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THE REACTION TIME IN RELATION TO THE MODALITY OF STIMULATION

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Abstract: *The goal of research is to estimate if there is a difference in speed reaction in the test of the association compared to the presentation of stimulation of different modality. The stimuli are presented visual and auditory. The subjects react to the drawings faster than to the printed words. The reaction time is longer under the unlimited exposition compared to the limited exposition of visual stimulus. The subjects faster give the associative answers to unlimited exposition to the auditory stimulus, but slower to the limited visual exposition. The results add to the further explanation of the meaning of the effect and the application of different modality of stimulus in physical culture and sport.*

Key words: *reaction time, stimulation, physical culture, sport*

The problem of the reaction time of man appeared in the science in the forties of the last century. The first researches come from Herman Helmholtz who worked on determining the speed of impulse conducting through the nerve fibre. He offered a method for determination of that speed. In the well-known experiments of his, Helmholtz stimulated first one point of the nerve near to the muscle, and then another point far from the muscle. The difference between the time intervals from the stimulation to the muscle contraction in those two situations is the time needed for the conduction of the nerve impulse from the first to the second point. By this method he established the fact that the speed of the nerve impulse conduction is about 30 metres in a second. Today we know that that speed varies from 20 to 120 metres per second, which depends on the neuron type.

Dutch physiologist Donders (1), apart from the physiological understood the psychological importance of the reaction time. The reaction time, as an objective method for measuring and determining the psychic processes was accepted by Vunt, whereas the Virtsburg school (Kilpe) refused it. With the appearance of behaviourism on the

psychological scene, in which the psychology of learning and behaviour gets the primary role and mental concepts are rejected - the reaction time as a parameter and a method becomes pushed into the background until the half of this century.

Today the solution of the reaction time problem goes in different directions. The reaction time has been more and more used as an objective method in the experimental procedure in the field of data processing. The difference in the reaction time in the two presented stimulations which differ in the degree of the task complexity points at the existence of a certain psychic process which takes part in the processing of additional degrees of the task complexity. The nature of the motor response itself has been more and more researched lately. Vrtunski developed the method of "microbehavioural analysis", i.e. the analysis of the progress of the motor response parameters (4, 5). The differences of the reaction time depend not only on the stimulus modality, but also on several psychic and physiological factors as well.

The time interval from the moment of stimulus presentation or the complex of the stimulus to the moment of giving the motor response, reflects the speed of the flow of neurophysiological, cognitive and information processes which are created by the action of stimulus on the examinee's sensory system. The receipt of information, its processing, decision making and giving the response - execution of the motor act are the processes which follow one another and make what we call the reaction time (2, 3).

The reaction time is effected not only by the characteristics of the stimulus (modality, intensity, volume), but also by its contrast, relation to the base, i.e. the environment which it appears in. With the increase of the stimulus contrast in relation to the background, the reaction time becomes shorter. The stimulus of lower intensity which is very significant for the subject, shortens the reaction time more than an intensive but less significant stimulus.

Apart from the physical characteristics of the stimulus, the reaction time is significantly influenced by psychophysical and somatic status of the examinee, such as the level of the emotional tension, motivation, fatigue, attention, fitness, biological rhythm, and health. Thus, people who are characterized by "strong" nervous system and low anxiety, when simple sensorimotor reaction is in question, react faster than people with basic anxiety over the optimal level.

1. THE PROBLEM

The main aim of this experiment is to determine whether there are differences between the reaction time in the association test of examinees, in relation to the influence of stimuli of different modality but the same meaning. The modalities are: visual stimulus - the written text and pictures, and auditive - the spoken word. (For example, the noun HORSE is exposed as a written word, a drawing and a spoken word). The influence of the exposition length of the visual stimulus was treated and the exposition of the same stimulus material was 125ms and unlimited - until the examinee gives his response. In that way there were five treatments.

2.HYPOTHESES

In relation to the problem and the aim of the research, the following hypotheses were suggested:

1. There are differences in the reaction time at free associations to stimuli of different categories.
2. There are differences in the reaction time when giving free associations to visual stimuli (words and drawings) with exposition of 125ms, as opposed to stimulus exposition until the subject responds.

3.THE METHODS OF RESEARCH

The sample of examinees

Since in all five sessions the stimulus material of the same meaning was present, there were five groups of examinees. In each of them there were 16, which makes 80 examinees altogether. They were students from the Department for Physical education of the Faculty of Philosophy in Nis. The group was equalized regarding to the age and sex of the members.

The sample of variables

The *independent* variables in this research are: 1. the stimulus material (free associations test) specially designed for this research; 2. the length of the stimulus material exposition (125ms and unlimited, until the examinee responds). The stimuli were nouns - thirty of them, and each was presented auditorily, as a spoken word, and visually. The visual stimulus exposition was carried out in two ways: as a drawing and a printed word, and exposition of both groups was 125ms and unlimited. The choice of nouns was made according to a certain standard procedure for the need of this research.

The *dependent* variable is the reaction time, that is the time from the moment of the stimulus presentation to the moment of giving the associative response.

The experimental procedure

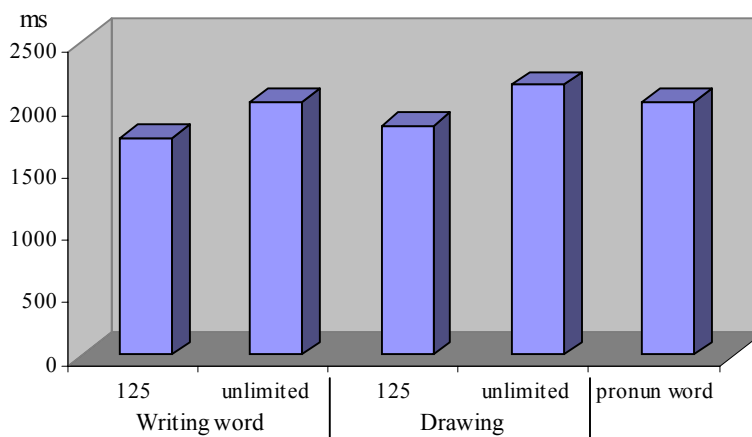
The stimulus material was presented to all the examinees at the same order. The test was carried out individually. For presentation of the visual stimuli, the tachistoscope was used with the time measuring device which started with the stimulus exposition and stopped over the speech overlap giving the verbal responses - examinee's associations. For presentation of verbal - auditive stimuli, the magnetic record of spoken words on the tape recorder was used.

4.THE RESULTS AND DISCUSSION

The analysis of the variance shows that there is statistically significant difference in the speed of reaction when associating between the five groups of examinees, $F=4.03$; $p<0.01$. Middle values of the reaction time at the associative test of all five experimental

situations are shown in diagram 1.

stimulus	exsposition			
	125 ms		unlimited	
writing word-drawing	64,28	p<0,01	2,14	p<0,05
writing word -pronun. word	3,30	p<0,05	16,21	p<0,01
drawing - pronun. word	58,10	p<0,01	9,77	p<0,01



1. The average values of the reaction time in groups who were presented with the drawings were longer then when presented with the printed word for the same group of concepts. The same applies both to the limited exposition (125ms) and the unlimited exposition to stimuli. Testing of significance of differences, done after the variance analysis, by means of t-test for the difference between the reaction time values (VR) for words and drawings of the same concepts, with exposition of 125ms is $t=64.82$; significant at the level of 0.001; and with unlimited exposition to the stimuli, $t=2.14$; significant at the level of 0.05. Figure 1. shows t-tests values and significances for the ratio of the middle values of the reaction time in the associative test for the five treatments.

2. The reaction time was significantly longer with visual stimulus exposition, with unlimited compared to the limited exposition, and the same applies both to words and to drawings. With words, the ratio of limited to unlimited exposition is $t=22.12$; significant at the level of 0.001; and with drawings the ratio is $t=21.48$; significant at the level of 0.001.

3. The reaction time of the fifth group of examinees to whom the stimuli were presented auditorily (spoken words) was significantly shorter than in the previous groups where the visual stimuli were exposed without limit, but significantly longer when compared to groups where the visual stimulus (drawings and written words) was exposed with the time limit (125ms)

Ad.1 The interpretation of the fact that associating is faster in response to the written word as compared to the drawing of a certain concept, is not yet complete. Some authors (5, 6) think that the visual stimuli in the form of drawings should first be coded in a verbal code, and only then articulated, whereas when presenting a written word it has already

been done. This coding of the picture into a verbal code requires certain amount of time, which was shown in our experiment by longer time of reaction to a drawing than to a written word when giving the associative answer, not only with 125ms exposition but also with unlimited exposition to the stimulus material.

Ad.2 The fact that with the limited exposition to a written word and a drawing of a stimulus of the same meaning, one associates faster than in the situation when the stimulus is exposed until the examinee gives his response, has the following explanation. When the stimulus is exposed 125ms, it is hold up at the retina of the eye for a very short period of time (between two winks) so that the examinee "does not have enough time" to scan the stimulus by eye movements, so that he makes the decision, i.e. gives associative response, faster. However, when the stimulus is exposed until the moment of response, the examinee is scanning the stimulus and selecting possible associative responses, which prolongs the reaction time and effects other qualities of associative responses.

Ad 3. The reaction time position is specific when giving associations to an auditory stimulus (spoken word). Considerably longer period of time is necessary for association related to limited exposition of the visual stimulus, and also considerably shorter period related to unlimited exposition. It is normal that the reaction time is shorter when giving associations to a spoken word than when responding to a visual stimulus with unlimited exposition, because the auditory word presentation is phylogenetically older than the written word. In this case, the coding of a visual into an auditory form of word, till it is understood, is not necessary. However, the limited, very short visual stimulus exposition in a special way "makes" the examinee respond as fast as possible. Due to this mechanism, which is not clearly defined up to now, the reaction time is shorter when giving associations to a visually presented 125ms compared to an auditorily presented stimulus.

5. CONCLUSION

The speed of reaction depends on several factors. These factors are the stimulus modality, its characteristics such as intensity and exposition period, as well as the kind of response: motor, verbal type "yes" or "no", or verbal associative response. It also depends on psychophysical, emotional and somatic status of the examinee, and the personality traits as well. The results of this research show the following:

- 1) The examinees give response to printed words faster than to drawings.
- 2) The reaction time is faster with the unlimited compared to the limited visual stimulus exposition.
- 3) When the stimulus is presented auditorily, the examinees give the associative responses faster then with the unlimited visual stimulus exposition, but slower than with the limited exposition.

The research can contribute to further clearance of the significance of the complex reaction time when giving motor or verbal response. The degree of reaction time variability at examinees can point out the level of one's emotional stability as well as one's psychophysical and somatic status at the moment.

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**BRZINA REAKCIJE U ODNOSU NA
MODALITET STIMULACIJE****Joviša Obrenović, Vladimir Nešić, Milkica Nešić**

Cilj istraživanja je da se utvrdi da li postoje razlike u brzini reakcije u testu asocijacija u odnosu na prezentovanje stimulusa različitih modaliteta. Stimulusi su prezentovani vizuelno i auditivno. Ispitanici brže reaguju na crteže nego na štampane reči. Vreme reakcije je duže pri neograničenoj u odnosu na ograničenu ekspoziciju vizuelnog stimulusa. Ispitanici brže daju asocijativne odgovore na auditivnu stimulaciju u odnosu na neograničenu ekspoziciju vizuelne stimulacije, ali sporije u odnosu na ograničenu vizuelnu ekspoziciju. Rezultati mogu da doprinesu daljem pojašnjavanju značaja uticaja i primene različitih modaliteta stimulacije u fizičkoj kulturi i sportu.

Ključne reči: vreme reakcije, stimulacija, fizička kultura, sport