

Published in: Gyöngyösiné Kiss Enikő: Comparing the factors of Cloninger's Temperament and Character Inventory (TCI) with the Szondi-test. In: Szondiana, Zeitschrift für Tiefenpsychologie und Beiträge zur Schicksalsanalyse. Szondi-Institut, Zürich 2005/1. 59-70.

## **Comparing the factors of Cloninger's Temperament and Character Inventory (TCI) with the Szondi-test**

Dr. phil. Enikő Gyöngyösiné Kiss

Dear Colleagues!

The presentation divides into two parts, in the first theoretical part I make a rough sketch of personality theories in the 20<sup>th</sup> century which have biological bases and in the second, empirical part I present a research.

### I. The theoretical part

1. In the beginning of the 20<sup>th</sup> century appeared the thinking about the connection of physique and personality. For example Kretschmer in the 1930's believed that there was a relationship between different physical types and certain psychological disorders. He distinguished one from another three types: the pyknic, asthenic and athletic. Sheldon in the 1950's built upon his work on Kretschmer's typology and he was interested in the variety of human bodies. He developed a precise measurement system and summarized three physical types: the ectomorphs, mesomorphs and endomorphs. To these physical types he associated three personality types: the cerebrotonics, somatotonics and viscerotonics.

This kind of view which wanted to find out direct connection between physics and personality really didn't follow in the second part of the century.

2. The second direct among personality theories which took biological origin into consideration was the trait theories.

The first trait theorist was Allport (1921), who believed that traits were the basic units of personality and based in the nervous system. In Allport's concept traits could be defined by three features: frequency, intensity, and range of situations. He made a distinction among cardinal traits, central traits and secondary dispositions. The strength of a trait decreases in this order.

In the 1970's Hans Eysenck made researches on traits which had biological bases. Eysenck described two main supertraits of personality in his early work:

neuroticism and extraversion-introversion, later he added a third dimension, which was psychoticism. These three factors (PEN) made up Eysenck's three-factor-theory of personality.

Among the trait theories which were built upon biological background I would like to mention two further researchers, Jeffrey A. Gray and Marvin Zuckerman. Gray as a neuropsychologist (from the 1970's) presumed that two brain systems regulated the behaviour: the behavioural approach system (BAS) and the behavioural inhibition system (BIS). In his concept those people, whose behavioural approach system was more responsible, showed more responsiveness toward rewards. Gray called this personality dimension impulsiveness. The other presumed personality dimension was anxiety in Gray's theory, which was connected to the behavioural inhibition system. Gray thought, that those people whose behavioural inhibition system had a stronger functioning, would be sensitive toward punishment.

Another researcher, Marvin Zuckerman (also from the 1970's) described another personality dimension which had biological origin which he called sensation seeking. This dimension means the permanent demand of new stimulus and unusual situations. As researchers pointed out, Zuckerman's sensation seeking trait could be connected to both Gray's impulsiveness and Eysenck's extraversion dimensions, although Zuckerman thought that it had a connection to psychoticism in Eysenck's view.

At first sight it seems, that we needn't speak about the Five – Factor Model of personality, because originally it didn't deal with the heritability and biological basis of personality dimensions, but later we see, that we can't save it.

This Five-Factor Model comes from the factor-analyses of large sets of trait terms in language and later from cross-cultural studies testing the universality of trait dimensions. Cattell was among the firsts who made factor-analyses on personality traits. Finally he got 16 traits (in 1965), and he thought that these traits represented the major dimensions of differences in human personality.

In 1963 Norman also did a factor-analytic study on personality traits and he found five basic factors. Later numerous studies confirmed the existence of the five factors, which factors are: Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness.

Although this Big Five Model based on the lexical terms of language, and originally didn't stress upon the biological roots, nowadays this view changed. Several studies deal with the heritability of the five factors and cross-cultural researches establish that the five factors can be the universal dimensions of personality.

3. The third main direct in this biological perspective on personality can be "neuroscience and personality". Neuropsychology is a newly born branch of learning, from the 1990's there is a significant advance in our understanding of functioning of different part of the brain. One of the areas of neuroscience is to understand neurotransmitter functioning, especially dopamine and serotonin. Neurotransmitters are chemical substances which transmit information from one neuron to another. Dopamin is associated with reward and pleasure, being described as a "feel good" chemical. Serotonin is also involved in the regulation

of mood. It seems that there is a relation between low serotonin levels at the neuron and synapses and depression, anxiety, violence and impulsivity.

Without going into the details and list other neurotransmitters we can say, that most of these researches – which wants to find connection between neuroscience and personality - are the first, but important steps of this area. Of course, these approaches don't think, that there is a one-to-one correspondence between biological processes and personality traits, these connections' functioning are much more complex.

4. The fourth main direct which deals with the biological bases of personality is behavioural genetics. Behavioural genetics studies the way inherited biological material - the genes – can influence patterns of behaviour. Researchers study monozygotic and dizygotic twins to find the role of heritability of certain personality traits.

5. The next direct - evolutionary psychology - views the personality as the product of a long history during which it was advantageous for humans to adopt particular characteristic ways of thinking and behaving. Evolutionary psychologists refer to Darwin and say that organism develops different traits to contribute individual survival and reproductive success. These traits have a genetic origin and create different personality styles by using different strategies in adaptations.

6. The modern temperament and character approaches also emphasis on the biological background of personality. The first question could be, what is temperament?

The several authors stress other aspects of temperament. Among others temperament is defined as: 1. the components of personality that are biological in origin (Buss and Plomin, 1984), or 2. traits that are relatively stable, cross situations consistent and evident throughout the age span and diverse cultures (Rothbart and Derryberry, 1981), or 3. behavioural style rather than the content or purpose of behaviour (Thomas and Chess, 1977), etc.

The paper mentions a few temperament models which demonstrate some different aspects of thinking.

Thomas and Chess (1977) on the basis of their New York Longitudinal Study made a nine-dimensional model of temperament. In their study Thomas and Chess have been following the development of 141 children. They used several methods: interviewed the parents, the teachers, made direct classroom observation, used psychometric tests and made direct interview with each child between the age of 16 and 17. The data showed that people have well-established emotional patterns by the time they are two or three months old. The nine dimensions which they investigated were: mood, approach, intensity, threshold, rhythmicity, distractibility, attention span, persistence, and adaptability. Later factor analyses suggest that these nine dimensions separate into five robust factors; and two factors are less consistent across measures and ages (these are threshold and biological rhythmicity). Refer to some researchers the remained five robust factors resemble the Big Five factors in adult personality models (Martin R. P. and colleagues).

Another view of temperament theories strengthens the genetic origin of its dimensions. Buss and Plomin believe that temperaments are primarily inherited, although they describe their model as an interaction model, in which personality is a product of both: inherited temperament and environment. Buss and Plomin used the twin-comparison method and finally defined three temperaments: activity, emotionality and sociability. Activity means the general level of energy of behaviour; sociability is the need to be with others and avoid being alone; and emotionality is a physiological excitation, which increases quick and intensive in emotionally stirring situations.

Rothbart and Derryberry (1981) defined temperament as individual differences in reactivity and self-regulation which have a constitutional basis. Reactivity refers to the excitability, responsivity or arousability of the behavioural and the physiological systems of the organism. Self-regulation refers to the neural and behavioural processes that modulate reactivity. This theory makes it possible to think about temperament dimensions to include those that do not appear within the first years of life. The role of self-regulation has more importance in the later years meanwhile it has more control on reactivity. The authors draw attention to the fact that self-regulation develops by the influence of social environment. Rothbart and her colleagues investigated the basic temperamental processes in infancy and early childhood. The results of their studies confirm that temperament processes are initial basis of dispositions and orientations toward others and the physical world and they shape adaptation. Rothbart and her colleagues examined also adult temperament; one of the exciting findings was that temperament processes had strong relationship with four of the Big Five Factors: Extraversion was related to Extraversion (this scale was in both questionnaires); Effortful Attention was related to Conscientiousness, Negative Affectivity to Neuroticism, and Orienting Sensitivity factor to Openness. This results show that some temperament dimensions in childhood can have relationship to traits in adult personality, and perhaps it will be possible to get continuity from temperament concepts to the Five Factor Model.

Goldsmith and Campos (1990) investigated the affective dimensions of temperament. Refer to the authors temperament means an individual difference how we express and live our primary emotions. They deal with the behavioural expression of primary emotions and its individual characteristics. During the development the affective temperament dimensions get into interaction with the cognitive and social environmental factors and form together the psychic structure of personality.

The next temperament theorist is Cloninger, who builds upon a unified biosocial personality theory. Cloninger's theory of personality, including 4 temperament dimensions and 3 character dimensions, is one of the most well-known theories in recent years.

Cloninger's definition on temperament and character is the following:

Temperament represents automatic responses in information processing and learning, presumed to be heritable, whereas character reflects personality development in the context of insight learning and environmental experiences.

Cloninger finally hypothesized four temperament dimensions of personality which are assumed to be genetically independent and have predictive validity for patterns of response to specific environmental stimuli. These temperament dimensions are: Novelty Seeking, Harm Avoidance, Reward Dependence and Persistence.

Novelty Seeking is characterized by behavioural activation in response to new stimuli or cues for potential reward or potential relief of punishment.

Harm Avoidance is defined as a heritable tendency to respond intensively to signals of aversive stimuli, and responsible for learning to inhibit behaviour to avoid punishment.

Reward Dependence is also a heritable tendency to respond intensively to signals of reward, and to maintain or resist the behaviour that was previously been associated with rewards or relief from punishment.

Persistence dimension means the maintenance of behaviour. Individuals high in Persistence are hard-working, persistent, and stable despite frustration and fatigue. They perceive frustration as a personal challenge, and do not give up easily. They tend to be a perfectionist, who wants to get more than what is necessary.

Refer to Cloninger Novelty Seeking, Harm Avoidance and Reward Dependence temperament dimensions have a biological background and he connects the temperament traits to three brain systems as well as to central monoamine modulators.

Cloninger also describes three character dimensions which are: Self-directedness, Cooperativeness and Self-transcendence. Self-directedness means an individual control, to regulate and adapt one's behaviour to fit the situation in accord with individually chosen goals and values. The second character dimension is Cooperativeness. Cooperativeness dimension shows the individual differences in identification with and acceptance of other people. Cooperative individuals are described as socially tolerant, empathic and helpful. Self-transcendence is the third character dimension which associated with spirituality, and refers generally to identification with everything which part of a unified whole.

Cloninger's Temperament and Character Inventory (TCI) measures the temperament and character dimensions and gives a profile on normal and pathologic personality as well.

## II. Empirical research

After the theoretical review of personality approaches which are built upon a biological background, in the following I would like to present an empirical study. But before the empirical study let's speak a few words about Szondi's view on personality.

Szondi used to say that fate-analysis is nothing else but the introduction of genetics to the Freudian psychoanalysis. Szondi established his fate-analysis on the one hand on the Freudian concepts of the role of the drives in personality, and on the other hand on the works of internationally recognized West European heredity researchers. Szondi considered his fate-analysis as belonging to depth psychology, and he thought that it would be a contact

between Freud and Jung. Szondi presumes that between the personal and collective unconscious there is a third: and this is the familial unconscious. The familial unconscious is originally based on geneology.

In Szondi's drive-system in a drive there are two opposite needs, and these needs aspire to be realised. But only the dominant genes can be realised, the latent ones cannot. The latent genes do not make their appearance genotypically but genotropically. This means, that the latent genes have their specific function of directing the act of choice. The familial unconscious directs from the background one choice of love, occupation, friendship, illness and death.

Szondi defined temperament as „drive-nature“ – the hereditary predispositions of personality. He thought about character as a result of building hereditary predispositions into the personality.

In our empirical research we used the Szondi Projective Test and Cloninger's Temperament and Character Inventory, so further on I would like to present this inventory.

The Temperament and Character Inventory (TCI) is a 240-items true-false self-questionnaire developed by Cloninger and his colleagues to assess the seven dimensions of personality. (Figure 1.)

Figure 1. Cloninger's (1994) temperament and character model (TCI scales and subscales)

### **Temperaments:**

#### **1. Novelty Seeking**

- NS1 - Exploratory Excitement vs stoic rigidity
- NS2 - Impulsiveness vs reflection
- NS3 - Extravagance vs reserve
- NS4 - Disorderliness vs regimentation

#### **2. Harm Avoidance**

- HA1 - Worry and pessimism vs uninhibited optimism
- HA2 - Fear of uncertainty vs confidence
- HA3 - Shyness with strangers vs gregariousness
- HA4 - Fatigability and asthenia vs vigour

#### **3. Reward Dependence**

- RD1 - Sentimentality vs insensitiveness
- RD3 - Attachment vs detachment
- RD4 - Dependence vs independence

#### **4. Persistence**

- Persistence vs irresoluteness (earlier as RD2 subscale)

## **Characters:**

### **1. Self-Directedness**

- SD1 - responsibility,
- SD2 - Purposefulness,
- SD3 - Resourcefulness,
- SD4 - Self-Acceptance,
- SD5 - Congruent Second Nature.

### **2. Self-Transcendence**

- ST1 - Self-forgetfulness,
- ST2 - Transpersonal identity,
- ST3 - Spiritual Acceptance.

### **3. Cooperativeness**

- C1 - Social Acceptance,
- C2 - Empathy,
- C3 - Helpfulness,
- C4 - Compassion,
- C5 - Integrated Conscience.

## Method

The subjects were 101 healthy men and women, whose ages were between 20 and 40. All the subjects have final examination at secondary school.

The subjects filled out the Temperament and Character Inventory, and the ten-profile Szondi Test was also taken with them. In our research we compared the scores of the TCI factors corresponding to the factors of the Szondi Test. We used the Spearman Rank Correlation statistical method to get the correlation coefficients.

## Results and conclusions

1. The first temperament factor which we investigated in the TCI is Novelty Seeking. Refer to Cloninger subjects who have higher scores in Novelty Seeking are enthusiastic and quickly engaged with whatever is new and unfamiliar. In our research we tried to find connections among the corresponding TCI scales, subscales and the Szondi Test factors. First we examined the correlation between Novelty Seeking and p+ factor in the Szondi Test. P factor is the factor of enlarging of the ego by projection or inflation. P+ tendency is the tendency of enthusiasm and possession; in early childhood being both: the mother and the child, the dual-union. Later, in adulthood this sign means to be possessed with an idea, or in love with the love-partner, and so on... Szondi calls this P factor as the factor of ego-diastrale, and one sign of extraversion in the test. In our research we found positive correlation between the Novelty Seeking scale and p+ sign in the Szondi-test. ( $r=0.24$ ,  $p<0.05$ )

After examining the main scale in TCI we try to find more connections among the TCI subscales and the Szondi Test signs.

Novelty Seeking 1 subscale in the TCI is a subscale of exploratory excitability. In our hypothesis this subscale has a correlation with the p+ factor in the Szondi Test. The results demonstrated this correlation the correlation coefficient is 0.229 and it is significant when  $p < 0.05$ . The explanation can be that both test measures the excitement and enthusiasm in personality.

Novelty Seeking 1 subscale also has a meaning that similar to e+ in the Szondi Test. This meaning can be a paroxysmal excitement, with e+ sign the person lives out this need in an ethical, social way. We found positive correlation between these two factors, the coefficient was 0.411 when  $p < 0.01$ .

We also tried to find connection between Novelty Seeking 2 subscale and p+ in the Szondi Test. Novelty Seeking 2 subscale means Impulsiveness versus Reflection. These persons with high score tend to be excitable, impressionistic individuals; they easily break rules, act on their momentary instincts and intuitive feelings and don't see the things in details. As we saw earlier, p+ in the Szondi Test is the sign of enthusiasm, excitement and creativity, being possessed with an idea. We got positive correlation between these two factors, the coefficient was 0.201, which was significant when  $p < 0.05$ .

2. Our next hypothesis is that the score of Harm Avoidance in Temperament and Character Inventory and e- hy- signs in the Szondi Test has a positive correlation, because both of them measure the degree of anxiety in personality. The results support our hypothesis Harm avoidance strongly correlates with the signs e- hy- in the Szondi Test profiles ( $r = 0.732$ ;  $p < 0.02$ ). These results are in line with the fact that Harm Avoidance and the Szondi Test Profiles' signs also measure the degree of anxiety in personality.

The following hypothesis is that the score of Harm Avoidance in TCI and d+ sign in the Szondi Test has a positive correlation, because d+ in the Szondi Test is the sign of depression, and in depression the quantity of anxiety has a higher score. In this case the results also support our hypothesis Harm avoidance correlates with the sign d+ in the Szondi Test profiles ( $r = 0.336$ ;  $p < 0.05$ ). These results confirm that a possible predisposition to depression among healthy subjects correlates with higher degree of anxiety in personality.

3. The third temperament factor in the TCI is Reward Dependence. Our hypothesis is that we find positive correlation between Reward Dependence and m+ sign in the Szondi Test. We base our hypothesis on that fact, that both factors are connected with sociability. The persons with high scores in TCI seek social contact and are open to communication with other people. High Reward dependence score shows the sensitivity to social cues, which facilitates warm social relations and understanding of others' feelings. The m-factor in the Szondi Test is part of the Contact-vector. Szondi describes these persons with m+ as they were able to give love and emotional support to the love object, through identification with the giving mother and through identification with the

person who needs love and support. In this case the Spearman correlation coefficient was  $r = 0.359$  which is a significant score when  $p < 0.01$ .

4. In our recent research we examined one character scale in the TCI, and that was Cooperativeness. Cooperativeness represents the acceptance of other people, to cooperate with others as much as possible, to understand and respect the preferences and needs of others. These people's capacity is important in teamwork and social groups for creating harmonious and balanced relationships. They are empathic, tolerant, and supportive.

We can find this character factor in the Szondi Test's two factors. E+ is the sign of ethical control. These persons are described by Szondi as helpful, tolerant and empathic to the others.

So, our hypothesis was that Cooperativeness dimension in the TCI and e+ sign in the Szondi Test had positive correlation. We got the same results, the correlation coefficient was 0.264 which was significant when  $p < 0.1$ .

The other Szondi Test factor which can be examined in connection with the Cooperativeness dimension in TCI is m+ sign. The m-factor is one factor of the Contact vector and means the need for external object, clinging to objects and to establish social relations. M+ generally indicates a warm social attitude and is given by subjects who not only are in the need of positive emotions from others, but who also are able to give love and affection to the others. The correlation between the TCI Cooperativeness dimension and the m+ in the Szondi Test is  $r = 0.266$  when  $p < 0.05$ .

Summing up the empirical research we compared Cloninger's temperament and character dimensions to Szondi's drive factors. Both theorists think, that temperament has a biological origin, and presume some temperament traits (or as Szondi calls them, drive needs). In our study we tried to find connections between the two authors' concepts by using their personality tests. In more cases we managed to get positive correlations between the Szondi Projective Test's factors and the corresponding TCI scales and subscales. The research can be continued in the future by trying to find more connections between the two theories and tests, not only at the level of the suitable dimensions but also the combinations, the "patterns" of the dimensions and test signs.

Figure 2. The correlations between the corresponding TCI and Szondi Test factors

TCI factor	Szondi Test factor	Number of subjects (persons)	Correlation coefficient	Significance
NS	p+	80	0.240	p < 0.05
NS1	p+	80	0.229	p < 0.05
NS1	e+	42	0.411	p < 0.01
NS2	p+	80	0.201	p < 0.05
HA	e- hy-	37	0.367	p < 0.05
HA	d+	38	0.336	p < 0.05
RD	m+	80	0.359	p < 0.01
C	e+	42	0.264	p < 0.1
C	m+	80	0.266	p < 0.05

#### Acknowledgements

I would like to acknowledge that this research is supported by the Hungarian OTKA grant T 034293 awarded to the author as principal researcher.

#### Summary

The presentation mentions personality theories of the 20<sup>th</sup> and 21<sup>st</sup> centuries, which connect their concepts of personality with a biological background. The main directs of these theories are: physique and personality, depth psychology, trait theories, neuroscience and personality, behavioural genetics, evolutionary psychology and the temperament and character theories.

We can see in the development of recent personality psychology that some of these concepts come to nearer to each other: for example the trait models (Five Factor Model), the temperament and character theories and the direct of neuroscience and personality. One of the integrative models is Cloninger's unified biosocial theory in which hypothesized four temperament and three character dimensions. In this model the temperament dimensions are thought to be genetically independent and have predictive validity for patterns of response to specific environmental stimuli.

In the second part of the presentation an empirical research is presented. We compared Cloninger's biopsychological theory and inventory with Szondi's drive system and his projective test. The subjects were 101 healthy men and women, between 20 and 40 years of age. The subjects filled out the Temperament and Character Inventory, and the ten profiles Szondi Projective Test was also taken with them. The results show, that in the cases of Harm Avoidance, Novelty Seeking, Reward Dependence and Cooperativeness factors in the TCI we obtained positive correlations with the suitable Szondi Test signs.

## Literature

Buss, A. H. - Plomin, R.: A temperament theory of personality development. New York, Wiley-Interscience, 1975.

Buss, A. H. - Plomin, R.: Temperament early developing personality traits. Hillsdale, Nj, Erlbaum, 1984.

Carver, Charles S. - Scheier, Michael F.: Perspectives on Personality. Allyn and Bacon, 3<sup>rd</sup> edition, 1995.

Cloninger, C. R. - Svrakic, D. M. - Przbeck, T. R.: A psychobiological model of temperament and character. In: Archives of General Psychiatry, 50 (1993) 975-990. p.

Cloninger, C. R. - Svrakic, D. M.: Integrative psychobiological approach to psychiatric assessment and treatment. In: Psychiatry, 60 (1997) 120-141. p.

Cloninger, C. R.: A systematic method for clinical description and classification of personality variants. In: Archives of General Psychiatry, 44 (1987) 573-588. p.

Costa, P. T. - McCrae, R. R.: Primary traits of Eysenck's PEN system: Three and five-factor solutions. In: Journal of Personality and Social Psychology 69 (1995) 308-317. p.

De Fruyt, F. - Van De Wiele, L. - Van Heeringen, C.: Cloninger's Psychobiological Model of Temperament and Character and the Five-Factor Model of Personality In: Personality and Individual Differences 29 (2000) 441-452. p.

Eysenck, H. J.: Personality genetics and behavior. New York, Praeger, 1982.

Gyöngyösiné Kiss, E.: Modern Theories on Biological Foundations of Personality. In: Szondiana, Zeitschrift für Tiefenpsychologie und Beiträge zur Schicksalsanalyse. (2002) 22. Jahrgang Heft I. 90-105. p.

Hansenne, M. - Reggers, J. - Pinto, E. - Kjiri, K. - Ajamier, A. - Ansseau, M.: Temperament and Character Inventory (TCI) and depression In: Journal of Psychiatric Research 33 (1999) 31-36. p.

Liebert, R. M. – Spieger, M. D.: Personality. Strategy and Issues. The Dorsey Press, USA, 1987.

Millon, T. – Lerner, M. J.: Personality and Social Psychology. In: Handbook of Psychology, Vol. 5. John Wiley & Sons, Inc. Hoboken, New Jersey, 2003.

Otter, C. - Huber, J. - Bonner, A. : Cloninger's tridimensional personality questionnaire: reability in an English sample In: Personality and Individual Differences 18 (1995) 471-480. p.

Pélissolo, A. - Lépine, J. P.: French validation study of the temperament and character inventory (TCI) in healthy volunteers In: European Psychiatry 11 (1996) 373. p. Supplement 4.

Pervin, Lawrence A. - John, Oliver P.: Personality. Theory and Research. 8<sup>th</sup> ed. New York, John Wiley & Sons, Inc., 2001.

Plomin, R.: Genetics and experience: The interplay between nature and nurture. Newbery Park, Ca: Brooks/Cole, 1994.

Rothbart, M. K. – Ahadi, S. A. – Evans, D. E. Temperament and Personality: Origins and Outcomes. In: Journal of Personality and Social Psychology, (2000) Vol. 78, No.1, 122-135.

Szondi, Leopold: Analysis of marriages. An attempt at a theory of choice in love. The Hague, M. Nijhoff 1937.

Szondi, Leopold: Die Triebentmischten. Bern, Huber, 1980.

Szondi, Leopold: Ich-Analyse. Bern, Huber, 1956.

Szondi, Leopold: Integration der Triebe. Die Triebvermischten. Bern, Huber, 1984.

Szondi, Leopold: Lehrbuch der Experimentelle Triebdiagnostik. Bern, Huber, 1947.

Szondi, Leopold: Schicksalsanalyse. Basel, Schwabe 1944.

Szondi, Leopold: Schicksalsanalytische Therapie. Bern, Huber, 1963.

Szondi, Leopold: Triebpathologie. Bern, Huber, 1952.

Takuro Tomita - Hiroko Aoyama - Toshinori Kitamura - Chiharu Sekiguchi - Tadashi Murai - Tatsuro Matsuda: Factor structure of psychobiological seven-factor model of personality: a model revision In: Personality and Individual Differences 29 (2000) 709-727. p.

Zuckerman, M. - C. Robert Cloninger: Relationship between Cloninger's Zuckerman's and Eysenck's dimensions of personality In: Personality and Individual Differences 21 (1996) 283-285. p.