck's 7.42. The score of lies and psychoticism was higher with women. However, since the motivation for dissimulation was not generally confirmed, this can be seen as a manifestation of personality – social naivety or conformity to a certain degree. The average reaction in the reactability test was 3.46 for men, 3.76 for women. The reaction time depended partly on the activation of the probands' attention and partly on their personal preference. There was no emphasis given on the correctness of reaction during the preparatory motivation. The probands also had no immediate feedback on the correctness of their response. The average number of correct reactions was 37.66 for women and 35.09 for men.

To conclude, it can be stated that our study confirmed our suppositions that were based on other works in the field with similar topics. Our research sample showed the expected characteristics, primarily lower neuroticism values and higher extraversion in comparison with the non-sporting population. Emotional stability, which was described in the neuroticism dimension (in EPQ-R), proved to be connected with variability of reaction times in the reactability test using visual stimuli, regardless of the reaction rate. The effect of extraversion is partly reflected by the above mentioned fact that sanguine temperament types tend to react in a balanced manner (with low reaction time variability) in the reactability test. Due to the relatively low number of other temperament types in our sample, it is not possible to draw any conclusions in this regard.

REFERENCES

ALLPORT, G. W. (1961). *Pattern and growth in personality.* New York: Holt, Rinehart and Winston.

BREBNER, J. T. (1980). Reaction time in personality theory. In A. T. Welford (Ed.), *Reaction Times.* New York: Academic Press, 309–320.

DEARY, I. J., DER, G. & FORD. G. (2001). Reaction times and intelligence differences: A population-based cohort study. *Intelligence*, 29 (5), 389–393.

EYSENCK, H. J. (1967). *The biological basis of personality*. Springfield, IL: Charles C. Thomas.

EYSENCK, H. J. & SIBIL, B. G. (1968). *Eyseneckov osobnostný dotazník*. Bratislava: Psychodiagnostické a didaktické testy.

EYSENCK, H. J. (1993). *Eysenckovy osobnostní dotazníky*. Praha: Psychodiagnostika.

HENDL, J. (2004). *Přehled statistických metod zpracování dat.* Praha: Portál.

KIRKCALDY, B. D. (1982). Personality profiles at various levels of athletic participation. *Personality and Individual Differences*, 3, 321–326.

KNOTEK, P. & KUBIČKA, L. (1971). Závislosti medzi tělovýchovnou aktivitou a některými vlastnostmi osobnosti poslucháčů tělesné výchovy pedagogických fakult. *Teor. praxe tel. výchovy*, 20, 129–138.

KOITKA, J. (2003). *Torhüter von morgen ausbilden: Bausteine für das Einzeltraining der Torwarte*, Teil 3: Reaktion, Komplexübungen.

LEHNERT, M. & DOBRÝ, L. (1994). Reakční doba a zpracování informací. *TVSM,* 60 (3), 2–10.

LEMIEUX, P., MCKELVIE, S. J., & STOUT, D. (2003). Extraversion and Neuroticism in Contact Athletes, No Contact Athletes and Non-athletes: A Research Note. *Athletic Insight*, 5 (3), online [2007-06-13]. From: http://www.athleticinsight.com/Vol5Iss3/ExtraversionNeuroticism.html.
LENZENWEGER, M. F. (2001). Reaction time slowing during high-load, sustained-attention task performance in relation to psychometrically identified schizotypy. *Journal of Abnormal Psychology*, 110.
MILLER, J. O. & LOW, K. (2001). Motor process in simple, go, no-go, and choice reaction time tasks: a psychophysical analysis. *Journal of Experimental Psychology*: *Human Perception and Performance*, 27.
ROBINSON, M. C. & TAMIR, M. (2005). Neuroticism as mental noise: a relation between neuroticism and reaction time standard deviations. *Journal of Personality and Social Psychology* 89 (1), 107–115.
SANDERS, A. F. (1998). *Elements of Human Performance: Reaction process and Attention in Human Skill*. Mahwar, New Jersey: Lawrence Erlbaum Associates, Publisher.
SCHWEITZER, K. (2001). Preattentive processing and cognitive ability. *Inteligence* 29.
STEJSKAL, T. (1994). Rözne typy reagovania. *Tel. vých. sport mlád.*, 60, 39–41.
STEJSKAL, T. (1998). *Reaktibilita športovcov*. Prešov: Manacon.
VANĚK, M., HOŠEK, V. & SVOBODA, B. (1974). *Studie osobnosti ve sportu*. Praha: UK.
WELFORD, A. T. (1980). Choice reaction time: Basic concepts. In A. T. Welford (Ed.) *Reaction Times*. New York: Academic Pres.

ANALÝZA EMOCIONÁLNÍ STABILITY A REAKTIBILITY STUDENTŮ TĚLESNÉ VÝCHOVY

RADKA PEŘINOVÁ

SOUHRN

Tento příspěvek poukazuje na možnou asociaci mezi emocionální stabilitou a časovou variabilitou dob reakcí u studentů tělesné výchovy. Lze konstatovat, že studie potvrdila naše předpoklady vycházející z odborných prací na obdobná témata. Výzkumný soubor vykazoval předpokládané charakteristiky, především nižších hodnot neuroticismu a vyšší extroverze oproti nesportující populaci. Emocionální stabilita vyjádřená pomocí dimenze neuroticismu (v EPQ-R) se ukázala v asociaci s časovou variabilitou dob reakcí v testu reaktibility na výběrový zrakový podnět bez ohledu na rychlost reakce. Vliv extroverze do jisté míry odráží naznačená tendence sangvinického typu temperamentu reagovat vyrovnaně (tedy s nízkou časovou variabilitou dob reakcí) v testu reaktibility. Vzhledem k relativně nízkému početnímu zastoupení ostatních typů temperamentu v našem souboru nelze v tomto ohledu činit zodpovědné závěry.

Klíčová slova: neuroticismus, časová variabilita dob reakcí, EPQ-R

Radka Peřinová
vencovska@seznam.cz