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# SOME ASPECTS OF PERCEPTION OF FINE ART AND ITS INFLUENCE ON A PERSON

***Abstract:*** *The article reviews questions of relation and size of compositional elements in fine art works, their influence on a viewer. A new scheme of analysis of compositional structure of fine art pieces is suggested, based on combination of empirical and theoretical methods of research, synthesis of art studies and neuroaesthetics. With accordance to it, practical analysis of great masterpieces of fine art was carried out (Giotto di Bondone«Kiss of Judas»,Raffaello Santi«School of Athens», Leonardo da Vinci «Lady with an ermine»), that conduced provision of objectively correct assessment of intuitional feelings of a viewer.*

***Key words:*** *Composition, analysis, neuroaesthetics, proportions, frequencies fluctuation of electrical activity of the brain, Giotto di Bondone«Kiss of Judas»,Raffaello Santi «School of Athens», Leonardo da Vinci «Lady with an ermine».*

Today it can be confirmed that «divine» proportions determination[1] is gaining scale. Specialists of different domains, apart from usual for us artists, designers, engineers, architects, mathematicians, during structural analysis of surrounding environment determine some fixed proportions at the heart of its design. This issue has gained a great popularity in philology, biology, medicine etc.[2]

In art studies issues on the meaning and understanding of the principles of function of proportions are mostly raised by the authors of theoretical works on painting, drawing and aesthetics. They review «divine» proportions from practical or purely theoretical point, without complex analysis and research of cause and effects of proportions influence on the perception of art piece. [3]

[1] Lucas de Burgo, *Divina Proportione,* Venetia 1509.
[2] I. Shevelev, I. Marutaev, I. Shmelev, *Golden section: Three views on the nature of harmony*, Moscow 1990.
[3] G. Doczi, *The power of limite. Proportional harmonies in nature, art and architecture*, London 1981.

The existence of the most famous, so-called «golden» proportions in the shapes of objects, created by the mankind, is explained on the basis of analysis of Fechner's research[4]. The choice of the rectangle with the ratio of sides α =1,618 by the majority of people is explained by the design of the eye ground (ocular fundus) of the human. It is due to the fact that anatomical field of clear vision of a person has the form of an ellipse, the exes of which relate to each other as α = 1,618. Therefore objects proportions of which contain «golden» section are felt «favourably» by a person.

Question of structured artwork analysis has gained a new direction after conducting research on analysis of the ratio of sides of formats of artworks[5]. Thus, it was concluded that the choice of the format other than the «golden» section by an artist might influence the power of the desirable impression from the artwork.

Numerous studies have shown that oscillations of different frequencies correspond to different states of the brain. Specific structures of neural chains with their own frequencies of electrical oscillations correspond to the main states of the brain (calmness, mental work, emotional excitement etc)[6]. Each of the «brain waves», which is denoted by a Greek letter, has its own frequency spectrum. An average geometric frequency divides frequency spectrum of any brain wave into a high-frequency and relatively low-frequency zones (bands). Ratio of these two bands to one another – is a constant value (invariant) for the given wave, that is, it depends only on the ratio of extreme frequencies of this wave.

During the mental work in the brain the wave β dominates, for which the division of frequency spectrum is in proportions of a «golden» section (the interval of frequency periods is divided by the frequency into the interval of «short» periods and the interval of «long» periods in the following relation 0,38:0,62). The most effective mental activity (thinking, analysis, aesthetic perception) occurs in conditions of physiological calmness combined with the absence of emotional excitement. Thus, the most effective work of the brain and the most effective mechanical work of the heart is related to the calmness of the organism, corresponding the wave β. There are the other waves as well: α, γ, θ and ρ. For instance, the wave θ with the ratio of 1,324 corresponds to the state of danger anticipation.

These and other studies performed at the intersection of various allegedly incompatible sciences became a basis of the young science of neuroaesthetics, which has received its formal definition as a scientific study of neural foundations for the contemplation and creation of works of art in the early 2000's. The term «neuoaesthetics» was coined in the 1990's by British neurobiologist Semir Zeki, Professor of the UCL *Institute of Neuroaesthetics*. Another founder of this science, French neurobiologist Jean-Pierre Changeux, in his research studied the work of nervous system of the human on multiple levels[7]. The search for the neural

[4] H. Hoge, "Fechner's experimental aesthetics and the golden section hypothesis today", *Empirical Studies of the Arts*, 1995, no. 13, pp. 131–148.

[5] A. Sokolov, "Secrets of the Golden Section", *Techniques of Youth*, 1978, no. 5, pp. 40–43. (in Russian).

[6] Ch. Johnston. "Secrets of Leonardo da Vinci painting laid bare by new scanning technique", *The Guardian*, (30 September 2014).

[7] J.-P. Changeux, *Les Neurones enchantés - Le cerveau et la musique, Entretiens avec Pierre Boulez et Philippe Manoury,* Paris 2014.

interpretation of creativity is revealed by the author in a model of the neurons' working space[8] and suggests a complex scheme for understanding the epigenetic dynamics of the artistic process and its structure.

Semir Zeki considers art as an example of the inconstancy of the brain[9]. Thus, the neurological approach to the source of this inconstancy can explain specific subjective feelings as well as ranges of abilities to create works of art. Zeki believes that artists unconsciously use the methods of creating visual art for the study of the brain and specifies that «…an artist in some sense is a neurologist who explores the potential and capabilities of the brain, albeit with different tools. These creations as such can cause aesthetic experience, can be fully understood only in terms of the nervous system, within our reach»[10].

Studies by Zeki and Indian neurologist Vilayanur Ramachandran[11] allowed to define a set of «principles» of art perception, such as: «peak shift», «grouping and binding», «contrast», «isolation», «perceptual problem solving», «symmetry», «abhorrence of generic viewpoint», «repetition, rhythm and orderliness», «balance», «visual metaphor». After detailed examination of these principles, it becomes clear that they to varying degrees correspond to the established concept of compositional construction of a work of art, but are derived from the physiology of higher nervous activity.

The first fundamental step towards the involvement of the neurological approach into the study of works of fine art was the work of Sokolov O.O. and Sokolova Ya.O. «Mathematical patterns of electrical oscillations of the brain» , in which the authors compared the aspect ratio of the most significant works of world art. It was concluded, that the choice by artists of formats other than harmonic ratio, aims to create a certain «emotional state» for the audience, which most closely corresponds to the creative idea of the artist. But the authors studied only the external dimensions of works of art, without delving into the composite aspects of the organization of paintings. Such incomplete analysis raised the question of a deeper study of the influence of geometric patterns of compositional organization of pictorial art works on their perception.

Since the publication of scientific research by Ya.O. Sokolova and O.O Sokolov[12], composition studies have acquired a new direction, set forth in the scientific work «Basis of composition» by V.E. Mikhailenko and M.I. Yakovlev[13]. The scheme proposed by the authors allowed to logically clearly distinguish the main composite elements of works of fine art, which determine the creative idea of the artist. The combination of research approaches[14] and the latest achievements in the study of the basics of composition gave an opportunity to study in more detail the possibility of the use of neurological effects on the viewer by artists not only of a comprehensive work of art, but also of its main compositional elements.

[8] J.-P.Changeux, "Ethique et Moralité: Philosophie du Comportement", *Choix et Caractère* [human], 1999, no. 5-6, Available at: http://vivovoco.astronet.ru/VV/PAPERS/MEN/CHANGEUX.HTM.

[9] S. Zeki, "Art and the Brain". *Daedalus,* vol. 127, No. 2, Spring, 1998, pp. 71-103.

[10] A. A. Sokolov, Ya. A. Sokolov, *Mathematical regularities of electrical oscillations of the brain,* Moscow 1977.

[11] V. Ramachandran, *Tell-Tale brain*, Moscow 2012 (russian trans.).

[12] A. A. Sokolov, Ya. A. Sokolov, op. cit.

[13] V. Mikhaylenko, M. Yakovlev, *The basis of composition*, Kyiv 2017.

[14] Ibidem, p. 127.

Three distinct works of art from Renaissance «Kiss of Judas» by Giotto di Bondone,«School of Athens» by Raffaello Santi, «Lady with an ermine» by Leonardo da Vinci were selected for study.

Initially, based on the model of geometric analysis[15], in order to identify the most significant composite elements, an appropriate geometric design was carried out (fig. 1, 2, 3). The calculation of dimensional relations of the determined basic composite elements was carried out, which were compared with the algorithms of brain waves.

During the analysis of one of the most prominent works of the proto-renaissance Giotto di Bondone's «Kiss of Judas» (400x410 cm, around 1305, fresco), without going into a detailed description of the scheme of subordination

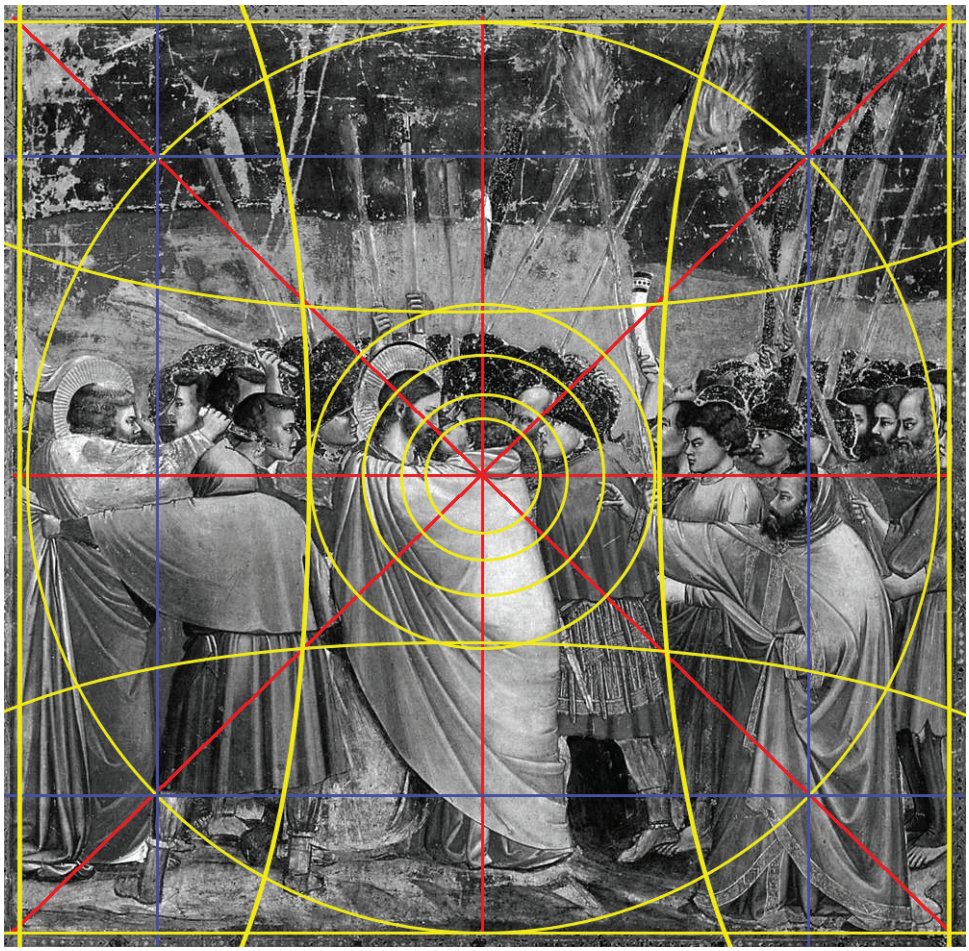

*Illustration 1: an analysis based on the work «Kiss of Judas» by Giotto di Bondone, Public Domain.*

[15] Ibidem, p. 213.

on the fresco, as a result of calculations it was found that the ratio of the size of the elements of the painting – the dark sky to the whole format is 1, 32 (θ-wave – that is anticipation of danger), silhouette of the gates of the city – 1,28 (α-wave - calm cheerfulness), silhouettes of people – 1,3 – (close to the γ-wave – emotional excitement). This corresponds to the emotional content of the depicted – a dark spot of the night sky, which presses on the light static silhouette of the gates of the city, and further on the silhouettes of people and creates an anticipation of danger.

An analysis of the composite center, namely the figures of Judas and Christ, revealed that the ratio of the format of the whole fresco to the depicted figures is 1,51 (close to ρ-wave (1,465) – corresponds to higher level of mental work during a life-threatening situation).

Following the proportions of the illuminated parts of the heads of Christ and Judas, which corresponds to 1,64, we can say that the application of this ratio, which approaches the «golden proportions», corresponds to the β-wave and provokes the most effective mental work of the brain in the viewer, which leads to a feeling of calmness in the most tense zone.

Summing up the results of the conducted research, it can be assumed that only due to the ratio of the size of the most significant composite elements of the painting, the artist managed to create a strong emotional image in the viewer's mind, full of a sense of danger and simultaneously of being conquered by fate. This emotional mood is amplified by the pictorial means and leads to an understanding of the biblical truths regarding the way of birth and development of the thought: the disbelief that has changed by enlightenment, and then by the calm awareness of righteousness.

The next work to analyze was the work by Raffaello Santi «School of Athens» (770x500 cm, 1508—1511, fresco). According to historians, the theme «Triumph of Philosophy» or «School of Athens» belonged to Pope Julius II[16]. The author of the painting separated philosophy from religion and allotted a separate temple for it, where great thinkers of antiquity gathered.

Practical analysis has revealed that the aspect ratio of the format is 1,54, which is the intermediary between the β-wave (mental activity) and the ρ-wave (the highest level of mental activity), but tends more to the first one.

Practical analysis was focused on matching the figures and architecture. The ratio of the central figures of philosophers to ancient statues in the background is 1,26 (close to the γ-wave) and corresponds to emotional excitement. That is, with the help of proportions put in place the artist emphasizes the eternity and constant development of classical philosophical ideas from antiquity (antique statues) until the time of painting of the frescoes. The ratio of the figures of philosophers, which the artist portrayed in the foreground, to the statues is 1,38 (σ-wave) and corresponds to the highest level of mental activity.

Also, the results of determining the ratio of the arch crowns in the work are quite interesting. The gradual distancing of architectural elements emphasizes a certain systematic feature. Elements with distancing are related to each other from 1,3 to 1,6, that is, from the proportion that corresponds to (γ-wave) emotional excitement, through 1,44 (ρ-wave) – the highest level of mental activity during

[16] *Raphael's "School of Athens",* ed. M. Hall, Cambridge 1997.

dangerous situations, to 1,6 (β-wave) – mental activity and harmony.

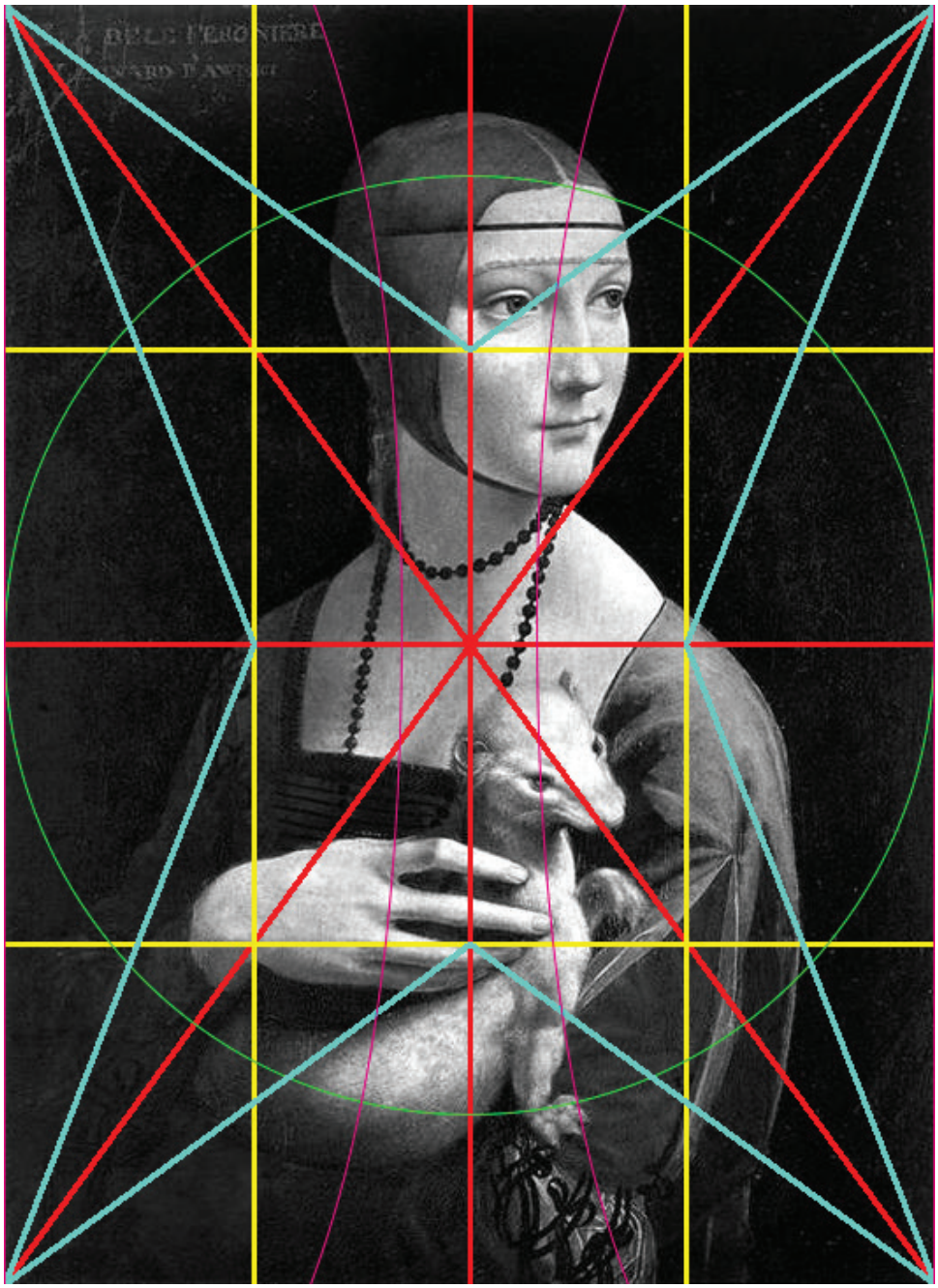

*Illustration 2: an analysis based on the work «Kiss of Judas» by Giotto di Bondone, Public Domain.*

Summing up the results of the research, it can be assumed that by the means of the ratio of the size of the figures and architectural elements, the artist created the viewer's belief in the need for knowledge, but at the same time warns about the danger on the path of acquiring knowledge and achievement of harmony.

The results of the study are consistent with the generally accepted reading of the fresco by the art critics: «... the heroes of the «School of Athens» have a special internal activity, lifted spiritual energy. The viewer is engulfed by the feeling of the indivisible power of the human mind, which encompasses the whole world. The expressiveness of individual images and groups in the «School of Athens» is enhanced by compositional means. So, despite the fact that Plato and Aristotle are depicted in the background, among the many other actors in the scene, Raphael has achieved their clear accentuation due to the fact that the most distant from the arches of majestic enfilade enflames only two of these figures. But even more importantly, both of them are depicted not statically in place, but going forward, directly to the viewer. Their solemn procession, as if inextricably linked with the movement of powerful architectural masses and arch passages, not only gives the main heroes of fresco the function of a dynamic center of composition, but also fills them with the increased force of figurative influence ...»[17].

The last object of the study was the work of Leonardo da Vinci «Lady with an ermine» also known as the «Portrait of Cecilia Gallerani» (54.8x40.3 cm, around 1490, wood, oil).

The aspect ratio of the work format is 1,36 (close to the ρ-wave) and corresponds to the highest level of mental activity in anticipation of danger.

The portrait depicts a fragile girl with a faint smile and a keen look. She holds a white beast in her hands, pressing it with thin and nimble fingers. The transparent cornette, fastened under the chin, forms a spot with proportions of 1,25 (corresponding to the α-wave), that is, calmness. The face illuminated by the artist is 1,66, which is closer to the «divine proportions» (corresponding to the β-wave) – mental activity. These proportions are also found in the elements of clothing, illuminated fragments of the figure of the depicted.

A simple necklace made of dark pearls wraps around the neck and, drawing down the second oval on the chest, reveals a contrasting plane in the form of a trapezoid with proportions of 1,31 – (θ-wave) – a sense of danger, excitement. The fingers of Cecilia (the proportion of – 1,22 (δ-wave) corresponding to the state of calmness) touch upon the fur of a timid animal. The artist thus transfers the moment of calming the ermine, which is in her hands.

To analyze the meaning of the ermine in the work, two illuminated parts of the work were analyzed separately, divided by the hand of Cecilia. The upper part has a proportion of 1,411 (close to the σ-wave), that is, the highest level of mental activity in a dangerous situation, in this way the artist emphasized the animal's nervousness, the other half – 1,2 (close to the δ-wave) – a deep sleep.

Summing up the results, it can be assumed that with the help of the ratio of composite elements the artist created the image of a woman who tries to calm the feeling of anxiety. An object of anxiety is an animal that can act as a symbol of yet

[17] J.-P. Changeux, op. cit…

an unborn child.

Such conclusions are consistent with some historical facts associated with the writing of the portrait. Cecilia Gallerani (guessed portrait model), in the marriage – Countess Bergamin Croce was one of the permanent lovers of the Duke of Milan Ludovico Sforza and the mother of his bastard Cesare. Another interesting fact is that the ermine became a personal heraldic animal Lodovico Moro after joining the Order of Gornosta in 1488, «white ermine» – the nickname Lodovico among the approximate[18]. Summing up the abovementioned, we can draw some conclusions:

First, it should be noted that the proposed new scheme of the analysis of compositional construction of works of fine art is based on a combination of empirical and theoretical research methods; synthesis of art history and neuro-aesthetics. The application of this type of analysis of works of fine art contributes to the provision of an objectively correct assessment of intuitive sensations. The obtained results of the analysis coincide with the results of art studies.

Secondly, in the course of practical solution to the compositional construction of future works of fine art, in order to increase their influence on the viewer, one can use the ratio and size of the composite elements of the artistic work in accordance with the mathematical patterns of electrical oscillations of the human brain.

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