

Canonical correlation between personality traits and intellectual abilities of dancers

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1. Introduction

Conative characteristics and cognitive abilities as segments of psychological features of human beings, do not exist independently, but are manifested in the complex interaction with other abilities. Covariability of different abilities is caused by the activity of various functional structures, which are to greater or lesser extent mutually dependent. One of the primary indications that are present in various forms of behavior, is orientation towards the achievement of a purposeful aim. Every meaningful behavior necessarily implies the optimal integration of functional structures of the central nervous system. One of the most frequent attempts in explaining the relationship between conative characteristics and cognitive abilities is based precisely on emphasizing the functions of the central nervous system.

The central nervous system has primarily an integrative function and enables meaningful and adaptive behavior of human beings. The most important is the integration at the cortical level, since purposeful behavior is directly related to

the integrated function of the cortex. The integration also exists at the subcortical level, although it is less flexible. The integration of functions at the subcortical level enables reaction in standard situations, that is, situations which require automatic reaction. Cognitive processes and cognitive functioning are central mechanisms of the cortical regulation.

The relationship between the conative and cognitive fields at the level of regulatory mechanisms is difficult to explain, first of all, due to the lack of sufficient amount of information about the function of the mechanisms. Another problem is of methodological nature, and it is reflected in the choice of the adequate models of analysis of the collected data.

For this reason one of the aims of this research was to determine the relations and interconnection of the two sets of data, one of which relates to the personality traits of examinees, and the other to the evaluation of cognitive abilities of the examinees.

2. Research methods

2.1. The sample of examinees

The sample of examinees is conditioned by financial capabilities necessary for the research procedure. Besides, the sample depends on the number of qualified and trained measurers, on the instruments and standardized conditions in which the planned research may be realized.

In order to conduct a correct research with satisfactorily stable results, in the sense of sampling error, it is necessary to include a satisfactory number of examinees into the sample. The size of the sample for research of this type is as well conditioned by the aims and tasks of the research, size of the population and the degree of variability of the applied system of parameters.³⁰

According to the selected statistical-mathematical model and the aim of the research, the sample of examinees included 131 female dancers and 136 male dancers, aged from 11 to 13, actively engaged in standard and Latin American dances in the Serbian dancing clubs.

The size of the so defined sample should satisfy the following criteria:

- the effectiveness of the sample should be planned so that it enables as many degrees of freedom as necessary for any coefficient in the pattern

30 Popović, D.: Determining the structure of psychosomatic dimensions in fights and developing the procedures for their evaluation and monitoring - The Monograph, the Faculty of Physical Education, University of Priština, Priština, 1993.

or correlation matrix, which is equal to or bigger than 0.22, to be considered different from zero with an inference error less than 0.01.

- in order to successfully apply the adequate statistical methods according to the latest convictions, the number of subjects in the sample must be five times bigger than the number of the applied variables.

During all factor procedures, it should always be kept in mind that the results of the analysis depend on three major systems which determine the selection and transformation of information: the sample of variables, sample of examinees, and the selected extraction, namely rotation, method.³¹

2. 2. The sample of variables

2. 2. 1. The sample of personality variables

For estimating personality dimensions the following measuring instruments have been selected so that they may cover the dimensions of the model of the functioning of conative regulatory mechanisms. The model implies hierarchical organization of the mechanisms for regulation and control of behavioral modalities, and it is constructed so as to avoid an artificial dichotomy to normal and pathologic factors.

The selected measuring instruments are:

- 1) Activity regulator (EPSILON)
- 2) Regulator of organic functions (HI)
- 3) Regulator of defensive reactions (ALFA)
- 4) Regulator of offensive reactions (SIGMA)
- 5) System for the coordination of regulatory functions (DELTA)
- 6) System for the integration of regulatory functions (ETA).

The mechanism for activity regulation is one of the elementary and lowest positioned systems in the hierarchy. Its function is regulation and modulation of activating function of the reticular formation; therefore, it is responsible for the activity and energy level according at which other subsystems, including cognitive processes, function.

Disorders of this system can form the energy basis for hypomanic or depressive reactions and they probably affect the speed of information stream in the central nervous system.

31 Popović, D.: Determining the structure of psychosomatic dimensions in fights and developing the procedures for their evaluation and monitoring - The Monograph, the Faculty of Physical Education, University of Priština, Priština, 1993.

The mechanism for regulation and control of organic functions is defined by the effectiveness of the coupling between subcortical regulation functions of the organic systems and higher-ranking cortical systems for regulation and control.

Disorders of this system are manifested by a functional disorder of the primary organic systems, such as cardiovascular, respiratory and gastrointestinal systems, as well as they are manifested by functional disorders of input and output operations.

The mechanism for regulation and control of defensive reactions is defined by the appropriate modulation of tonic arousal, probably based on the adequacy of the programs of genetic origin or formed during the evolution and positioned in the center for regulation of defensive reactions.

Disorders of the system for regulation of defensive reactions are manifested by various symptoms of anxiety and they form the basis for specially modulated pathological reactions such as phobia, obsession and compulsion.

The mechanism for regulation and control of offensive reactions is also defined by the appropriate modulation of tonic arousal, based on the adequacy of the programs transmitted by the genetic code or formed under the influence of conditioning and positioned in the center for regulation of offensive reactions.

Disorders of the system for regulation and control of offensive reactions are manifested in various aggressive reactions and in poor control of immediate impulses.

The mechanism for homeostatic regulation is determined by the coordination of activities of functionally and hierarchically different subsystems, including, especially the coordination of functions of conative regulatory system and intellectual processors. Owing to this, homeostatic regulatory system is functionally superior to the systems for regulation of organic functions, defensive and offensive reactions, and it controls the processes occurring in the system for excitation and inhibition regulation.

The disorders of the system for homeostatic regulation cause dissociation and disorganization of conative and intellectual processes, including motor functions that depend on the system of movement structuring.

The mechanism for integration of regulatory functions is responsible for the integration of conative regulatory processes under the guise of the structure of the social field and changes within it. The set of programs which determine its functioning is formed mostly during the educational process. Social disadaptation is an immediate consequence of the functioning of this mechanism.³²

32 Popović, D.: Determining the structure of psychosomatic dimensions in fights and developing the procedures for their evaluation and monitoring - The Monograph, the Faculty of Physical Education, University of Priština, Priština, 1993.

2. 2. 2. The sample of cognitive variables

For estimating cognitive dimensions, the measuring instruments are selected so that the cybernetic model can be covered, paying attention to the fact that the selected tests can measure three types of cognitive processing.

For estimating the efficiency of the input processor, or perceptual reasoning, this test has been selected:

IT-1: the test for matching the drawings is designed for the evaluation of the perceptual identification and discrimination. The test consists of 30 tasks, and the test execution time is limited to 4 minutes. The analysis of the test has revealed that the difficulty of the tasks and their intercorrelation indicate that this is a typical speed test.

For estimating the efficiency of the parallel processor, or identification of relations and correlates, the following measuring instrument has been selected:

S-1: the spatial reasoning test is designed for the evaluation of rapid simultaneous education of spatial relations. It consists of 30 tasks, where it should be determined which of the 4 transversal projections of the brick cluster corresponds to the specified picture of the brick cluster. The test execution time is 10 minutes.

For estimating the efficiency of the serial processor, or symbolic reasoning, the following measuring instrument has been selected:

AL-4: the synonym-antonym test is designed for the evaluation of identification of the denotative meaning of verbal symbols. It consists of 40 tasks of double-choice format. The test execution time is 2 minutes, therefore this test belongs to the category of speed tests. The first main subject to measure is defined mostly by the tasks from the second half of the test and interpreted as the ability of rapid identification of the denotative meaning of the verbal symbols.

2. 3. Methods of data processing

All the data collected in this research were processed in the Multidiscipline Research Centre of the Faculty of Sports and Physical Education, the University of Priština, supported by the system of data processing programmes developed by D. Popović, 1980, 1993, K. Momirović and D. Popović 2003.

For determining the relations of particular segments of the psychosomatic status of dancers, the canonical correlation analysis has been applied. However, it should be known that there are some difficulties in the application of the canonical correlation analysis especially during the interpretation of canonical variables. This interpretation is complex even when the canonical correlation analysis is used not only as a statistical method, but also as a method for the data analysis

which belongs to the general factor model. Statistically significant canonical dimensions do not have to be informatively important variables, which leads to new difficulties. Further on, the problem appears because the canonical factors do not have a simple structure, therefore the interpretation of those factors is also uncertain.

Some problems may appear in case of nearly singular sets of variables, because then the basic matrix for determination of canonical correlations and vectors of transformation of variables into canonical variables is very vaguely determined.

The algorithm applied in this research attempts to reduce to some extent most of the mentioned problems. It retains as interpretatively important only those canonical dimensions associated with canonical correlations, whose squares are bigger than the average coefficients of determination of any of the analyzed sets of variables determined on the basis of another set.

Furthermore, the algorithm transforms the retained canonical dimensions into the orthogonal parsimony position, which may also facilitate the interpretation of canonical factors, because after that transformation the vectors of canonical variables stretch the same common space.

This, as well, determines the canonical relations of the sets of variables after their transformation into the principal components with non-zero variances, thus avoiding the problem of incorrectly determined inverses of the correlation matrix of nearly singular sets of variables and then it facilitates the interpretation of canonical factors by explicit determination of the relations of those factors and principal components of the analyzed sets.

3. Results and discussion

In order to accomplish the analysis of the results, it was necessary to analyze, first of all, the relations within the sets, and then to find more detailed explanations through the analysis of partial correlations between the variables of one set and the variables of the other.

By examining (table 1) which shows cross correlations between the tests for evaluation of conative regulatory mechanisms and the instruments for evaluation of cognitive abilities, it could be noticed that significant correlation between the mechanism for integration of regulatory functions and the input processor is obtained.

By further analysis of cross correlations, it can be noticed that the greatest connection with a negative sign is between the system for activity regulation and efficiency of serial processing of information at the cognitive level, that is symbolical reasoning. Then follow the connections between the system for integration of regulatory functions and system for regulation of defensive and offensive reactions.

It may also be noticed that there have also been obtained negative correlations between the efficiency of parallel processing of information on a cognitive level and regulation of organic functions, and the regulator of defensive reactions, regulator of offensive reactions and coordination system.

By examining (table 4), it can be seen that two canonical correlations statistically significant at the level .00 are obtained. These two canonical correlations were sufficient to explain the connection between conative regulatory mechanisms and cognitive information processing.

The first canonical correlation, which is otherwise the largest information carrier, amounts .81 which is about 66% of the explained variance. Namely, predictor and criterion variables are in a high and statistically significant relationship.

The first canonical factor in the space of canonical dimensions, is best defined by the mechanism for estimating coordination and integration of regulatory functions. Then follows the mechanism for estimating regulatory organic functions, afterwards the mechanism for estimating the regulator of defensive and offensive reactions, and finally, the mechanism for activity regulation (table 2).

The corresponding canonical dimension is isolated from the space of intellectual variables, it is best defined by the tests for estimating the efficiency of parallel and serial processing on a cognitive level with a negative sign. (table 3).

The parallel analysis of the first pair of canonical factors in both sets leads to the conclusion that efficient recognition of relations and correlates as well as good symbolical reasoning is directly connected with proper functioning of the mechanism for coordination and integration of regulatory functions.

The second canonical correlation amounts .60 which is a total of 36% of the explained variance. The second canonical factor in the space of conative dimensions is bipolar, it is defined with a negative sign by the mechanism for activity regulation and the mechanism for integration of regulatory functions but it is also defined with a positive sign by the mechanism for coordination of regulatory functions.

The corresponding factor in the space of cognitive abilities is defined, to the greatest extent, by the efficiency of the input processor, that is perceptual reasoning.

By parallel analysis of these two factors, it may be concluded that perceptual reasoning is in direct relationship with the mechanism for excitation and inhibition regulation and it enables better information flow in the central nervous system of those people in whom this mechanism is stable, and extrovert and introvert behavior models are directly dependent on the functioning of this system.

CROSSCORRELATIONS BETWEEN CONATIVE CHARACTERISTICS AND COGNITIVE ABILITIES OF DANCERS

Table 1.

TEST	IT1	AL4	SI
EPS	.16	-.51	-.01
HI	.06	-.16	.20
ALF	.01	-.24	.26
SIG	.07	-.27	-.22
DEL	.16	-.17	-.26
ETA	.20	-.33	.00

FACTOR STRUCTURE OF PERSONALITY CHARACTERISTICS

Table 2.

TEST	CAN1	CAN2
EPS	.54	-.65
HI	.37	-.01
ALF	.50	.06
SIG	.03	.38
DEL	-.05	.60
ETA	.38	-.52

FACTOR STRUCTURE OF INTELLECTUAL VARIABLES

Table 3.

TEST	CAN1	CAN2
IT1	.11	-.64
AL4	-.58	.53
SI	.62	.47

CANONICAL VARIABLES

Table 4.

R	R-sqr.	Chi-sqr.	df	p	A
.81	.66	202.61	18	.00	.38
.60	.36	70.25	10	.00	.71

4. Conclusion

The research was conducted in order to determine the relations between personality traits and conative abilities of dancers occupied with standard and Latin American dances.

For determining the relations between the personality traits and cognitive abilities, 267 dancers, aged from 11 to 13, actively engaged in standard and Latin American dances, were involved.

For estimating personality dimensions, measuring instruments were selected so as to cover the dimensions of the model of the functioning of conative regulatory mechanisms. The model implies hierarchical organization of the mechanisms for regulation and control of the behavioural modalities, and it is constructed so that the artificial dichotomy to normal and pathological conative factors could be avoided.

For determining the latent structure of dancers the method of component factor analysis has been applied.

The following measuring instruments have been selected:

- 1) Activity regulator (EPSILON)
- 2) Regulator of organic functions (HI)
- 3) Regulator of defensive reactions (ALFA)
- 4) Regulator of offensive reactions (SIGMA)
- 5) System for the coordination of regulatory functions (DELTA)
- 6) System for the integration of regulatory functions (ETA).

For the evaluation of intellectual abilities, three measuring instruments were applied, previously selected so as to solve the structure analysis, on the basis of the cybernetic model of Das, Kirby and Jarman, respectively Momirović, Bosnar and Horge 1982, taking into account the fact that the chosen tests measure three types of intellectual processing.

For estimating the efficiency of the perceptual processor, test IT-1 was selected; for estimating the efficiency of the serial processor, test AL-4; and for estimating the efficiency of the parallel procession, test S-1.

All the data collected in this research were processed in the Multidiscipline Research Centre of the Faculty of Sports and Physical Education, the University of Priština, supported by the system of data processing programmes developed by D. Popović, 1980, 1993, K. Momirović and D. Popović 2003.

After conducting the canonical correlation analysis, statistically significant correlation between predictor and criterion variables was obtained. The first canonical factor in the space of canonical dimensions is best defined by the mechanism for estimating coordination and integration of regulatory functions. Then follows the mechanism for the assessment of regulatory organic functions and then the mechanism for the assessment of the regulator of defensive and offensive reactions and, finally, the mechanism for activity regulation. The corresponding canonical dimension is isolated from the space of intellectual variables, it is best defined by the tests for estimating parallel and serial processing of information on the cognitive level but with a negative sign. The second canonical factor in the space of conative dimensions is bipolar, it is defined, with a negative sign, by the mechanisms for activity regulation and for the integration of regulatory functions, and with a positive sign by the mechanism for the coordination of regulatory functions. The corresponding factor in the space of intellectual abilities is defined mostly by the efficiency of the input processor, respectively, perceptual reasoning.

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Summary

The research was conducted in order to determine the relations between personality traits and intellectual abilities of dancers occupied with standard and Latin American dances. In this research, 267 dancers, aged from 11 to 13, were involved. For estimating personality dimensions, some measuring instruments were selected so that they could cover the dimensions of the model of the functioning of conative regulatory mechanisms. The model implies hierarchical organization of the mechanisms for regulation and control of the behavioural modalities and it is constructed so that the artificial dichotomy to normal and pathological conative factors could be avoided. For estimating the dancers' latent structure, the method of component factor analysis was applied. The selected measuring instruments are: an activity regulator (EPSILON), the regulator of defensive reactions (ALFA), the regulator of offensive reactions (SIGMA), the system for the coordination of regulatory functions (DELTA), the system for the integration of regulatory functions (ETA). For the evaluation of intellectual abilities,

three measuring instruments were applied, previously selected so as to solve the structure analysis of the cybernetic model of Das, Kirby and Jarman, respectively Momirović, Bosnar and Horge 1982, taking into account the fact that the chosen tests measure three types of intellectual processing. For estimating the efficiency of the perceptual processor, test IT-1 was selected; for estimating the efficiency of the serial processor, test AL-4; and for estimating the efficiency of the parallel processor, test S-1. All the data collected in this research were processed in the Multidiscipline Research Centre of the Faculty of Sports and Physical Education, the University of Priština, supported by the system of data processing programmes developed by D. Popović, 1980, 1993, K. Momirović and D. Popović 2003. After conducting the canonical correlation analysis, the statistically significant correlation between predictor and criterion variables was obtained. The first canonical factor in the space of canonical dimensions is best defined by the mechanism for estimating coordination and integration of regulatory functions. Then follows the mechanism for the assessment of regulatory organic functions and then the mechanism for the assessment of the regulator of defensive and offensive reactions and, finally, the mechanism for activity regulation. The corresponding canonical dimension is isolated from the space of intellectual variables, it is best defined by the tests for estimating parallel and serial processing of information on the cognitive level but with a negative sign. The second canonical factor in the space of conative dimensions is bipolar, it is defined, with a negative sign, by the mechanism for activity regulation and for the integration of regulatory functions, and with a positive sign by the mechanism for the coordination of regulatory functions. The corresponding factor in the space of intellectual abilities is defined mostly by the efficiency of the input processor; that is, perceptual reasoning.

Key words: /input processor/integration/function/factor/reasoning/perception/mechanism/.

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