*Original research papers*

# SEX-DEPENDENT INDIVIDUAL DIFFERENCES AND THE CORRELATIONAL RELATIONSHIP BETWEEN PROPRIOCEPTIVE AND VERBAL TESTS

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**Abstract**

***Introduction***. The aim of the study was to analyze the relationship between proprioceptive and verbal tests on personality in both sexes separately due to existing proprioceptive differences in fine motor behavior between men and women in our previous studies [1, 2, 3]. ***Material and methods***. 114 middle-aged participants from Belarus completed verbal tests (personality: Eysenck's EPQ, Big Five in Hromov's Russian adaptation, and Rosenberg's Self-esteem) together with Proprioceptive Diagnostics of Temperament and Character (by Tous). Complementary information, such as tests of time perception, was collected and used in correlative and ANOVA analyses with the use of SPSS v.19. ***Results***. The relationship between proprioceptive variables in personality and individual differences, time perception and the results of verbal tests were determined for each sex subgroup and discussed. ANOVA results reflected the corresponding differences and similarities between men and women in the variables of each test. Time perception was found to be significantly correlated to all five dimensions of the Big Five Test in both sexes, and both had a significant relationship to the same variables of the DP-TC test. ***Conclusions***. Time perception can be used as an indirect indicator of personality. Existing individual and personality differences should be taken into account in coaching and education to obtain more effective results.

**Key words:** proprioception, Proprioceptive Diagnostics of Temperament and Character (DP-TC), personality and individual differences

## Introduction

Mira y Lopez [4] and Luria [5] studied the somatico-mental relationship in fine motor expressive analysis and both noticed that motor function reflects the hidden structure of psychological processes, which can describe our individual or personality differences [2, 6, 7, 8]. Proprioceptive Diagnostic of Temperament and Character (DP-TC), based on fine motor behaviour, was created by Tous and colleagues within the Mira y Lopez tradition with the use of new technologies [7, 9, 10] and was validated [11] through confirmatory factorial analysis [12]. Our previous studies showed a relationship between certain proprioceptive indicators and visual memory [13], a multiple sclerosis case [14], academic performance [15], sex differences in Parkinson's patients [1], sex and cultural [3], age-related differences [16] and more. Researchers from other countries applied Mira y Lopez's MKP test for investigations [6] in the psychophysiological description of adaptation [17], in sports psychology [18] in observations of psychomotor responses and interhemispheric relationships in adaptation to a new time zone [19] and as psychophysiological markers of adolescents' tolerance [20].

Personality differences were also analysed using the proprioceptive DP-TC and verbal tests [21]. However, in order to ensure correct interpretation, studies related to sex-dependant differences are also required. Thus, the aim of this study was to determine to what extent the motor-expressive parameters in the proprioceptive condition are related to verbal tests of individual differences and whether they are the same for both sexes.

## Material and methods

114 volunteers (42 males 38.93±15.78 years old and 72 females 39.14±12.72 years old) from Belarus with at least a secondary school education performed proprioceptive (DP-TC, Tous) and verbal (EPQ, Eysenck; Russian adaptation of Big Five Personality Test, R – Rosenberg Self-esteem) tests. Other parameters such as time perception (TP, perceptive estimation of a 1 minute interval) and BMI were included for the sex-dependent individual differences in statistical analysis by SPSS (v.19). The Big Five Personality Test was adapted from the Japanese BFI into Russian by Hromov [22] and represents the following bipolar dimensions: 1) Introversion-Extraversion; 2) Independence-Affection; 3) Naturalness-Control; 4) Emotional Stability-Emotional Instability, and 5) Practicality-Friskiness. The DP-TC bipolar variables [7, 23] are as follows: 1) Mood (Pessimism-Optimism); 2) Decision Making (Submission-Dominance); 3) Attention Style (Intra-tension – Extra-tension); 4) Emotivism (Distant-Affective); 5) Irritability (Inhibition-Excitability), and 6) Variability (Rigidity-Flexibility).

## Results

The average values for male and female groups for all observable variables are represented in table 1. ANOVA analysis for sex differences revealed significant differences in DP3 (transversal movement and non-dominant hand) with a higher

tendency towards outward shifts (extra-tension in men) in women: 5.51±16.45 mm, in men vs. -0.54±17.62 mm. Sex differences were statistically significant for the following variables in verbal tests: E (Extraversion), N (Neuroticism) and P (Psychoticism) of Eysenck's EPQ and dimension I-E (Introversion-Extraversion) of the Big Five Test.

**Table 1.** Descriptive statistics for observed variables in both sex subgroups

| Test | | Men | | Women | |
|---|---|---|---|---|---|
| | | *M* | *SD* | *M* | *SD* |
| DP-TC | DP1 (Mood, T) | -2.72 | -2.72 | -2.72 | -2.72 |
| | DP2 (Mood, C) | -7.19 | -7.19 | -7.19 | -7.19 |
| | DP3 (Attention style, T) | 5.51 | 5.51 | 5.51 | 5.51 |
| | DP4 (Attention style, C) | -2.86 | -2.86 | -2.86 | -2.86 |
| | DP5 (Decision making, T) | 13.84 | 13.84 | 13.84 | 13.84 |
| | DP6 (Decision making, C) | 13.14 | 13.14 | 13.14 | 13.14 |
| | DS1 (Emotivism, T) | 7.72 | 7.72 | 7.72 | 7.72 |
| | DS2 (Emotivism, C) | 11.19 | 11.19 | 11.19 | 11.19 |
| | LL1 (Irritability, T) | 46.58 | 46.58 | 46.58 | 46.58 |
| | LL2 (Irritability, C) | 42.44 | 42.44 | 42.44 | 42.44 |
| | LV1 (Variability, T) | 21.42 | 21.42 | 21.42 | 21.42 |
| | LV2 (Variability, C) | 24.19 | 24.19 | 24.19 | 24.19 |
| | BMI (Body Mass Index) | 0.25 | 0.25 | 0.25 | 0.25 |
| | TP (1 minute, 60 seconds) | 43.29 | 43.29 | 43.29 | 43.29 |
| | R (Self-esteem) | 31.52 | 31.52 | 31.52 | 31.52 |
| Big Five (bipolar) | I-E (5) | 33.63 | 33.63 | 33.63 | 33.63 |
| | Ind-Affect (5) | 32.33 | 32.33 | 32.33 | 32.33 |
| | Nat-Cont (5) | 33.40 | 33.40 | 33.40 | 33.40 |
| | EmSt-EmInst (5) | 33.88 | 33.88 | 33.88 | 33.88 |
| | Pract-Frisk (5) | 34.30 | 34.30 | 34.30 | 34.30 |
| EPQ | E | 13.73 | 13.73 | 13.73 | 13.73 |
| | N | 11.06 | 11.06 | 11.06 | 11.06 |
| | P | 5.12 | 5.12 | 5.12 | 5.12 |
| | L | 10.70 | 10.70 | 10.70 | 10.70 |

*Legend*: For DP-TC variables raw parameters are performed, measured in mm: DP1 and DP2 – primary deviations in frontal movement, DP3 and DP4 – primary deviations in transversal movements, DP5 and DP6 – primary deviations in sagittal movements; DS1 and DS2 – formal deviations in frontal movement; LL1 and LL2 – line length, and DL1 and DL2 – difference between maximum and minimum line lengths. All odd numbers belong to non-dominant hand (temperament, T), and all even numbers belong to dominant hand (character, C). TP is measured in seconds.

Bivariate correlational analysis of the observed parameters revealed a moderate, statistically significant relationship between DP-TC variables and verbal tests. However, this correspondence differed between men and women. In men the Psychoticism (P) subgroup of Eysenk's EPQ test negatively correlated ($r$=-.40, $p$=.023) with primary deviation in frontal movement and non-dominant hand (DP1) and positively correlated ($r$=.38, $p$=.029) with secondary deviation of frontal movement and non-dominant hand (DS1) in the proprioceptive test (DP-TC). The "Lie" scale of the EPQ test positively correlated ($r$=.34, $p$=.03) with variability of line length in dominant hand (LV2) in men. Finally, primary deviation of sagittal movement in non-dominant hand (DP5) negatively correlated ($r$=-.31, $p$=.043) with time perception (TP) and three of five dimensions of the Big Five Test: Introversion-Extraversion ($r$=-.35, $p$=.021), Independence-Affection ($r$=-.31, $p$=.047) and Emotional Stability-Emotional Instability ($r$=-.41, $p$=.006).

In the female subgroup, statistically significant positive correlations were found between Rosenberg's Self-esteem Verbal Test and proprioceptive DP4 – primary deviation in transversal movement and dominant hand ($r$=.34, $p$=.008), as well as between proprioceptive DP5 – primary deviation in sagittal movement (non-dominant hand) and Eysenck's Extraversion (E) ($r$=.27, $p$=.034) and BMI ($r$=.26, $p$=.040). Proprioceptive line length variability in dominant hand (LV2) also positively correlated with BMI in women ($r$=.27, $p$=.030). Finally, line variability in both hands of proprioceptive test DP-TC negatively correlated with time perception and all five dimensions of Big Five tension. This difference was more pronounced in the dominant hand (exhibiting a higher magnitude of correlations) than in the non-dominant one. The following correlations were found there: in TP: $r$=-.24 ($p$=.045) with LV1 and $r$=-.29 ($p$=.014) with LV2; in the Big Five Test I-E: $r$=-.34 ($p$=.005) with LV1 and $r$=-.38 ($p$=.002) with LV2, Ind.–Affect.: $r$=-.31 ($p$=.009) with LV1 and $r$=-.38 ($p$=.002) with LV2, Nat.-Contr.: $r$=-.24 ($p$=.045) with LV1 and $r$=-.27 ($p$=.026) with LV2, Em.St.-Em.Inst.: $r$=-.28 ($p$=.019) with LV1 and $r$=-.37 ($p$=.002) with LV2, and Pr.-Frisk.: $r$=-.28 ($p$=.022) with LV1 and $r$=-.33 ($p$=.006) with LV2.

Moreover, time perception (which is related to the proprioceptive sense as well) was positively and significantly related to all dimensions of the Big Five Verbal Test in both sex subgroups (tab. 2). Statistically significant negative correlations were also found between TP and DP-TC variables: in men with DP5 ($r$=-.31, $p$=.043) and in women: with PL1 ($r$=-.24, $p$=.045) and PL2 ($r$=-.29, $p$=.014).

**Table 2.** Correlations between time perception (TP) and Big Five dimensions test in both sexes

| Big Five dimensions | r (women) | r (men) |
|---|---|---|
| Introversion-Extroversion | .27* | .48** |
| Independence-Affection | .24* | .51** |
| Naturalness-Control | .27* | .51** |
| Emotional Stability-Emotional Instability | .33* | .51** |
| Practicality-Friskiness | .27* | .58** |

Note: Significance level: * – p ≤.05; ** – p ≤.01.

## Discussion

Since verbal behaviour does not always reflect real or dispositional behaviour [21], it was logical to expect a weak link between proprioceptive motor behaviour and verbal parameters of personality and individual differences. For this reason the statistically significant correlations that were found were of weak or moderate magnitude. Though some researchers [24] have investigated sex differences in sensory integration (vision and proprioception), little attention is paid to motor control in psychology, as Rosenbaum states [25]; few or almost no studies have been done in this context.

Whereas ANOVA showed one statistically significant difference between sex subgroups for all performed variables, the greatest difference between men and women was for fine motor precision performance (DP3) in the cultural subgroup under examination. As for motor control (proprioceptive parameters of the DP-TC test), in DP3 (transversal movement, non-dominant hand) men showed a tendency towards the external world (Extra-tension) compared to women, whereas this tendency was less accentuated in the non-dominant hand (5.51±16.45 mm in men; -0.54±17.62 mm in women); in DP4 (transversal movement, dominant hand), the average value in men shifted more towards intra-tension, and was even slightly higher in absolute error compared to women (-2.86±16.93 mm and -1.90± 13.88 mm, respectively).

In frontal movement and directional bias, men shifted towards the pessimism pole (Mood dimension of DP-TC): performance in their average group value in the dominant hand (adaptive behaviour, character): -7.19±22.53 mm vs. -2.72±19.04 mm in the non-dominant hand, while women performed quite similarly for both hands. Similar hand performance in fine motor precision (hand incongruences) was observed in secondary bias, DS1 and DS2, with a shift towards slightly more positive values in men and more constant behaviour in women.

Concerning sagittal movement (directional bias), men, to the contrary, exhibited a more stable error in precision for both hands (13.84±14.51 mm in non-dominant and 13.14±13.13 mm in dominant), whereas women performed with the dominant hand quite similarly to men with an average error of 13.27± 13.50 mm, while doing slightly worse with the non-dominant hand (15.27±14.10 mm), shifting more from their body position. In line length (LL) performances both men and women performed slightly worse with the non-dominant hand, while line length variability (VL) was greater in the dominant hand in both sexes; however these differences did not reach a statistically significant level.

In the time perception test, participants were asked to estimate (by perception, not by counting or taking into account other external/internal indicators of time) when 1 minute had passed. The results were supposed to reflect a more internal (proprioceptive and individual) clock. Both male and female participants underperformed 60 seconds, showing average group results that were slightly less in women (37.35±20.88 sec vs. 43.29±24.92 sec); however this difference did not reach a statistically significant level. The relationship between TP and individual (personality) traits was moderate and significant.

## Conclusions

The fact that personality (Big Five Test) verbal parameters, as well as TP, were related to the same DP-TC variables within each sex subgroup, but to different variables (and movement types) in men and women, as was shown in the results section, suggests that they express their individual traits in different ways. However, one of the limitations was the Big Five Test: Its dimensions were inter-correlated, not totally independent. Thus, this is one possible explanation why all significant correlations of the Big Five Test were correlated to TP and specific DP-TC variables or movement types: sagittal movement (non-dominant hand) in men and line length variability (both hands) in women. Since TP had significant correlations with the same variables of the DP-TC test as the Big Five dimensions, TP could be considered as a personality indicator within express-diagnostics.

The current study results showed the existence of some moderately significant differences between male and female proprioceptive and verbal parameters of individual differences. Moreover, fine motor behaviour was expressed distinctly in relation to personality and individual differences in each sex subgroup. These exploratory findings could help to shed light on and contribute to an understanding of the nature of the differences between the sexes, leading to the application of different approaches in education and coaching in order to obtain better and more effective results. More studies are required to determine how different verbal tests (which reflect a more desirable level of self) are related to motor proprioceptive test (which reflect a more dispositional attitude towards one behaviour or another).

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