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APPROPRIATENESS AND LIMITATIONS OF FACTOR ANALYSIS METHODS UTILISED IN PSYCHOLOGY AND KINESIOLOGY - PART I

Abstract

The goal of the paper was to depict the status of FA from the historical and contemporary aspects of trait psychology and kinesiology research along with the guidelines for the use of FA methods. Researchers in psychology and kinesiology apply factor analytical methods in research of abilities and traits with the purpose of developing hierarchical theories of personality organization. However, limiting oneself to a single research approach with the purpose of developing a classification of abilities and personality traits is restrictive, determining our understanding of human behaviour according to a certain theoretical perspective. Furthermore, researchers in psychology and kinesiology have different approaches according to application of FA in identifying people's abilities and traits and to the number of abilities and traits used for describing personality. The development of research methodology which defines latent structural relationships inherently brings the necessity to reconsider appropriateness and limitations of factor analysis application in psychology and kinesiology. Statistical technique of factor analysis is used as a part of the nomothetic model to answer questions within the theory of abilities and traits which correspond to the personality structure in a more general sense. Through a problem-based approach, factor rotations, the possible ambiguity of the results obtained and the degree of correspondence between different research studies were considered. Furthermore, the appropriateness of strategies of the research approach in the usage of FA methods was illustrated. In accordance, examples of problems in the usage of FA methods were elaborated.

Key words: FACTOR ANALYSIS / APPROPRIATENESS / LIMITATIONS / FACTOR ROTATIONS / PERSONALITY STRUCTURE

INTRODUCTION

Factor analysis (FA) is for the trait theorists (Cattell, 1965; Eysenck, 1970, 1980a, 1980b, 1991; Momirović, 1971; Mejovšek, 1977; Fulgosi, 1984; Eysenck, & Eysenck, 1985), as well as for kinesiologists (Štalec, & Momirović, 1971; Viskić-Štalec, 1987, 1991; Malacko, & Popović, 2001; Dizdar, 2006) one of the most important statistical techniques in multivariate research. FA methods occur in theoretical and applied research alike with two primary purposes: the first goal is the description of inter-correlations of a larger number of variables in terms of fewer factors, that is, the exploration and detection of fundamental latent dimensions in certain areas - exploratory factor analysis (EFA); the second goal is to test the hypotheses or models about the number of factors responsible for the results obtained in the measurement procedure of a larger number of variables - confirmatory factor analysis (CFA). By CFA

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hypothetical theories or hypotheses derived from a hypothetical theory can be tested. This analysis developed only after exploratory factor analysis had become a completely objective procedure. This happened by introducing analytical rotations in exploratory factor analysis that have replaced subjective graphical rotations (Mejovšek, 2008). CFA presents a special analytical strategy - one in which presumption of factor structure of a measuring instrument or a theoretical construct is verified (Milas, 2009).

Metikoš, Gredelj, and Momirović (1979), as well as Schonemann (1990) express general opinion that either exploratory or confirmatory techniques of FA are the most appropriate procedures of determining latent dimensions responsible for co variability of multivariate systems, hence of determining basic anthropological characteristics and abilities. Furthermore, these authors also state that factor logic is not the only framework within which the research issue of motor abilities' determination could exclusively be solved. Yet, sensible application of confirmatory methods is possible only if hypotheses can be explicitly defined and if among numerous procedures of FA the most appropriate one to the researched issue has been found. Interpretation of the obtained results in the spirit of the exact meaning of the factor model parameters is extremely important. Mulaik (1987) also stated that each manifest variable could be described by means of linear combination of latent variables and one conspicuous latent variable – the specific factor, pertaining exclusively to that particular variable, regarding the not yet explained portion of the variance.

The ultimate goal of FA is, instead of a large number of inter- and cross-related, dependent variables (for example, anthropological characteristics of examinees), generated from some research, to determine a smaller number of mutually independent, latent variables or dimensions, which are, from the mathematical aspect, linear combinations of manifest variables (Cudeck, & MacCallum, 2007). Results obtained by factor analysis indicate fundamental causes and sources of diverse reality, which are the subject of our scientific interest (Fulgosi, 1984). Goldberg and Digman (1994) state that factor analysis can be thought of as a variable-reduction procedure, in which many variables are replaced by a few factors which summarize the relations among the variables.

So, the fundamental goal of FA is to investigate probable causal mechanisms of intercorrelations among researched phenomena, and to disclose which latent dimensions and to what extent influence the performance of entities in certain manifest variables (Viskić-Štalec, 1987; Dizdar, 2006). Furthermore, Buick (1990) states that factor analysis is a mathematical procedure for analyzing correlations between variables; its purpose is to find, among a large number of variables with different levels of correlation, a smaller number of_basic variables which are as independent (uncorrelated) as possible and which can explain relations between manifest variables on a higher level. On the other hand, from the standpoint of research strategy, trait theorists use factor analysis to determine the structure of personality. Famous trait theoreticians (Cattell, 1965; Eysenck, 1970, 1980a, 1980b, 1991) state that the factors obtained by factor-analytic research correspond to the structure of personality.

Recommendations for the use of factor analysis methods

Ford, MacCallum and Tait (1986) provide the following recommendations regarding technique and presentation of factor analytic results:

1. Default options of computer packages are avoided unless justified by the researcher
2. Factor analysis methodology is described completely with accurate terminology
3. The factor model is related to the goal of the research
4. Oblique rotation is used unless the ortogonality assumption is tenable
5. Multiple solutions are examined prior to the decision factor retention
6. Factors are interpreted based on knowledge of the variables and an examination of all factor loadings.

The same authors suggest parameters that should be presented so that the interpretation of the results is more explicit to the potential reader.

Appropriate FA methods for research of kinesiological issues and phenomena

Given that man is a bio-psycho-social entity, scientific knowledge about its structure and the theory of change are significantly based on data analysis methods of data obtained by objective measuring systems or by linking objective and subjective assessments of experts. Mathematical-statistical procedures are the foundation of these methods and without these procedures it is impossible to accept or discard hypotheses. Within the system of scientific research in the field of psychology and kinesiology, there are occasions when a technical approach to interpretation of the obtained data does not find adequate application in practice. Therefore, research must be based on: refinement of research methodology (identification of appropriate measurement procedures, methods or algorithms) and on identifying and explaining the principles of transformation of the living dynamic and flexible system. This requires an integrated and interdisciplinary approach in the area of psychological and kinesiological issues and phenomena.

Viskić-Štalec (1987) applied a battery of 74 motor tests (which did not include tests of strength) on 693 entities drawn from the normal male population aged 19 to 27 years, thus incorporating the most important factor and component techniques applied in kinesiology**.** These were: the component analysis in the standardized variables metrics with the PB criterion, the partial image analysis with the DMEAN criterion, the component analysis of standardized image variables with the GK criterion, and the component analysis in universal metrics with the WG criterion. For all four solutions mentioned under the component model the following rotations were used: promax with the target matrix determined by varimax rotation, direct oblimin and orthoblique rotation under the model of independent clusters.

For the factor techniques used: FA of the reduced correlation matrix with uniquities (obtained on the basis of Guttman's procedure) and FA of principal axes of the reduced correlation matrix with the iterative communality estimation, the following rotations were used: pseudopromax (in which correlation matrix of factorial scores is determined based on promax factorial scores) and pseudooblimin rotations (with the modified standard algorithm – with the orthogonalization of pattern matrix vectors).

The results of the so obtained total of 18 basic solutions were subjected again to the principal components factorization method under the GK criterion and orthoblique transformation. The outcome was that the applied method had given relatively congruent solutions, which was interpreted as a consequence of two causes: the respect given to the kinesiometric principles when selecting measuring instruments and the utilization of more strict criteria for latent dimensions' extraction. It was also found that the component methods, applied on motor tests, gave better solutions. Further, the results obtained with batteries of motor measuring instruments, arranged according to the test proportionality principle (obtained from the metric characteristics of these tests), was safer to factorize by applying component methods in image or Harris' metrics than by any other method from the factorial model. Real metrics from the factorial model was found in this case to be least appropriate. It should be applied as a routine in every research to see the nature of variables, but it should not be used for reaching definite conclusions. When motor space is not covered well with measuring instruments, the standardized image metrics from the component model is suitable for application but together with the stricter extraction criterion.

Furthermore, Viskić-Štalec (1987) states that the results regarding the application of criteria for determining the number of significant latent dimensions would indicate the feasible application of stricter criteria. Hyperfactorization leads to the occurrence of factors of different functional order within one functional segment and to topologically defined factors.

Viskić-Štalec cautioned that the validity issue, and the complexity of instruments related to it, was the key problem in motor tests. In her research, more valid tests formed well defined dimensions. The less valid tests, due to their specific variance, were dissolved by the stronger factors.

Empirical findings of the scientific research performed by Viskić-Štalec (1987) show that tests with factorial validity create a simple factor structure, invariant to metrics, to criteria, and to rotations. In one-factor tests application it is of no consequence which solution will be used. The tests of poorer validity may, but need not to appear, depending on the metrics, criteria and transformations used, and frequently they are divided among several factors. If we are dealing with complex tests, then the decision on the extraction criteria becomes extremely important. In such a case, the stricter criteria are recommended. In fact, the choice of one-factor tests is a solution to the problem.

Viskić-Štalec (1987) corroborated the existence of eight motor dimensions: *efficiency of coordinated movement performance, flexibility, simple movements' performance speed, stretching of thigh adductors, balance, imitating rhythm with movement, locomotion,* and *dexterity in handling various objects*. The same author also suggested that the ninth motor dimension - *accuracy* should be investigated by further research. She presumed the obtained dimensions were not of the same hierarchical order or scope, nor accuracy was purely a motor phenomenon.

APPROPRIATENESS AND LIMITATIONS OF APPLICATION OF FA METHODS

The most influential trait theorists as well as motor abilities theorists prefer to lean on mathematical-statistical procedures, most often FA. Approaches of researches, trait psychologists and kinesiologists, are different. The difference is primarily manifested in the application of FA in the detection of anthropological features used in the description of latent structures. Steiger (1990) states that oblique rotation is a type of rotation in FA in which the obtained factors are in correlation and that this rotation enables performance of hierarchical FA. The purpose of hierarchical FA is the determination of factors at various levels of generality. Factors determined on the basis of correlation matrix of starting variables are called the first-order factors (1^{st} order factors). If the intercorrelation matrix of 1^{st} order factors is factorized, the second-order (2^{nd}) factors are obtained and so on. The higher the factor's order, the smaller the number of the factors and the factors assume more general meaning.

From the historical point of view, Allport (1958) criticised factor analytical approach of Eysenck and Cattell saying that factors obtained in that procedure: "...Resemble sausage meat that has failed to pass pure food and health inspection…" Lykken (1971) and Tomkins (1962, in Pervin, & John, 1997) compared FA methods to putting people trough a centrifuge and expecting the „basic stuff" to come out.

Furthermore, Cervone and Pervin (2008) state that the question, then, is whether the factors identified when studying populations enable one to make any claims about psychological structures possessed by individual persons. They reference to a detailed study about the topic by Boorsboom, Mellenbergh and van Heerden (2003). These authors emphasize that the analysis of populations and of individuals are entirely different things and that he only way to claim validly that the five factors explain the personality functioning of individuals would be to conduct factor analyses of individuals one at a time and to find that, for each individual person the five factor model is recovered. For example, Boorsboom Mellenbergh and van Heerden (2003) say: "if one wants to know what happens in a person, one must study that person", therefore "…these constructs cannot be assumed also to describe factors in the head of each and every individual." Cervone and Pervin (2008) state that a FA of between-person differences does not reveal this within-person style of behaviour.

Even more critically, Bandura (1999) suggests: „Seeking the structure of personality by factor analyzing a limited collection of behavioural descriptors essentially reduces to a psychometric method in search of a theory. That is why Pervin, Cervone, and John (2005) expect the same factors should have been found in every, no matter how different, research due to power of FA, as suggested by its advocates.

On the other hand, Eysenck (1991) says that FA has improved the situation in personality trait research, as has clearer theorizing, but the problem of naming factors is of course still with us. Bucik (1990) claims that choosing the method of FA and naming the factors is the responsibility of the researcher, due to the fact that the results depend on how the analysis was conducted. In accordance with afore-mentioned, Widaman (1990, 1993) emphasizes the importance of regarding the relativity of FA model choice within the context of any particular psychological research.

Furthermore, Eysenck (1991) states that the interpretation of factors does of course tend to be subjective, as is their naming. The problem is discussed more extensively in Eysenck and Eysenck (1985); it is typical of the kind of problem which must be left to normal science to solve.

From the viewpoint of research in kinesiology there are limits to the application of factor analysis. These limitations occur especially in the relation to biological age periods. At the beginning of human development different abilities and characteristics are tightly associated. No individual dimension can be singled out (e.g., speed, intelligence, accuracy, coordination or any other factor) in the anthropological status of an individual (Trninić, 2006). During further development and biological maturation, integration among the mentioned anthropological characteristics decrease gradually, that is, dimensions differentiate. Therefore, in kinesiological research it is not advisable to use FA to extract latent anthropological dimensions on the samples drawn from the prepubertal children population. Potential actual quality of an athlete, which could not have been manifested during puberty nor properly analysed with FA methods, is fully manifested in postpubertal age (Trninić, 2006). Hence, FA methods are applicable for the extraction of latent dimensions yet in postpuberty and in mature age. Otherwise, FA will probably generate one-dimensional latent structure due to high correlation coefficients among the manifest variables.

Problem approach to understanding factor rotations

Rotation of factors is a procedure that, starting from the principle of "simple structure", because of greater flexibility in determining the position of the individual factors, searches final, easily interpretable factor structure (Mejovšek, 2008). So this procedure of transformation of the factor matrix is target oriented toward a more meaningful interpretation of extracted factors. Thurstoone criteria of "simple structure" is used to achieve a higher factor loading on only one factor, and as small as possible (preferably zero) loadings on other factors after the rotation of each manifest variable (Petz, et al., 2005). Furthermore, the same author points out that this is to be achieved by rotation of factor axes into a position which will produce the largest possible number of end points of test vectors on the axes or in their immediate vicinity. It should be noted that a rotation can be graphical (visual), which is based on subjective location of the factor axes, or analytic, based on objective, mathematically specified criteria (Petz, et al., 2005). A large number of analytical rotations have been developed over time. They are usually divided in two standard groups: orthogonal and oblique rotations. In the orthogonal rotations independence is retained of "raw" factors and principal components, whereas in the oblique rotations a certain nonorthogonal relationship, that is, correlation between them is allowed. It is also possible for factors to be in correlation prior to the rotation which can change these correlations among the factors. In that case, the rotation, that is, the adjustment of the coordinate system, provides results which are difficult to interpret.

Significant principal components and "raw" factors obtained with one of FA methods should be rotated or transformed to become the final factors in FA. The factor loading or structure easy to interpret is the one in which only a few starting or manifest variables have a high or medium high correlation with a particular factor, whereas all the other manifest variables have low or zero correlations with the same factor. Ideally every variable should have only one high correlation with one factor, while all other correlations of the same variable with all other factors should be low or zero. The goal of any rotation is to make the final structure of every factor close to that ideal.

Furthermore, for Fulgosi (1984), only the orthogonal rotations are justifiable because they are unequivocal, whereas in the oblique rotations there are several possible solutions. Momirović (1966b) asserts the orthogonal rotation to be simpler than the oblique one (orthogonal factors are manipulated easily in statistics), but he also considers its solutions artificial because, in reality, factors are actually correlated. Namely, it is very hard to imagine psychologically functional structures, persons, without inner correlations (Momirović, 1966b). The same author states that the orthogonal factors can be, mathematically, an adequate solution for the measuring subject issue, but such a solution can hardly ever be interpreted in the psychologically adequate way. Besides, it is not possible to determine factors quite precisely to the orthogonal structures. Dizdar (2006) explains that many researchers prefer orthogonal solutions due to the computational reasons and the questions imposed by the correlated factors (usually called the second-order factors) about which correlations the 1st order factors are responsible for. However, if factors are not treated as mathematical abstraction, but the psychological existence is assigned to them, then it is necessary to let them be in any possible correlations.

Nonorthogonal transformations in kinesiological and anthropological research are utilised to define anthropological latent structures, to identify latent anthropological variables and to determine interrelations among latent variables (Malacko, & Popović, 2001). As the oblique rotation is not restricted by orthogonality of latent dimensions, factors "have more freedom" to find optimal placement in factor space. Due to a greater flexibility in factor positioning, the oblique rotations should enable more thorough realization of the Thurstone's principle of a simple structure. In the orthogonal rotation the spatial interrelation of factors is determined in advance. When, for example, the best placement of the first factor has been determined, the position of the second factor is determined a priori; hence these two factors must assume mutually orthogonal positions. Accordingly, Steiger (1990) says that a quest for the final best position of all factors is not a simple task and requires certain compromises.

As Reise, Waller, and Comrey (2000) have noticed, simple structure rotations, such as varimax, are not guaranteed to find the most psychologically defensible placement of factors. This is especially true when the scale items do not correspond to a simple structure arrangement. For example, simple structure maximizing rotations (e.g., varimax and oblimin) are not appropriate when analyzing tests that were developed to represent circumplex models of personality (Wiggins, 1980), psychopathology (Becker, 1998; Gurtman, & Balakrishnan, 1998), or vocational interests (Tracey, & Rounds, 1993). As it has been already said, in the orthogonal rotation, such as varimax, the factors are not allowed to correlate, whereas in oblique rotations, such as promax or oblimin, the factors are allowed to correlate. Researchers prefer orthogonal rotations because of the interpretation simplicity.

From the kinesiological point of view and based on numerous previous research studies determining latent structure of anthropological characteristics, Dizdar (2006) advocates for the justifiable conclusion that nonorthogonal relations are more acceptable than the orthogonal. Namely, it would be quite senseless to assume that all the anthropological characteristics are mutually independent; therefore, orthogonal transformations cannot give actual solutions. Besides, nonorthogonal rotations may generate even orthogonal factors if the analysed data (manifest variables) require so. Since nonorthogonal rotations can give correlated factors, the factorization of the obtained factors is enabled to get higher-order factors. We should recommend preference of nonorthogonal rotations despite the facts that they do not give final solutions and that they are more complex than the orthogonal rotations from the aspect of mathematics and interpretation. Namely, nonorthogonal rotations are not subjected or sensitive to mathematical restrictions (orthogonality rule); therefore, they enable simple factor structure to be obtained, consequently, solutions that are closer to reality.

APPROPRIATENESS OF RESEARCH STRATEGIES IN THE USE OF FA METHODS

According to Viskić-Štalec (1987), although many FA methods resemble each other formally, they are differentiated by the applied model, initial metrics of variables, number of the dimensions determination criteria, and transformational procedure oriented towards parsimony. It is not yet known which of the mentioned elements generates the greatest difference or similarity in the final factorial solution. Seemingly, the biggest difference in the solution is produced by the component and factorial model, due to the specificity of the initial data matrices and correlation or covariance matrices which are being factorized. The fundamental difference between these two models lies in the conception of composition, or decomposition of variable variance and, in association with that, in the part subjected to the processing. Consequently, Snook and Gorsuch (1989) analyze differences in using different methods of FA.

Velicer and Jackson (1990) say that they have found little basis to prefer either component analysis or FA. For practical purposes, the choice of method will not have a crucial impact on empirical results or substantive conclusions. If FA is considered a statistical technique, it must be used to confirm hypothesis about the existence of latent dimensions, since hypotheses are tested, with a certain level of significance, by statistical methods.

Therefore, mathematical methods of manifest space reduction should be used exclusively like techniques which will help a researcher to form new hypotheses that will further generate a new approach to research and new measurements. It can be said that at the one end of the FA methods' continuum is the verification of hypotheses; on the opposite end is general reduction of the manifest space, whereas in the middle of the continuum are methods that only help researchers in generating new hypotheses.

Furthermore, Fabrigar, et al. (1999) point to the issues of using the initial, default and standard settings as well as the issues of using "ready-made" software options in practical applications of FA. The same authors claim that the use of EFA might also be improved by editors of journals adopting higher standards for the manner in which FAs are conducted and reported.

The following is their list of these problems:

Problem 1: Contrary to what many researchers probably believe the decisions in the design of studies and in selecting factor analytic procedures are not arbitrary and inconsequential.

Problem 2: Researchers sometimes base their analyses on studies with less than optimal features and commonly make questionable choices when selecting analytic procedures.

Problem 3: Researchers are ill-informed regarding the use of EFA (much of this literature is relatively complex).

Problem 4: There is a strong tendency for researchers to conduct analyses in a manner that is similar to what has already been done.

Problem 5: Another reason for poor use of EFA has to do with the statistical software currently popular in psychological research. Many researchers probably follow the default options of their programs.

When all factors have been interpreted, the final control is performed on the basis of factors' intercorrelation check up (Mejovšek, 2008). If correlations among the factors deviate from the expected, then there is a strong doubt about the correctness of factors' interpretation. In that case, the interpretation procedure should be repeated.

Examples of problems in application of FA methods

In the field of kinesiology of sport, a goal of the research which includes FA can be the detection of latent structure of sport-specific motorics in individual and team sports, or the verification of factorial validity of the tests aimed at assessing sport-specific or situation-specific measures (Trninić, 1995, 2006). Tinsley and Tinsley (1987) state that the fundamental assumption in the use of FA is the linear relationship between variables and that it is insensitive if there is a nonlinear relationship which produces vague factors.

If input data are not appropriate, then the latent structure cannot be appropriate either. In other words, the focus is on the characteristics of measuring instruments and sample representativeness. Problems in application of FA in kinesiology are additionally becoming bigger in research of complex dynamic systems (Trninić, et al., 2009). In the field of applied kinesiology these are undoubtedly team sports games which have the highest complexity of motor activities from the aspect of information or cognitive component (structures of movement and of situation structures), energetic component (structure and volume of training and competition loading), and sociomotor interaction, based on the model co-operation - opposition (Trninić, 1995).

Trninić (1995) conducted a quantitative analysis of the game of basketball using mathematical-statistical multivariate procedures. For the purposes of statistics he used the basic and specific game attributes and entities (tasks during play) and employed knowledge about the game of the selected elite basketball experts - players and coaches. By FA of basic attributes or variables under a component model, a correlation matrix was factorized within the exploratory strategy. Using GK criterion (Guttman, & Kaiser, 1956) four factors were extracted which depleted 76.9% of the total variance of the manifest space. Out of the total, the first factor (*inside players*) covers 32.4%, the second (*flow of the game*) 23.7%, the third (*outside players*) 20,8% of the total variance.

The obtained factor solutions show that the investigated experts (players and coaches) understand the game of basketball in accord with their own tactical theories. In the same article FA of specific attributes was conducted under the component model. A correlation matrix has been factorized within the exploratory strategy and, using GK criterion, three latent dimensions were extracted which exhausted 80.3% of the total variance of the manifest space. Out of that, the first latent dimension (*informational component of basketball game*) exhausted 37.3%, the second (*energy supply component – play intensity*) 31.5%, and the third (*sociomotor interaction*) 11.4% of the total variance. The correlation matrix between OBLIMIN factors showed a correlation between the *informational component* and *sociomotor interaction* (.38). The author assumed that there was probably the common denominator in the background of it - the cognitive component. A negative correlation was noticed (-0.17) between *energy supply* component and *sociomotor interaction*. Due to the established latent structure in the space of specific attributes (informational, energetic, and sociomotor component of sports activity), it is assumed that exactly such a structure is needed for the successful performance of tasks in the game of basketball. In the field of kinesiology, this provides an insight and understanding of poly-structure and complex sports activities (Trninić, Trninić, & Papić, 2009; Trninić, et al., 2010a, 2010b).

CONCLUSION

We believe that the tendency of research scientists in the field of psychology and kinesiology should be finding the smallest number of latent dimensions which can explain the relation between the measured traits and factors. Clearly, the resulting factors are mathematical abstractions (or idealization), but they do have actual plausible psychological and kinesiological meaning for which mechanisms underlying the researched phenomena can be identified and explained. There are numerous attempts of trait psychologists to identify models of personality traits and relate them to specific biological processes and genetic programmes. However, regardless of the fact that all models are similar, the models do not always overlap in an unambiguous manner (Pervin, Cervone, & John, 2008).

We believe that, regardless of the fact that FA is an objective statistical procedure its use is not appropriately objective.

We must emphasize that FA methods do not give an answer to the question why do the variables covariate, that is, isolated factors explain only a part of the covariance. Psychologists and kinesiologists used to analyze residual correlation matrix as well. Also, because the final result of the factor analytical research depends partly on the decisions and interpretations of researchers, that is, upon the competence of the researchers. The researcher is the one who infers, using her/his knowledge of psychology and leaning upon her/his theoretical convictions, about the existence of a common entity (a factor), and she/he creates a name to denote that factor. The ultimate result of factor analytical research partially depends upon the decisions and interpretations of the researcher. Accordingly, different researchers, using similar correlation and factorial methods may reach different conclusions (Cervone, & Pervin, 2008).

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