

The identification of temperamental factors in the graphical analysis of the testing of neuro-motoric control

VESCAN GEORGE¹; de HILLERIN PIERRE JOSEPH²

¹University of Pitesti, Department of Physical Education and Sport

²University of Pitesti, Department of Physical Education and Sport; Space Sciences Institute

Published online: November 24, 2017

(Accepted for publication November 15, 2017)

DOI:10.7752/jpes.2017.s5260

Abstract: *Problem Statement:* The idea of this study came from the need to find a tool for identifying temperamental factors in the analysis of a predetermined motoric task. Because classical psychological testing has some drawbacks. The tendency of athletes to provide social desirable answers, the fact that psychological personality tests are not calibrated for performance athletes, the long duration of the test, the fact that answers also depend on the intellectual or self-knowledge level of the subjects are a few examples of the drawbacks. On top of that, the method of structured observation can be affected by the observer's subjectivity. On the other hand, the analysis of a predefined set of physical movements established in the neuro-motoric control test was considered able to highlight the psychological factors that underlie the internal regulation of a person. *Aim:* Identification of temperamental factors that are significant in the motoric behavior observed in the neuro-motoric control test.

Methods: The task was to follow a predefined model of -5N (the level of force that the athlete must maintain throughout the length of the traction). The device is adjusted according to the anthropological parameters of the athlete. The neuro-motoric response is recorded graphically. The information given by the force (daN) was transformed into a mathematical and graphical language that could be analyzed from the point of view of the dimensions of the indicative function (over-regulation and stationary error) [3], which in turn are interpreted according to their intensity, from the perspective of the Proportional, Derivative and Integrative components of the PID regulator system [1]. The latter were compared with the psychological factors that have a major influence on the motricity: N.A.E. (nervous activism energy) I.F. (inhibitory force) and E.M. (emotional ability) [2]. Knowing the intensity of these factors determined the characteristics of the motoric behavior and the type of temperament the subjects.

Results and discussions: It should be noted that if the requirements for the execution require only a small application of force and if the individual anthropological parameters are adapted to the neuro-motoric control device during execution, only the differences in the control of a constant force, the neuro-motor coordination, have a psychological significance. There are differences in the neuro-motoric control from one subject to another due to emotional, nervous or inhibitory intensity.

Conclusions: The graphical analysis method in the neuro-motor control test was validated by the method of statistical calculation of the indicative sizes as well as the results of the psychological tests and by the structured observation method.

Key words: neuro-motor control, testing, regulation, functions, temperament.

Introduction

Athletes show their motricity in a special environment and with specific requirements where the adjustment of the neuro motoric device greatly influences the performance. On top of that the temperamental factors specific to motricity assert their individuality in the athletes' motoric behavior [2]. This paper analyses these observations and checks whether the performance on the simulator of conditions for water sports can determine the intensity of temperamental factors involved in the neuro-motoric control and the assessment of the temperamental type. In the end, the results obtained in this way can be compared and thus checked with the results of the psychological tests. Due to the specific needs in the field of competitive sports, the issue of regulation and self-regulation of the psycho-neuro-motoric structures is of contemporary and scientific interest.

Material and Methods

12 athletes subjects were tested. The testing of neuro-motoric control took place on the same day. To be able to control as many of the factors that can influence the results of the research, the following aspects were considered: From the perspective of psychosocial factors: all athletes were instructed in the same way. In addition to the verbal explanations, the task was demonstrated. No further instructions or explanations were made during the tests; it was forbidden to have other people in the room except of the athletes and the researchers.

From the perspective of technical factors: the neuro-motoric control testing device had been checked beforehand; a visible pattern was chosen on the screen and contrasting colors were used with the background. An optimal microclimate had been attempted: by preserving a no-noise environment with adequate light. Testing took place between 12: 00-15: 00, the factor - the moment of the day - being considered. From the sample perspective: all subjects had the age between 16 and 19. The degree of novelty for the experiment was the same for all the athletes in the sample.

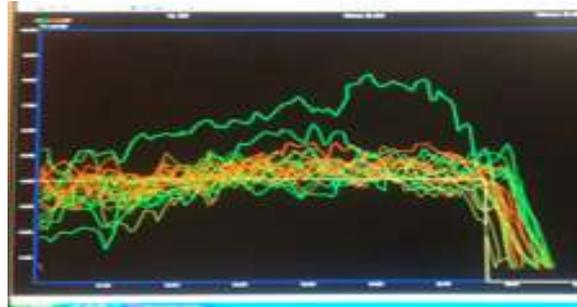


Fig. 1. Gross information from the neuro-motor control sample

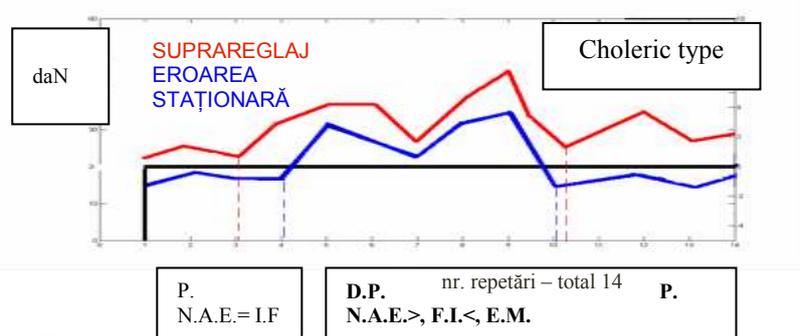


Fig. 2. Gross information transformed: graph of the indexed and interpreted sizes

Graphical analysis from the perspective of the sizes of the indicial function (over-regulation over-regulation and stationary error), which in turn are interpreted according to their intensity, from the perspective of the components of the regulating system P.I.D. Finally, they are compared with the temperamental factors N.A.E., I.F. and E.M. These results were compared with the psychological evaluation and the systematic observations during trainings and matches

Table 1. Comparing the intensity of the over-regulation with the PID control components and temperamental factors

SIZE INDICIALS	ADJUSTMENT P.I.D.	TEMPERAMENTAL FACTORS
OVER-REGULATION LARGE	$P \leq, I <, D >$	Choleric type I.F.<, N.A.E.> E.M.>
OVER-REGULATION OPTIMUM	$P \geq I = D \geq$	Sanguineous type N.A.E.>, E.M.>, I.F.>
OVER-REGULATION SMALL	$P \leq, I >, D <$	Phlegmatic type I.F. >N.A.E.>, E.M.<
SUPRAREGLAJ BELOW THE MODEL	$P <, I >, D <$	Melancholic type I.F. >N.A.E.< E.M.<

Table 2. Comparison of the intensity of the stationary error with components of PID control and temperamental factors

SIZE INDICIALS	ADJUSTMENT P.I.D.	TEMPERAMENTAL FACTORS
STATIONARY ERROR LARGE	$P \leq, I <, D >$	Choleric type I.F.<, N.A.E.>, E.M.>
STATIONARY ERROR OPTIMUM	$P \geq I = D \geq$	Sanguineous type N.A.E.>, E.M.>, I.F.>
STATIONARY ERROR SMALL	$P \leq, I >, D <$	Phlegmatic type I.F. >,N.A.E.>, E.M.<
STATIONARY ERROR BELOW THE MODEL	$P <, I >, D <$	Melancholic type I.F. >,N.A.E.<, E.M.<

Results

The graphical analysis of the neuro-motoric control test shows the following characteristics of the motoric control that are specific to one of the temperamental types, as follows: When most of the subjects tested are far above the over-regulation model, it shows that the intensity of N.A.E. is high and I.F. is low, due to the small component I (integrative) and the accentuated component D (derivative). The amount of stationary error is slightly above the pattern, which shows that the subject manages to have a good setting in the end but with an extra energy cost. This result shows a Choleric type of motoric behavior [2].

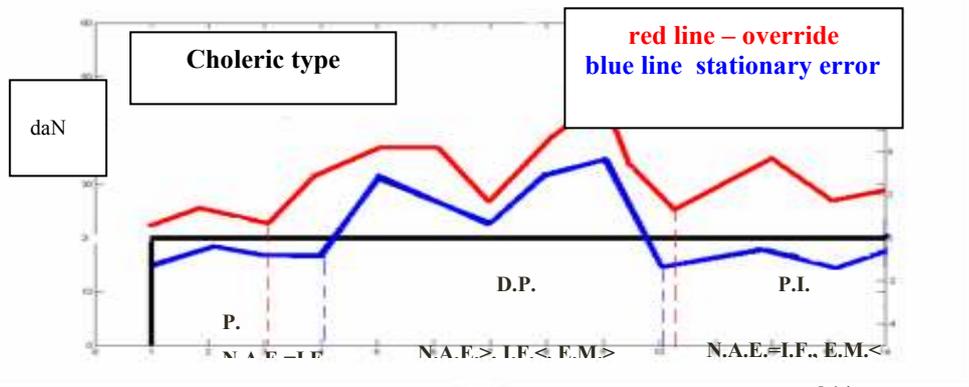


Fig.3. Graphical pattern of choleric typologies no. reps – total 14

If the subjects managed to follow the model well, and over- adjustment and stationary error were a little over the model, it shows the balance of psychological factors that can be compared with an efficient type of P.I.D.; even if the N.A.E. factor is emphasized, E.M. and I.F. due to their intensity, succeed in regulating the high intensity of activism. This are specific aspects of the Sanguineous type [2].

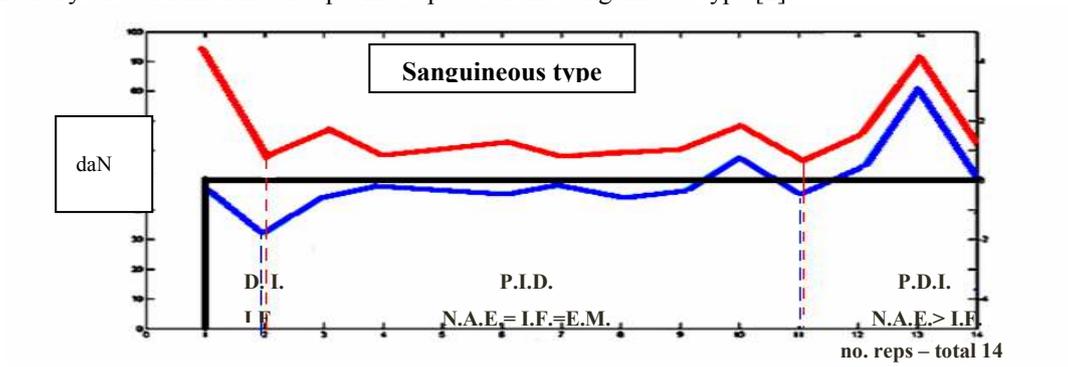


Fig.4. Graphical pattern of sanguineous typologies

When over-regulation is often under the model, and the stationary error also under the model, this is a consequence of a large component I, which means that I.F. is emphasized. This aspect reduces N.A.E. and E.M. This t t shows that these subjects are cautious and inhibited by new tasks that require speed and spontaneous reactions. The subjects that show these types of reactions are part of the Phlegmatic typology. [2].

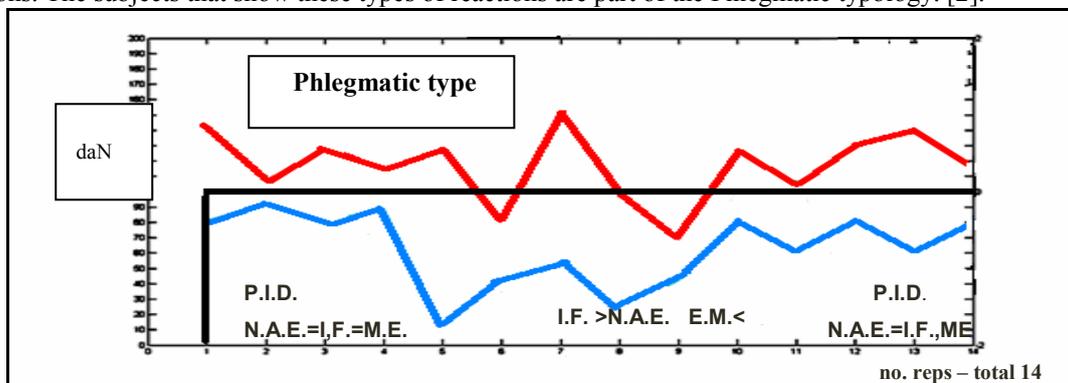
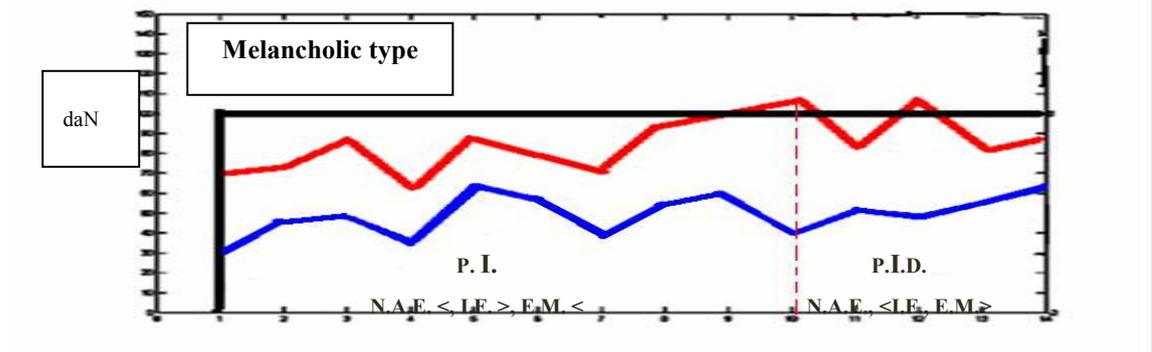


Fig.5. Graphical pattern of phlegmatic and melancholic typologies

When over-regulation and stationary error are far below the model, this does not mean that subjects of this typology have no force, but they have an inability to adjust or coordinate quick enough for the task of the exercise. The I.F. factor is so large that the subject is not able to do the task at hand the emotional inhibition

reduces N.A.E. and E.M. is so small that the subject does not find the needed resources to change the emotional / nervous state and therefore fails to find quick solutions. This are issues typical of the Melancholic type [2].



Conclusions

From the neuro-motoric control test, one can obtain a tool for identifying the main psychological factors that greatly influence motoric behavior and that can characterize the temperament typology without using the classical tests: questionnaires, paper-pencil tests but by only analyzing neuro- motricity [2]. Thus, aspects of the motoric behavior that originate in the biological, instinctive area of temperament can be examined without the use of answers that are filtered through educational, cultural filters, etc., ... After several attempts (20-40 executions), all subjects succeed in following the exercise model. Because by then the subjects have learned how to follow the model, the results no longer reflect the individual's temperamental factors, thus exceeding the goal of our research. By comparing the results of neuro-motoric control testing with the results of psychological testing and direct observations we consider the method to be effective and valid.

Acknowledgments

The idea of information's identification regarding the psychological meaning of the neuromuscular test analysis belongs to PhD professor de Hillerin Pierre Joseph (2010).

Special appreciation for Prof. Univ. Dr. Pierre Joseph De Hillerin who observed psychological aspects in neuro-motoric responses of athletes in neuro-motor control training. Thank you, Miss Andra Baltoiu, a researcher from the National Research Institute for Sport, who helped me to understand how self-regulation systems work and how to calculate mathematical models.

References

- Mihoc, D., Ceaparu, M., & Borangiu, T., 1980, *Theory and elements of automatic regulation systems*. Bucharest: Didactic and Pedagogical Publishing House.
- Vescan, G. A., 2016, *Report no. III: Study of the possibility of identifying the psycho-neuro-motor characteristics by driving samples*. Unpublished Manuscript.
- <https://www.mathworks.com/help/control/ref/stepinfo.html?RequestedDomain=www.mathworks.com> (accessed on 15/10/2017)