

Projective Psychological Tests from the Point of View of Neural Network Theory of Society

Suleimenov Ibragim¹, Kostsova Mariya², Vitulyova Yelizaveta³

Abstract

It is shown that the issues raised by the international expert community in the discussion regarding the legality of using projective techniques (in particular, tests such as the Lüscher test, the Szondi test and the Dellinger test) can be resolved on the basis of an adequate interpretation of the concept of “archetype” and an analogy with neural networks. At the same time, the interpretation of the concept “archetype” is based on the neural network theory of society, which allows us to remove the difficulties that arise with the traditional interpretation of this concept. It is shown that there is an equivalent scheme for the testing procedure, in which the testing itself can be reduced to the functioning of the external (output) layer of the general neural network, which also includes a neural network formed by the human brain. This approach makes it possible to remove many of the criticisms put forward against the use of projective techniques (even declaring them pseudoscientific), but it implies a significant change in existing approaches to the interpretation of results obtained when using tests of the type in question. Namely, within the framework of the proposed approach, not every possible combination of images on which the test is built makes sense. Such a meaning can be given only to some of them, specifically to those that are most often encountered in experiments. Such combinations, which can be interpreted as basic, are interpreted on the basis of an analogy with images recognized by a neural network. The remaining combinations are treated as images containing errors; they are reduced to the basic ones based on an analogy with the methods used in constructing error-resistant codes.

Keywords: *Projective Techniques, Psychological Testing, Archetypes, Concepts, Noise-Resistant Coding.*

Introduction

Currently, tests in which the respondent is asked to arrange a certain set of images in an order corresponding to his/her preferences are widely used. The best known examples of such tests are the Lusher test (Furrer, 1967), the Sondhi test (Borstelmann & Klopfer, 1953), and Susan Dellinger's psychogeometric test (Mayall & Dellinger, 1953), which have been used for many years for various purposes. There is also relevant methodological literature in various countries around the world, e.g., (Yakimanskaya & Karymova, 2012). These tests are examples of techniques known in the psychological literature as projective techniques ("projective techniques"). This term reflects the fact that, according to the basic ideas of the method in question, there is a connection between the choice of visual or other stimuli and the psychological state of an individual, and the nature of these stimuli can be very different - the respondent projects his psychological state onto the sample he creates.

One of the originators of projective techniques is Lawrence Frank, who used this term back in 1939. He reveals the essence of this method as follows (Frank, 1939)

allows people to discover the nature of the formation of their experiences by providing them with objects, materials, and experiences of relatively low structure and weak cultural pattern, so that on this formed field they can project their own way of perceiving life, their feelings, their values, and especially their own emotions. In this way, a projection of the personal world of the individual is evoked."

Despite the widespread use of tests of this type, the validity of their application in the circles of psychological specialists belonging to different schools is often regarded as debatable; a relevant review is presented in (Stemplewska-Żakowicz & Paluchowski, 2013).

¹ al-Farabi Kazakh National university, Almaty, Kazakhstan, Email: esenych@yandex.kz.

² Sevastopol State University, Sevastopol, Russia, Email: mashasev@mail.ru.

³ al-Farabi Kazakh National university, JSC «Institute of Digital Engineering and Technology», Almaty, Kazakhstan, Email: lizavita@list.ru, (Corresponding Author)

It is appropriate to emphasize that the cited article was written on the basis of discussions held within the framework of a specially organized conference "Conditions for the use of projective methods in psychological diagnosis for forensic purposes", which took place in Lublin on November 16-17, 2012. As noted in (Stemplewska-Żakowicz & Paluchowski, 2013), the conference was held on the initiative of the Polish Society of Skeptics under the slogan "Psychology is science, not witchcraft" as a protest against the use of projective techniques, which it considered harmful and anachronistic, and this discussion in 2012 splashed on the pages of the Polish media.

Moreover, the authors (Stemplewska-Żakowicz & Paluchowski, 2013) argue that tests of the type in question are not, strictly speaking, projective techniques. In their opinion, these tests are not based on Frank's projective hypothesis, but on the belief - which cannot be explained rationally - that there is a set of interdependencies between a person's private preferences and general characteristics of his or her personality.

The authors (Stemplewska-Żakowicz & Paluchowski, 2013) argue that the interpretation of projective material derived from test results is based on a sign system according to which specific characteristics of a drawing (such as the size of a figure) or a subject's preference for the color purple over green are assigned a universal symbolic meaning that is the same for everyone.

The authors of (Stemplewska-Żakowicz & Paluchowski, 2013) also mockingly note that the "interpretation" systems of such tests as (Furrer, 1967; Borstelmann & Klopfer, 1953; Mayall & Dellinger, 1953) resemble an ancient Egyptian dream book, in which a large figure is interpreted as signifying self-confidence and high self-esteem, while a small figure expresses insecurity and low self-esteem.

We emphasize that (Stemplewska-Żakowicz & Paluchowski, 2013) represents only one example of critical publications. It is easy to find numerous similar judgments, including in Internet resources, for example, the author of the note (FalineDeer, 2024) calls the Lusher, Sondhi and psychogeometric tests pseudoscientific.

It should also be noted that verification of tests of the considered type by traditional methods allows us to put forward counterarguments only partially. The works devoted to their verification have been carried out for a very long time, and the wide distribution of such tests allows us to accumulate a considerable amount of experimental material.

Accordingly, if the traditional approach could provide some breakthrough in this field, it would have been done long ago.

In particular, one of the main theses relied upon by critics of the use of such tests as (Furrer, 1967; Borstelmann & Klopfer, 1953; Mayall & Dellinger, 1953) is related to the question of the model/concept that underlies them.

In this paper we propose a new interpretation of the "projective approach" based on the neural network theory of sociality (Bakirov et al., 2021; Suleimenov et al., 2024), the theory of noise tolerant coding as formulated by (Bakirov & Suleimenov, 2021) and the works of (Vitulyova et al., 2020; Suleimenov et al., 2021), in which it was shown that the functioning of a neural network can be analyzed in terms of projective geometry.

In our opinion, this approach allows us to largely remove the objections reflected in (Stemplewska-Żakowicz & Paluchowski, 2013) and similar works.

The concept of "Archetype" is used more than widely, however, its essence in the works of the Jungian school, as well as in philosophical studies, is disclosed deliberately incompletely. In our opinion, this is due to the fact that the essence of the archetype cannot be revealed without revealing the essence of the collective unconscious.

From our point of view, the essence of the collective unconscious can be fully revealed only by recognizing that human consciousness has a dual nature, i.e., it simultaneously contains both individual and collective components (Suleimenov et al., 2023; Massalimova et al., 2024; Berzina et al., 2019; Kunicina et al., 2019).

At the qualitative level, this conclusion can be explained as follows. Any interpersonal communications are in fact an exchange of signals between neurons that make up the brain of individuals. Consequently, the result is the formation of a common neural network (more precisely, a system of interpenetrating networks). In the extreme case, when the population of the planet as a whole is considered, we are talking about a global neural network, which can be identified with the noosphere.

It follows from this that along with the personal level, there is also a suprapersonal level of information processing (Suleimenov et al., 2023; Massalimova et al., 2024), where specific information objects are fixed. Archetypes are one of them, which makes their interpretation difficult.

The "elusive" from logically transparent interpretation essence of the archetype was reflected in historically first formulations. Thus, the interpretation of the archetype according to C. Jung sounds as follows: "Here I must clarify the difference between archetypes and instincts. What we call instincts is a physiological urge and is comprehended by the senses. But at the same time instincts manifest themselves in fantasies and often reveal their presence only through symbolic images. These manifestations I have called archetypes. They have no definite origin; they reproduce themselves at any time and in any part of the world, even where direct transmission or 'cross-fertilization' through migration is completely excluded" (Jung, 1991).

An example of a more modern approach to interpreting the essence of an archetype is provided by (Bol'shakova, 2010).

It defines "archetype" as a concept: "an invariant core of human mentality, modified in accordance with a particular historical situation, in resistance to it and in adaptation to it. Archetypes are basic concepts that set the coordinates in which a person perceives and conceptualizes the world and carries out his/her life activity."

A.Y. Bolshakova further introduces the following clarification of the interpretation of archetypes: they are "primary concepts that determine the essential development of human civilization" (Bol'shakova, 2010). Archetype in her interpretation is considered as a certain "constant" characteristic of human worldview. Otherwise, in this interpretation archetypes should be considered as primary "mental formations" possessing the property of invariance.

From our point of view, this interpretation remains vulnerable to criticism. In any case, in this interpretation of the term "archetype" there is a certain share of metaphoricality, which unites them with the interpretation proposed by Jung. However, the interpretation (Bol'shakova, 2010) undoubtedly contains a rational grain.

In order to reveal it, let us start from another provision reflected in the cited work.

"If the terminological scope of 'concept' is synonymous with 'meaning', then 'concept' is synonymous with 'sense', 'essence'."

De facto this means that "concept" is opposed to "concept", although, from our point of view, such opposition, as well as the thesis itself, also remains vulnerable to criticism. The opposition between "concept" and "concept" cannot mean the opposition between "meaning" and "essence", at least not without substantial reservations.

Further, if among "concepts" we can identify certain "constants" or "invariants" that represent (according to A.Y. Bolshakova) archetypes, then, guided by the principle of dialectical symmetry justified in (Vitulyova et al., 2020), we can try to identify a similar construct among "concepts". Such an approach seems quite justified, since all considerations related to "concepts" are obviously more evident than those related to "concepts".

This task was largely solved by us earlier in connection with the problem of interpreting the category of information as an undefined concept (Suleimenov et al., 2019). D.S. Chernavsky pointed out numerous difficulties arising in attempts to give a constructive definition of information (Chernavsky, 2000).

Clearly, the essence of these difficulties can be demonstrated in the following way. In explanatory dictionaries, the meaning of certain terms is revealed through sentences formed from natural language words. These terms can be called derived concepts. Along with them, there are undefinable concepts. More precisely, they cannot but exist, since attempts to define them lead to a vicious logical circle. Objective dialectics finds a way out of the situation by defining basic concepts (dialectical categories) through opposition (Suleimenov et al., 2019).

In particular, as shown in the cited works, "information" is also a basic ("limit") concept that can be defined through contraposition. The dialectical pair to the category of information is the category of matter, which, among other things, removes the difficulties associated with the definition of the latter category (Suleimenov et al., 2019).

However, dialectical opposition represents only one of the possible forms of connections between concepts. Such a connection can be much more complex, which requires the use of the apparatus of multi-valued logic (Suleimenov et al., 2023; Gabrielyan et al., 2022).

A detailed discussion of this issue is, of course, beyond the scope of this paper, however, the main conclusion is important - there are indefinable concepts, and the meaning is given to them only by connections between them, which, however, may be of a nature that does not correspond to binary (Aristotelian) logic.

An important nuance appears in this reasoning. Contradiction itself is a formal procedure. It is important as a tool for constructing, among other things, the apparatus of dialectical categories. But, de facto, it says nothing about how exactly one operates with the concepts that lead to dialectical categories. This is something that is internalized through mechanisms of thought that are not fully understood.

In this sense, fundamental (undefinable) concepts are close to archetypes. They can be understood and reasoned about, but without some experiential knowledge they lose their meaning. It is experience - including the most primitive - that allows students to understand the texts of the founding fathers of classical mechanics, in which they talk about motion as such.

The understanding of "motion" must be learned by the student/scholar in a pre-logical form in order for him/her to understand the constructs of classical mechanics.

Generalizing, there is every reason to assert that even at the basis of exact sciences there are some constructs which by their nature differ little from archetypes. These are the basis of fundamental concepts that can be formalized and interpreted, but this does not cancel the existence of the primary basis. Moreover, the basic concepts of the above-mentioned type are fundamental in all respects. Thus, without their assimilation - and at an intuitively perceived level - it is impossible to master any particular specialty. The basis of any professionalism is the assimilation of basic concepts at the "archetypal level".

This consideration allows us to reveal the meaning of "archetypes" as "basic concepts" more deeply.

From a relatively small number of words of natural language a wide variety of texts can be constructed (using logical or other connections between them), expressing the most complex scientific constructions or the most refined emotions. But behind these constructions is a relatively small number of basic - undefinable - concepts.

Similarly, a relatively small number of certain "quanta of thinking" provides thinking activity. From our point of view, such "quanta of thinking" (we can call them otherwise) are archetypes.

The difference is that speech (and text) corresponds to sequential calculations, while human thinking is parallel.

The "parallel" nature of thinking implies that "thinking quanta" corresponding to real thinking processes "layer" on each other, just as images fixed by a neural network in the process of its training "layer" on each other. As it is known, a neural network can be likened to a hologram - each of many images is "distributed" throughout the network as a whole, none of them is assigned an independent set of memory cells, as it is the case in computers.

The term "thinking quantum" above was used only for clarity. It seems much more correct to use the term "irreducible concepts/images", the essence of which is revealed through analogy with indefinable concepts existing in any of natural languages.

The proposed interpretation of archetypes remains largely debatable. It, however, allows us to visualize the scheme presented in Fig. 1, which illustrates the essence of projective techniques of psychological testing from the neural network point of view.

This figure presents an equivalent scheme of psychological testing using tests in which the respondent is asked to organize certain images (photographs, geometric figures, etc.).

The neural network formed by the respondent's brain cells is de facto connected to one more external additional layer of neurons during such testing. In the case of four pictures, this layer contains three binary neurons, and one neuron whose number of output states is equal to three.

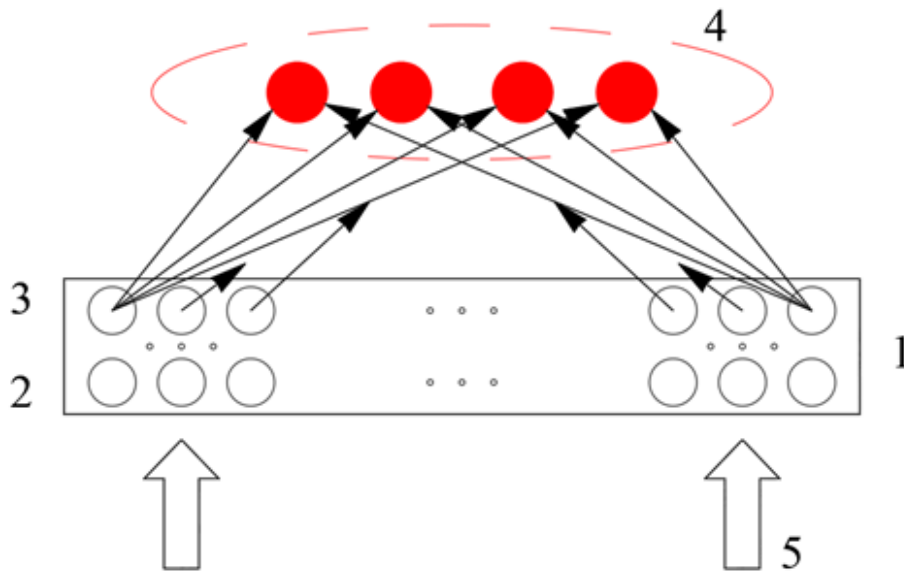


Figure 1 - Equivalent Scheme of Testing Procedure with The Help Of "Projective Techniques".

This follows directly from the theory of group representation, specifically from the representation of the symmetric group S_4 - the group of permutations of a set of four elements.

The elements $Q_{\{n_i\}}$ of the group under consideration can be represented as

$$Q_{\{n_i\}} = (12)^{n_1} (123)^{n_2} ((12), (34))^{n_3} ((13), (24))^{n_4} \tag{1}$$

where $n_1 = 0,1; n_2 = 0,1,2; n_3 = 0,1; n_4 = 1,0$

The representation (1) corresponds to the composition series possessed by the group S_4 ; this series includes the covariable group A_4 and the quadruple Klein group V_4 .

Recall that the concept of "image" is widely used in neural network theory. The "image" is often understood as a set of binary (or other) variables, which is formed at the inputs of neurons of the first layer of the network (as well as at the outputs of its last layer).

Accordingly, according to the scheme of Fig. 1, those complex images that are formed in the basic neural network (respondent's brain) are indeed projected onto the last (outer) layer.

What is most significant here is that the test result should also be interpreted as an "image". In particular, this means that not any sequences are meaningful, but only those that dominate the statistics, i.e. are most often encountered in practice.

This removes many of the objections reflected in publications such as (Stemplewska-Żakowicz & Paluchowski, 2013). Not every sequence of pictures (not every respondent's choice) is meaningful. This is a projection of a complex image onto an extremely simplified one, and such a projection may also contain "errors". But, they can be interpreted as acceptable deviations from the basic ones, i.e. from those that statistically occur most often.

Consequently, the tests of the considered type can be interpreted, first of all, as classification tests. At the same time, the choice of images used is largely arbitrary.

Tests of the type under consideration contain a very small number of "equivalent neurons". At first glance, the corresponding classification should be too poor. However, it is the possibility of its practical use, in our opinion, that proves the adequacy of ideas about archetypes. Indeed, archetypes - as basic concepts that are analogs of basic/indefinable concepts - influence the formation of image/images on the output layer of the neural network representing the human brain in the scheme of Fig. 1. The number of archetypes, as well as the number of basic/indefinable concepts in natural language is relatively small. Therefore, the outer layer of the aggregate neural network represented in Fig. 1 may contain a relatively small number of equivalent neurons.

Conclusion

To summarize, we can suggest the following approach to the construction of tests related to projective techniques. Large enough groups of respondents selected by the criterion of representativeness are tested. The images (answer options) dominating in statistics are selected. Interpretation of these options and their correlation with specific psychotypes, for example, is carried out using additional information.

The actual testing is carried out using correlation of a specific result with basic images that correspond to the most frequently occurring answer options. The correlation is carried out by the closeness of a particular answer to those that meet the basic images. "Proximity" is understood in the sense of an analog of the Hamming distance used in noise-resistant coding (Bakirov & Suleimenov, 2021). Specifically, two different answers corresponding to two elements of the group S_4 are maximally close if they differ from each other by a single transposition (the two pictures are swapped).

Thus, the question of the adequacy of projective techniques realized through tests in which respondents are asked to arrange certain images according to their preferences requires further experimental research based on a refined understanding of the essence of the archetype.

We believe that for this purpose an experimental technique should be used in which the results of testing (ordered sets of pictures) should be interpreted on the basis of a model in which testing is interpreted as a connection of the neural network formed by the human brain to one more external layer. This means that the result of testing should be interpreted as a digital image created at the output of the common neural network.

Acknowledgments

This research has been/was/is funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant № AP14870416).

References

- Bakirov, A. S., Suleimenov, I. E. (2021). On the possibility of implementing artificial intelligence systems based on error-correcting code algorithms. *Journal of Theoretical and Applied Information Technology*, 99(1), 83–99.
- Bakirov, A. S., Vitulyova, Y. S., Zotkin, A. A., and Suleimenov, I. E. (2021). Internet users' behavior from the standpoint of the neural network theory of society: prerequisites for the meta-education concept formation. *Remote Sens. Spatial Inf. Sci.*, XLVI-4/W5-2021, 83–90. <https://doi.org/10.5194/isprs-archives-XLVI-4-W5-2021-83-2021>.
- Berzina, K., Kunicina, N., Ziravecka, A. & Caiko, J. (2019). Promoting of Lifelong Learning in Engineering. 60th Annual International Scientific Conference on Power and Electrical Engineering of Riga Technical University, 8982289. <https://doi.org/10.1109/RTUCON48111.2019.8982289>.
- Bol'shakova, A. Ju. (2010). Arhetip-koncept-kul'tura. *Voprosy filosofii*, 7, 47–57. (in Russian).
- Borstelmann, L. J. & Klopfer, W. G. (1953). The Szondi Test: A review and critical evaluation. *Psychological Bulletin*, 50(2), 112–132. <https://doi.org/10.1037/h0058845>
- Chernavskii, D. S. (2000). The origin of life and thinking from the viewpoint of modern physics. *Physics-Uspexhi*, 43(2), 151–176. <https://doi.org/10.1070/PU2000v043n02ABEH000609>
- FalineDeer Psychological tests and what you should know about them https://pikabu.ru/story/psikhologicheskie_testyi_i_chno_vyi_dolznyi_o_nikh_znat_8712506 (in Russian).
- Frank, L. K. (1939). Projective Methods for the Study of Personality. *The Journal of Psychology*, 8(2), 389–413. <https://doi.org/10.1080/00223980.1939.9917671>
- Furrer, W. (1967). Psychiatric test methods, especially the Lüscher color test *Psychiatrische Testverfahren, besonders Lüscher-Farbttest. Therapie der Gegenwart*, 106(10), 1290–1300.
- Gabrielyan, O., Vitulyova, E., & Suleimenov, I. (2022). Multi-valued logics as an advanced basis for artificial intelligence (as an example of applied philosophy), *Wisdom*, 1 (21), 170–181. <https://doi.org/10.24231/wisdom.v21i1.721>.
- Jung, C. G. (1991). Archetype and Symbol. *Renaissance*, 343.
- Kunicina, N., Bilic, I., Zabasta, A., Caiko, J. & Ribickis, L. (2019) Development of entrepreneurship skills for students creative thinking support in higher education. 2019 International Conference on Engineering Applications, 8883450. <https://doi.org/10.1109/CEAP.2019.8883450>.
- Massalimova, A, Suleimenov, I., Gabrielyan, O., Vitulyova Y. (2024). The evolution of consciousness from the point of view of modern theory of information and telecommunications. *Adam Alemi*, 100(2), 40–51. <https://doi.org/10.48010/aa.v100i2.551>.
- Mayall, K. & Dellinger S. (1953). Your personal communication style. Parenting Shape eBook. Kindle Edition.
- Stemplewska-Żakowicz, K. & Paluchowski, W. J. (2013). The reliability of projective techniques as tools of psychological assessment. Part 1: Why it is unjustified to describe some of them as projective? *Problems of Forensic Sciences*, 93, 421–437.
- Suleimenov I. E., Vitulyova Y. S., Kabdushev S. B. & Bakirov A. S. (2023) Improving the efficiency of using multivalued logic tools. *Scientific Reports*, 13(1), 1108. <https://doi.org/10.1038/s41598-023-28272-1>.
- Suleimenov, I. E., Bakirov, A. S., & Matrassulova, D. K. (2021). A technique for analyzing neural networks in terms of ternary logic. *Journal of Theoretical and Applied Information Technology*, 99(11), 2537–2553.
- Suleimenov, I. E., Gabrielyan, O. A. & Bakirov, A. S. (2023) Neural network approach to the interpretation of ancient chinese geomancy feng shui practices. *European Journal of Science and Theology*, 19(2), 39–51.
- Suleimenov, I. E., Gabrielyan, O. A., Bakirov, A. S., & Vitulyova, Y. S. (2019). Dialectical understanding of information in the context of the artificial intelligence problems. In *IOP Conference Series: Materials Science and Engineering*, 630(1), 012007. <https://doi.org/10.1088/1757-899X/630/1/012007>.
- Suleimenov, I., Gabrielyan, O. & Vitulyova, Y. (2024). Problems of many-valued logic from the point of view of the theory of socio-cultural code. *Journal of Ecohumanism*, 3 (4), 236–248. <https://doi.org/10.62754/joe.v3i4.3548>.
- Vitulyova, Y. S., Bakirov, A. S., Baipakbayeva, S. T., & Suleimenov, I. E. (2020). Interpretation of the category of “complex” in terms of dialectical positivism. In *IOP Conference Series: Materials Science and Engineering*, 946(1), 012004. <https://doi.org/10.1088/1757-899X/946/1/012004>.
- Vitulyova, Y. S., Bakirov, A. S., Shaltykova, D. B., & Suleimenov, I. E. (2020). Prerequisites for the analysis of the neural networks functioning in terms of projective geometry. In *IOP Conference Series: Materials Science and Engineering*, 946(1), 012001. <https://doi.org/10.1088/1757-899X/946/1/012001>.
- Yakimanskaya, I. S. & Karymova, O. C. (2012). Semantic psychogeometric test: methodological guidelines. *Orenburg State University*, 84. (in Russian).