CASE STUDY

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QUANTITATIVE AND QUALITATIVE PROPRIOCEPTIVE ANALYSIS OF INDIVIDUAL DIFFERENCES: A CASE STUDY OF MULTIPLE SCLEROSIS

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SUMMARY

Background: Proprioceptive Diagnostics for individual neuropsychological differences, as a basis for temperament and character, was developed within the Mira y Lopez tradition of myokinetic psychodiagnosis, and both theoretical and experimental works in the Mira y Lopez Laboratory of the University of Barcelona using new technologies. Some quantitative parameters observed in proprioceptive fine motor behaviour and other information (qualitative) can be used during test performance. The qualitative aspects of the graphomotor performance of a participant with multiple sclerosis (MS) was distinct from that of hundreds of other individuals with no such diagnosis.

Material/ Methods: Proprioceptive Diagnosis of Temperament and Character (DP-TC) was used to observe fine motor behaviour in proprioceptive test conditions. The size and spatial deviations of a participant's performance were distinguished from models, with and without vision, whereas a qualitative analysis (global graphical behavior) provided important complementary information.

Results: In the lineograms of left hand (right hemisphere) in frontal movement in the proprioceptive sensory condition, the linearity of lines was disrupted: the subject drew non-linear forms, curves, sometimes figure-eights, and in parallels, he drew intersected lines instead.

Conclusions: If quantitative parameters are important in order to obtain the general individual neuropsychological profile, qualitative information regarding fine motor behaviour in proprioceptive sensory conditions could provide a specific pattern of importance in preliminary neurological examinations, and at lower cost. Also, this examination could help medical workers to discover the hidden patterns of any neurological pathology, and psychologists to identify any specific individual organization in proprioceptive spatial perception.

Key words: proprioceptive diagnostics, myokinetic psychodiagnosis, qualitative analysis, quantitative analysis, spatial perception

INTRODUCTION

In studies carried out to develop the Proprioceptive Diagnosis of Temperament and Character test (Spanish abbreviation: DP-TC), exploratory factor analysis (Tous, Viadé, & Muiños, 2007) and subsequent confirmatory factor analysis (Muiños, 2008) showed that the instrument had six orthogonal bipolar factors:

1. Mood (from pessimism to optimism, with depression and mania at the poles);
2. Decision-Making (from submission to dominance, with self- (directed to one self) and hetero- (directed to others) aggressiveness at the poles);
3. Attention Style: Intra-tension and extra-tension (from inward to outward, with high self-absorption and high distractibility at the poles);
4. Emotivism (from cold/distant to empathy/affiliation);
5. Irritability (from behavioral inhibition to behavioral excitability);
6. Variability (from rigidness to variability or flexibility in behavior).

These factors are different from those that can be obtained from verbal tests, since they correspond to how a person really behaves, rather than to what he/she thinks about his/her behaviour. As Kagan argues (2005), if our goal is to make reliable predictions about behaviour and to intervene effectively in it, it is more important to know how a person behaves than it is to know what that person thinks about him or herself. Moreover, as Shibutani said (cited by Miroshnikov, 1963), "the person should be determined in terms of his/her potential activity, and not what is seen by others." Real behavioral trends can be repressed. These hidden internal behavioral trends are reflected in motor function (Luria, 1932). Miroshnikov (1963), in his review of the scientific literature, described the psychological reactions that led to or were related to specific motor actions:

- *increased movement amplitude* could be a way of expressing anxiety, fear, anger, happiness, exaltation or other psychomotor excitability caused by various sources, including pharmacology;
- *deterioration of motor control* may be due to fatigue, worsening of both concentration of attention and sensorimotor coordination mechanisms;
- *decreased volume (or amplitude) of movement* was related to deterioration of motor control, with increased inhibitory impulses that led to rigidity of movements, which were observed in any asthenic states related to depression and high anxiety;
- *tempo*: conservation or stability (especially when changes occur in the environment) were related to the stability of conative force;
- *increased muscular tonus*: as a reactive protection in situations of anxiety, fear, insecurity and timidity, when the person experiences intrapsychic tension; this "demobilization," reflected in muscular hypertonia, can provoke depletion of the emotional-conative sphere, passivity and depression;
- *movements in the vertical plane*: dropping the hands and changing the posture due to gravity reflected a loss of psychomotor tonus; thus movements directed downwards denoted fatigue, unwillingness to fight or apply force, depression; on the contrary, an upright body position and the capacity to han-

dle the extremities at the same level meant activity and vitality. When the person felt psychomotor excitation (strong fear, anger and happiness), he/she had a tendency to move the hands up;

- *movements in the vertical plane:* active interest in any subject/object in the visual field was related to movement towards that subject/object; however, the highest reaction in this movement occurred when the person had strong emotions and a drive to remove the source of danger or barrier (aggressive behavior); on the other hand, a passive reaction to it, or a wish to be hidden or culpability, provoked "inward" movements (introjective aggression);
- *movements in the horizontal plane*: movements tending outwards were related to exteriorization and more social contact, while movements inwards were related with submerging into the interior world (interiorization);
- *motor disorganization*: visual or latent chaotic distribution of muscular tonus was related to behavioral disorders (mainly due to affective causes, when the perception was changed and kinesthetic control affected); here also the "psychological blockade" can be observed: paralysis of movement with high muscular tonus.

Experimental work with the use of the myokinetic method was also used to study individual differences in frustration (MacKinnon & Henle, 1948) and interhemispheral motor asymmetry in patients with schizophrenia and neurosis (Efremov, Sluchaevskii, Popov, Rozenfel'd & Dunaevskaia, 1982) and in healthy participants to study their tolerance of and adaptation to environmental changes (Berezin, 2011; Ezhov & Krivoshchekov, 2004; Draganova, 2007). This psychomotor method has been reported to be informative in behavioral changes to stress.

Thus proprioceptive methodology can be also used to measure individual profiles based on their neurological and physiological characteristics, which are reflected in psychological and behavioral types. Some quantitative measurements of special biases that appear to be a base of the psychological skeleton of individuum, also qualitative analysis can be done (any specific non-regular performances can be observed during the test performance). Some studies with Mira y Lopez's PMK were conducted to see the qualitative changes in fine motor behaviour related to intoxication (Binois & Lefetz, 1962; Alonso Fernandez, 1968).

METHODS

Specific instructions for performing the DP-TC test (Figure 1)

Lines (lineograms)

The following instructions were used in the task for all six lineogram (Fig. 2) segments, representing the three measured directions for each hand:

> Please trace over the model line from the starting point to the end; then trace back to the starting point without stopping. Repeat these movements, trying to reproduce the model line as accurately as pos-

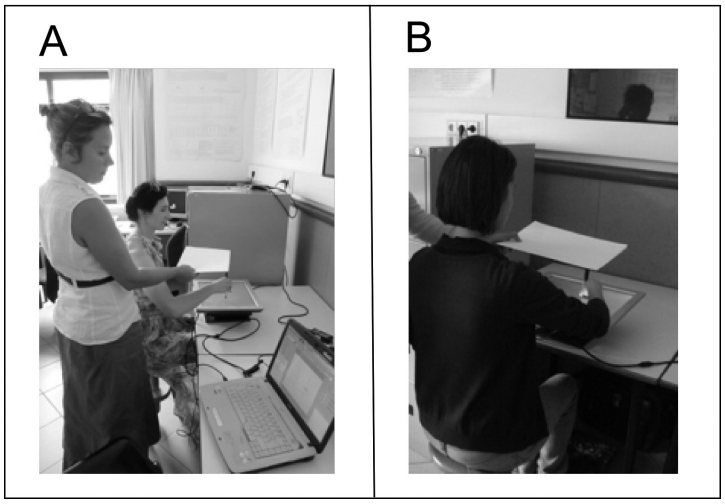

Fig. 1. The DP-TC test (right hand, transversal movement type in proprioceptive sensory condition. A: Photo by Plotka Anastacia, used by permission; B: Photo by Liudmila Liutsko

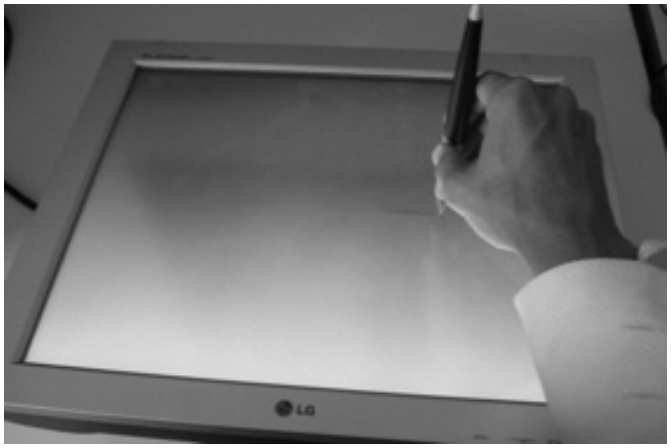

Fig. 2. Line tracking over the model (right hand, transversal movement type, visual sensory condition). Photo by Luidmila Liutsko

sible. At first you will be able to see the model line, but after some trials a piece of cardboard will be placed between you and the screen. You will not see your hand position or the line model, but you will have to continue drawing the lines as before without stopping. While performing each task, do not lift your stylus until the end of the task.

Parallels (Figure 3)

You will first have to track first lines, from the inside end to the outside, lifting the stylus at the end of each line. You will need to follow

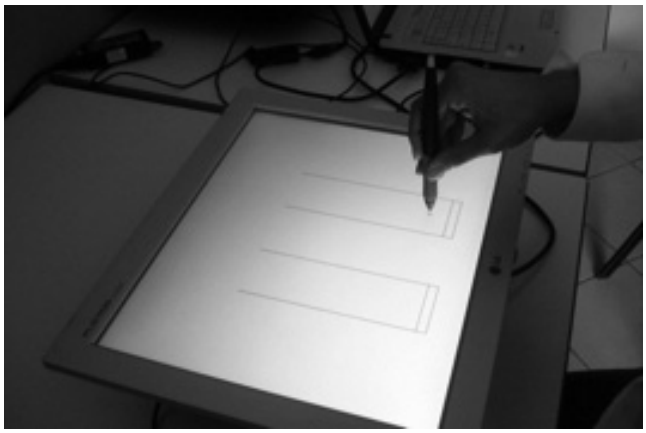

Fig. 3. Before performing the DP-TC test: stimuli – parallels; right hand, transversal movement type, visual sensory condition. Photo by Liudmila Liutsko

the drawing of parallel lines up and down (depending on whether they are ascending or descending), preserving their length and the distance between them as initially drawn (or traced). After several trials with vision, you will not be able to see the model or your active hand; however, you will have to continue until the signal or command is given to stop.

General instruction to start:

Point with the stylus to the dot you see at the beginning of the model, and when you are at the correct start position (for everyone it is the same point), the line color will be changed from red to green. At that moment, please do not move your hand or lift it; I will press the record button and give you a signal to start tracing.

RESULTS AND DISCUSSION

The two participants whose proprioceptive graphomotor performance on the DP-TC test will described below, participated as volunteers (among a total of more than 100) in research related to the topic "Proprioception and individual differences," realized in the facilities of the Regional Epidemiological Center at Brest, Belarus. However, the performance of these two persons (Participants A and B) was qualitatively distinct from that of the other volunteers. Their stories are explained below in order to have a descriptive exploratory neuropsychological report.

Participant A (male, 31 years old)

This individual has a diagnosis of multiple sclerosis (MS) and had a fall from a high tree at age 18 (from personal interview). The DP-TC test (and the related

psychological profile) showed qualitatively only one parameter that was at the border of normality and pathology, having a standardized T-mark of 80 (where the T-range from 40 to 60 describes 67% of the population): fluctuation in behaviour, or the Variability scale and the Irritability scale. He had T=80 for these scales for both hands. The deviations for the rest of the scales were those of the majority of people, quite normal, with a slightly higher tendency to optimism in the Mood scale (see Fig. 4 for his psychological skeleton). However, the qualitative analysis of his DP-TC performance showed "rareness" in two cases:

- First, in the lineograms of frontal movement type by the left hand (right hemisphere) in the proprioceptive sensory condition (without visual control), the linearity of lines was disrupted: he drew non-linear forms, curves, sometimes similar to figure-eights.
- The second and stronger indicator was when he drew intersected lines in the part of the test where they should be parallel.

Participant B (female, 13 years old)

This was the second and the last person from this group (of 114 participants) who was observed to perform the same curved drawings instead of lines in the lineograms (Participants A and B took the DP-TC test several days apart). The most surprising thing was the remarkable similarity of drawing curves, which was repeated for the same hand and movement type (frontal movement, left hand). This girl had no observed behavior similar to the symptoms of multiple sclerosis (this disease usually develops and is diagnosed later, from 20 years old) and she kept the line parallel in another part of the test; however, she demonstrated

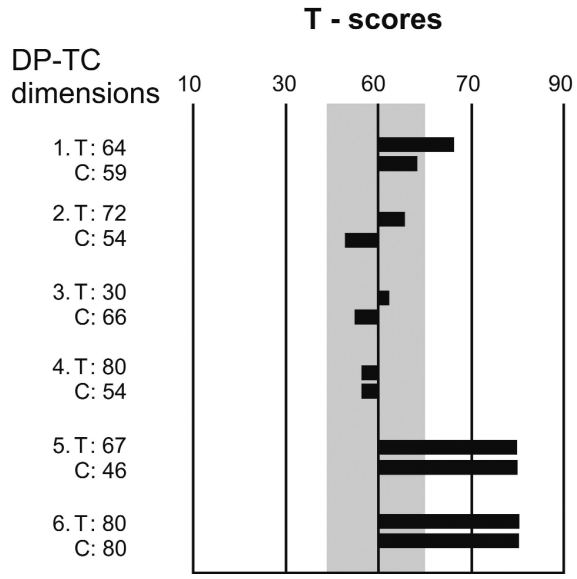

Fig. 4. The psychological skeleton with T-scores of Participant A (male, 31 years of age)

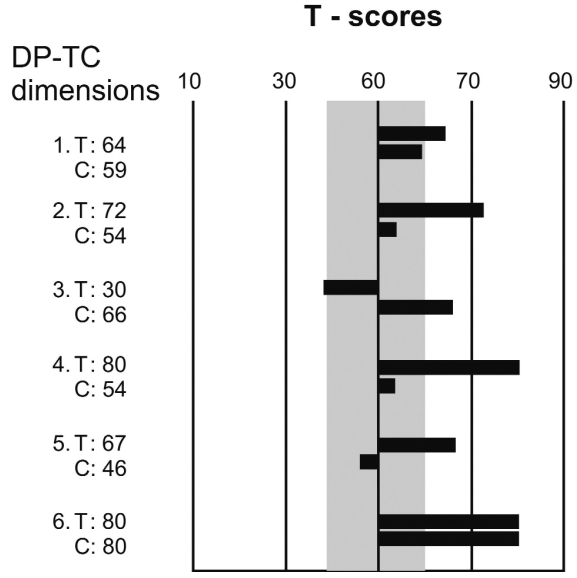

Fig. 5. The psychological skeleton with T-scores of Participant B (girl, 13 years of age)

a difficulty of upright posture throughout the whole test (15-20 minutes). As for the quantitative and psychological skeleton, she showed a similarity to Participant 1 in her temperamental tendency to optimism and „ca lear„ temperamental tendency to Irritability. As concerned the Impulsivity scales, their scores were actually identical: T=80 (borderline pathology) for both hands (see Fig. 5 for the psychological skeleton image). Another distinct indicator of her DP-TC profile, which was as high as the Impulsivity scale, was Emotivism for non-dominant hand, showing temperamental predispositions, though stabilized by her character within norms. Perhaps both a high capacity to natural Emotivism together with high Impulsivity explains why she attends art school and is an original and unusual artist (in drawing and painting). Nevertheless, one thing in drawing the line by left hand in frontal movement was very similar to the Participant A. During the interview with her mother, we asked if she remembered her daughter ever falling from a high place. The answer was affirmative: when she was 3 years old, she was pulled down by a boy as they played together on stacked construction materials; however, the height was not as great as an average tree.

CONCLUSIONS

In this particular observation of graphomotor fine behaviour in the proprioceptive test condition (when the subject does not see his/her active hand for graphic feedback, and thus cannot rectify his/her movements), we made the following observations that could be used an exploratory neurological screening:

- curves instead of lines in lineograms drawn by left (non-dominant hand) in frontal movement in participant A and B (and both had experienced falls earlier in their biographies);
- crossed lines instead of parallels could be a neurological marker of multiple sclerosis.

To sum up, qualitative analysis is important for detecting some neurological disturbances, as was shown here on the example of a multiple sclerosis case and the possible effects of falling down or other neurological damage. Further studies are required to confirm the hypotheses arising from these clinical, individual observations:

- whether intersections of lines instead of parallel occur in all (or the majority) of patients with multiple sclerosis; and
- whether non-linear representation of lineograms by the left (non-dominant) hand in the frontal movement type and proprioceptive sensory condition of the DP-TC test can help detect other neurological problems related to significant falls.

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