Constructive Analysis Of Shape. An Important Characteristic Of Pen Art And Imaginative Expression

Abdullayev Alimardon Khaydarovich — Associate Professor, Kokand State University

Sharabayev Ulugbek Mukhamedovich — Associate Professor, Kokand State University

ABSTRACT

This scientific article covers the theoretical and methodological foundations of the constructive analysis of form, the important features of the science of pen drawing in the visual arts, and the psychological, physiological, and graphic mechanisms of the process of figurative expression on a deep scientific basis. The purpose of the research is to determine the geometric structure of the form, analyze proportions based on a mathematical model, reveal the constructive and figurative properties of lines and strokes through scientific criteria, connect the physical and optical laws of the light-shadow system with artistic practice, and study the process of formation of visual perception based on the gestalt principles. It covers the analytical construction of form, generalization mechanisms, spatial construction, visual thinking, compositional stability, the semantic power of lines and strokes in the process of image creation, and the processes of image processing by the brain on a scientific and theoretical basis. This article shows the didactic, psychological and artistic functions of the science of pencil drawing as a single scientific system, and justifies the inextricable link between the constructive analysis of form and figurative expression based on the theories proven in science.

Keywords: constructive analysis, pencil drawing, geometry of form, gestalt perception, line, stroke, light-shadow, perspective, figurative expression, analytical generalization.

INTRODUCTION.

Constructive analysis of form is the foundation for all stages of fine art, and its scientific and methodological essence begins with determining not the external image of the object, but its internal geometric-tectonic structure; that is, the center of mass of the form, the system of main proportions, the main geometric axes, the spherical-prismatic-block construction, spatial directions and general tectonic stability are analytically constructed through lines. In deep scientific sources (Euclid's geometry, Descartes' coordinate theory, Dürer's constructive models) it is noted that the correct depiction of a form is carried out by determining its constructive basis, these principles serve as the main methodological task for the science of pen drawing in artistic practice. Research by Goldstein, Hubel and Wiesel on the physiology of vision has proven that the brain divides visual signals into a structure based on shapes, axes and proportions, which confirms the scientific basis for the constructive analysis of form; the principles of integrity, proximity, continuity, generality and centrality of Gestalt psychology

determine the original mechanism of figurative perception, that is, a person perceives an image not according to lines or strokes, but according to the structure they form. An important feature of the science of pen drawing is that it controls the constructive process of seeing, understanding and depicting an object at the level of thought: a line is not just a contour, but an energetic direction of the form, and a stroke is a means of volumetric modeling; light and shadow are the spatial reality of the form, and its physical and optical essence is modeled based on the Lambert law, diffuse reflection and optical density theories. The relevance of this topic is that scientifically based methods for the constructive analysis of form are not sufficiently used in modern art education, which causes problems such as proportional errors, perspective distortion, light and shadow ambiguity, poor visual thinking, and weakening of artistic thinking in creating an image. Therefore, this study aims to study theoretical models of the constructive analysis of form, the fundamental properties of pencil drawing and the psychological and emotional mechanisms of figurative expression as a whole scientific system and offers modern scientific and methodological foundations of academic training at the A3 level.

MATERIALS AND METHODS.

This scientific research was based on a multi-stage complex methodology in order to conduct a constructive analysis of the form, to study the important features of the science of pen drawing on a scientific basis, and to identify the cognitive-logical mechanisms of figurative expression. First of all, geometric construction methods were used: classical geometry based on Euclid, Descartes' coordinate system, Dürer's principles of proportional modeling, Le Corbusier's "Modulor" system became the main scientific platform for determining the mathematical-proportional structure of the form; the block construction of the form was decomposed into a generalized geometry consisting of elements such as a sphere, prism, cylinder, cone, and then these elements were returned to a real form through analytical synthesis. As a second methodological direction of the research, the principles of integrity, proximity, continuity, figure-ground, and centralization of Gestalt psychology (Koffka, Wertheimer, Köhler) were used, which served to scientifically confirm what constructive structures the perceptual analysis of the form is decomposed into in the human mind; The Nobel Prize-winning research of Hubel and Wiesel on the physiology of vision, the sensitivity of retinal photoreceptors to light, contrast differentiation, and the sensitivity of orientation neurons to lines were used to determine the neurophysiological foundations of the constructive perception of form. The third area of research was based on the physics of light and shadow, and the Lambert law of diffuse reflection, Fresnel's model of light reflection, the optical properties of the surface, the penumbra differentiation, the effect of reflected light on the surface relief, and the angles of light incident on tectonic forms served as physical and optical criteria in graphic modeling; the fourth set of methods was the optical-semantic analysis of lines and strokes, in which Helmholtz's theory of optical perception, the dependence of stroke density on tonal changes, the correlation of directional strokes with shape rotation, and the creation of a volumetric effect of cross-hatching were analyzed on the basis of scientific experiments. As a fifth method, the semiotic and psychological mechanisms of figurative expression were studied, and parameters such as the emotional energy of the line, the semantic center of the form, and the psychological effect of rhythm were studied based on Langer's theory of "coherent figurative language", Arnheim's model of "visual thinking", and Gombrich's concept of "construction through perception". Also, analytical generalization methods were used, and the process of cleaning complex forms from unnecessary details, preserving the main tectonic blocks, transforming the form into a simplified construction, and then transforming it into an artistic whole was studied on a scientific-theoretical and practical basis. As a result, the multi-layered scientific methodology used in the study scientifically substantiated that the constructive analysis of the form is a complex process inextricably linked with the system of geometry, optics, psychology, physiology, and

artistic thinking, and made it possible to illuminate the instrumental and structural role of the science of penmanship in figurative expression at a fundamental level.

RESULTS AND DISCUSSION.

1. **Results of the constructive analysis of the form**

The results of the study showed that the constructive analysis of the form is not only a technical stage of the fine arts, but also a process of thinking with a scientific basis; when the geometric model of the form is divided into basic forms such as a sphere, prism, cylinder, cone, it acquires a clear and unambiguous construction in terms of tectonic stability, which is a scientific condition for the correct perception of the object. The results of the mathematical analysis of the proportional system confirmed that the "golden section", modulus, anthropometric ratios, rhythmic dimensions govern the visual stability and aesthetic perception of the form; it is precisely the slightest violation of the ratio that creates perceptual uncertainty and constructive defects. The analysis conducted along the constructive axes of the form allowed us to identify the main dynamic directions of the object and accurately place it in spatial planes. At the same time, it was noted that constructive models built on the theories of Dürer and Descartes are the most stable and scientifically proven way to describe space through geometric logic. These results confirm that the constructive analysis of form is an intellectual and scientifically sound component of fine art.

2. Constructive and figurative properties of the line

Scientific analysis of the line has shown that it is the main constructive element that expresses not only the external contour of the image, but also the internal structure, energy and spatial character of the object; the pressure, rhythm, duration, direction, bending and plastic force of the line directly affect the tectonic stability and figurative expressiveness of the form. Neurophysiological studies by Hubel and Wiesel have proven the existence of special neurons that respond to the line, scientifically substantiating the perceptual significance of the line. The study found that constructive lines divide the form into tectonic axes, and figurative lines create emotional dynamics; the sharpness of the line expresses the energy of anxiety, softness - peace, sinusoidal shape - rhythm and movement, solid constructive lines - stability. From the point of view of the semiotics of art, the line is one of the most basic signs of visual language, and its reading is carried out by the brain through certain associative systems; The results scientifically confirm that the line is the constructive support and figurative center of the pencil drawing.

3. Optical and perceptual essence of hatching

The results obtained on hatching showed that the hatching is a scientific tool that determines the optical-energetic structure of the image, and its density, direction, rhythm, intensity and structure of repeating energy impulses are the most stable method for determining the size of the object. The optical model of hatching shows that as the density of the hatching increases, the level of light absorption in the photoreceptors of the retina decreases, which causes the image to thicken; a change in the direction of the hatching represents the trajectory of the shape's curvature - in cylindrical shapes, a directional hatching has a modeling effect, and in spherical shapes, an arc-shaped hatching has a modeling effect. The volumetric effect of cross-hatching is scientifically based on the interference of hatching layers, an increase in optical density and an increase in contrast differential. Psychological analysis also shows that fast, sharp strokes create a dynamic image, while soft strokes create images that give a sense of calm and balance. These results confirm that the stroke has not only technical, but also scientific, physiological and psychological properties.

4. Scientific results of the light-shadow system

As a result of the light-shadow analysis, it was found that in order to accurately represent the volumetric structure of the form, the physical nature of light, diffuse reflection, absorption and refraction coefficients, and optical properties of the surface material must be modeled based on Lambert's law; the angle of incidence of light, the intensity of the shadow, the penumbra zone, and the distribution of reflected light along the surface are directly related to the tectonic

structure of the form. The study showed that the balance of light and shadow is interpreted by the brain as the main sign of spatial perception: the illuminated part is perceived as close, the shadow is perceived as far, and the penumbra is perceived as a transition zone. Light-shadow errors distort the volumetric structure of the form and reduce the perceptual quality of the image. These results scientifically confirm that the light-shadow system is one of the most important elements of constructive analysis**.**

5. Geometric generalization of the form and analytical synthesis

The results obtained on the analytical construction show that the decomposition of a complex form into simplified geometric models - such as a sphere, prism, cylinder, cone - is the most reliable scientific way to determine the tectonic basis of the form; generalization is the process of reuniting these elements into an artistic whole, in which unnecessary details are removed, the main tectonic lines are strengthened, and the semantic center of the image is isolated. The study showed that the perception of a generalized form is much easier for the brain than complex forms, which fully corresponds to the principle of "integrity" of Gestalt psychology. Analytical synthesis creates a scientifically based structure of the image in art and strengthens its constructive logic.

6. Psychological and semantic mechanisms of the process of figurative expression

The results of the scientific analysis of figurative expression show that the image is created by the brain as a set of not only visual, but also emotional and semantic signals; Langer's theory of figurative language, Arnheim's model of visual thinking, Gombrich's concept of construction through perception scientifically substantiated the semantic role of lines and strokes in creating an image. The study confirmed that figurative expression is formed through the energetic power of the line, the psychological effect of rhythm, the role of light and shadow in separating the semantic center; the success of the image depends on the unity of the constructive basis and emotional energy. These results show that the image is not only a technical, but also a cognitive-semantic process.

7. The scientific and methodological significance of pencil drawing in art

The final results of the study showed that the science of pencil drawing serves as a scientific and methodological center for all areas of fine arts; components such as constructive analysis, light and shadow, line, stroke, spatial construction, figurative expression are formed as a whole scientific system in pencil drawing. Pencil drawing is the intellectual foundation of painting, sculpture, graphics, design, architecture, and digital art, developing creative thinking, deepening spatial perception, creating compositional stability, and increasing the level of artistic understanding on a scientific basis. The results prove that the science of pencil drawing is not only a technique, but also a scientific system of perception.

CONCLUSION.

The results of this scientific study show that the constructive analysis of form is the main theoretical and methodological support of the science of pen and ink drawing, and is manifested as a fundamental process that scientifically reveals the geometric, tectonic and spatial structure of the form at all stages of the practice of fine arts; the inextricable connection of constructive analysis with geometry, optics, physiology, psychology and semiotic systems allows interpreting the perception of form based on objective scientific criteria, this process is carried out by scientific stages such as the reconstruction of the object as a mathematical-proportional unit through spherical, prismatic and cylindrical models, the use of lines and strokes along the constructive axis, optical modeling of the light-shadow differential based on Lambert's law, and the determination of the center of mass and tectonic rhythm of the form. The results of the study on the constructive and figurative properties of the line, the optical-physiological processes of hatching, the laws of perspective and spatial construction, the mechanisms of perception based on Gestalt psychology, and the semantic-energetic nature of figurative expression proved that the science of pen drawing is not just a set of technical exercises, but a scientific system that governs artistic thinking, visual perception, spatial analysis, and the process of image

creation. The place of pen drawing in art education is strengthened precisely through constructive analysis, and the process of simplifying and geometricizing the form, and then re-unifying it through artistic synthesis, systematizes the thinking of the creator, increases perceptual accuracy, strengthens compositional thinking, and forms a deep scientific foundation for figurative expression. The results also confirmed that pen drawing is the most reliable and theoretically stable model of image creation, in which line - structure, stroke - volume, light - space, composition - logic, image - content constitute a whole scientific system; This conclusion fundamentally substantiated the fact that the constructive analysis of form serves as a common scientific foundation for all areas of fine art, and that pencil drawing is the main didactic and scientific discipline that puts this foundation into practice.

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