Development Of Student Geometric Spathic Imagination By Points

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ABSTRACT

In design, architectural and design activities, business owners are required to have a highly developed geometric imagination. The role of engineering and computer graphics taught in higher education institutions in the formation and development of spatial imagination in future designers, architects and designers is special. This article presents a study material designed to use students' spatial imagination in the development of the process of constructing imaginary point geometric sets by memorization.

Keywords: Geometric Imagination, Computer Graphics

In design, architectural and design activities, business owners are required to have a highly developed geometric imagination. The role of engineering and computer graphics taught in higher education institutions in the formation and development of spatial imagination in future designers, architects and designers is special. This article presents a study material designed to use students' spatial imagination in the development of the process of constructing imaginary point geometric sets by memorization.

It is advisable to read the lecture in the beginning of the training course on engineering and computer graphics.

Geometric elements. In the language of geometry, points, straight lines, and planes are recognized as the basic elements of that language. They can also be represented, for example, by drawing on paper, in pencil: in particular, in practice it is common to represent a point in the form of a dot, a straight line in the form of a straight line, a plane in the form of a triangle or parallelogram. In the written expression of geometric ideas in muhan-dislik graphics today:

- points A, B, C, D, etc. in the form of capital letters of the Latin alphabet or 1, 2, 3, 4, etc. with Arabic numerals in appearance;
- straight lines a, b, c, d, etc. in the form of written letters of the Latin alphabet;
- planes α, β, γ, δ and so on. in the form is marked by the written letters of the Greek alphabet.

Also, geometric models with dimensional or spatial properties are marked with capital letters of the Greek alphabet, such as Λ, Σ, Ξ, Ψ, Ω which are not similar to the symbols in other alphabets.

Philological operations similar to word formation from letters are pairs of geometric elements in geometry. is done in the form of making.

Elementary pairs. If we take two of the three different elements and make pairs, we get six different elementary pairs. They are:

1) dot and dot,
2) point and straight line or straight line and point,
3) point and plane or plane and point,
4) straight line and straight line,
5) straight line and plane or plane and straight

line,

6) plane and plain.

When a predicate occurs among the elements that make up an elementary pair, it begins to take on a definite meaning.

Predicates. The relation of one of the elements in an elementary pair to another is called a predicate (Latin: cut) [1], [3]. The predicate can be in the form of either a point, or a straight line, or a plane (two straight lines that intersect and represent a definite angle). In this case, predicates are divided into the following types:

- node predicates - this type of predicate forms one of the relations for one of the elements of the elementary pair, such as "superimposed"($\equiv$), "lying" ($\subset$), "passing"($\supset$), "intersecting" ($\cap$) gives an appearance during;
- gonometric predicates - this type of predicate appears when one of the elements in an elementary pair forms a certain (including right) angle with the other, this predicate is denoted as follows: $|E_1,\hat{}E_2| = \varphi°$, $\varphi°$ - angle between two elements, E1 - straight line or plane, E2 - straight line or plane;
- longometric predicates - this type of predicate appears when one of the elements in an elementary pair is at a certain distance from the other, this predicate is denoted as follows: $|E_1, E_2| = |m|$, where m is the distance, E_1 is one of the three different geometric elements, E_2 is one of the three different geometric elements.

THREE consisting of two elements and one predicate (only pairs where one of the elements serves as a point are given):

– $(A \not\equiv a)$ - "Point A does not lie in a straight line", where there is a longometric predicate, which | A, a) | = | m | will be recorded as The distance from the point is measured by a perpendicular drawn to a straight line;

– $(A \not\equiv \alpha)$ - "Point A does not lie in the plane α ", where there is also a longometric predicate, which $|A, \alpha| = |m|$ will be recorded as The distance from a point is measured by a perpendicular drawn to the plane;

– $(A \subset a)$ - "Point A lies in a straight line", where the node predicate is another point overlapping with point A;

– $(A \subset \alpha)$ - "Point A lies in the plane α", where the node predicate is another point overlapping with point A;

– $(a \supset A)$ - "a straight line passing through point A", where the node is a pre-cat, and another point overlaps with point A;

– $(\alpha \supset A)$ - "The plane α passes through point A", where the node is also a pre-dikat and is served by another point on top of point A;

Elementary plurals. Elemental plurality [6] occurs in the process of constructing a second element if one of the elements in the elementary pair and a predicate corresponding to that pair are given. Depending on what the plural is called, they will look like this:

1. Point sets. 2. Straight linear sets. 3. Flat-sided sets.

Below we will focus on what images can be represented by one of the elements in an elementary pair and the point set assigned by the predicate, given the predicate corresponding to that pair.

Examples of point sets [4], [7].

The row of dots is $\{l: A_i \subset l\}$. l is the set of A_i points that make it up while lying on a straight line. The line l here is called the owner of the plural. Such a pattern can be imagined, for example, in the form of a bunch of tiny beads tied with a thin thread stretched.

The area of the points is – $\{\lambda: A_i \subset \lambda\}$. the set of points λ that make up the plane lying in the plane. Here the plane λ is called the owner of the set. An additional condition: for a point to lie in a plane, it must lie in that plane. Such a plurality can be imagined, for example, in the form of a large dough thinner and pits in it.

Using different combinations of longometric predicates, it is possible to graphically visualize a series of points by separating different magnificent point sets from the field of points. In particular, in the practice of geometric constructions it is often encountered to describe flat point sets as follows: regular polygons, circles, connections, coils, bisector, mediatrix, ellipse, parabola, hyperbola, circle evolvent, An-ezi verzierasi, Bernoulli lemniscata . , trifolium, cyclic curves (cycloid, hypocycloid, epicycloid; cardioid, hypotroxoid, epitroxoid, nephroid; Steiner curve), “windmill” curve, etc. [5].

Sphere – $\{\Omega : |W_i, O| = |r|\}$; from that point $|r|$ the number of points in the distance. As a point geometric set, the sphere also has sub-sets called meridians, parallels, equator, bipolar, and spherical loxodromia. When this method of plurality is performed in a plane, a circle appears: $\{c: |C_i, O| = |r|\}$; Where - O is the center of the circle, the distance r is called the radius of the circle.

Round cylinder– $\{\Omega: |W_i, v| = |r|\}$; v from the straight line $|r|$ the number of points in the long-distance league. As a geometric image, a circular cylinder has constructors parallel to its axis and circular guides perpendicular to its axis.

Circular elongated ellipsoid – $\{\Omega : |E_i, F_1| = |E_i,F_2| = |AB|\}$. A set of points whose sum of distances from a pair of points, called foci, is equal to a constant distance. When this method of plurality is performed in a plane, an ellipse line appears: $\{e: |E_i, F_1| = |E_i,F_2| = |AB|\}$; the cross section is called the major axis of the ellipse (Fig. 2).

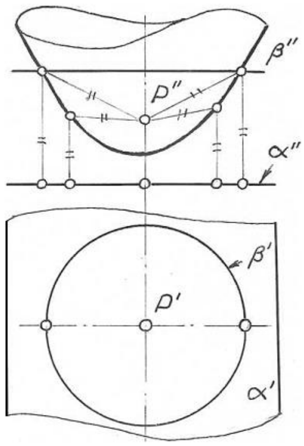

Figure 1

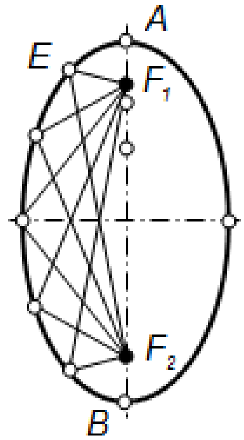

Figure 2

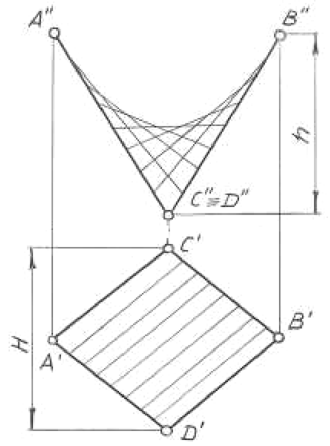

Figure 3

Two-phase rotation hyperboloid – $\{\Omega : |G_i, F_1| - |G_i, F_2| = |A_1, A_2|\}$. A set of points whose distances from a pair of foci are equal to a constant distance. When this method of plurality is performed in a plane, a hyperbola line appears. The hyperbola has a line called an asymptote (Greek: "overlapping").

Rotational paraboloid – $\{\Omega : |W_i, F| = |W_i, \omega|\}$; the set of points equidistant from the point F and the arbitrary plane ω, called the focus (Fig. 1). When this method of plurality is performed in a plane, a parabola line is formed, the parabola having a line called direktrisa (Latin: "direction").

Straight line – $\{d: |D_i, A| = |D_i, B| = |D_i, C|\}$; a set of points equidistant from three points that do not lie on the same line. Such a set is a straight line passing through the center of a circle drawn outside the triangle at points A, B, and C, and perpendicular to that triangle.

Mediatric plane – $\{\mu: |M_i, A| = |M_i, B|\}$; a set of points equidistant from a pair of points. Such a set is in the form of a plane, which is located in a position perpendicular to that intersection, passing through the intersection of a straight line connecting the two points. If this method of plurality is performed in the plane, a mediatrix line appears.

Bisector planes I – $\{\beta_1;\beta_2: |B_i, a| = |B_i, b|\}$; a set of points equidistant from the intersecting straight lines a and b. Such a set is in the form of a pair of mutually perpendicular planes, the common line of which passes through the point of intersection of the straight lines a and b, and they are perpendicular to the plane $a \cap b$. If this method of multiplication is performed in the plane $a \cap b$, a bisector line will appear.

Bisector planes II – $\{\beta_1;\beta_2: |B_i, \alpha| = |B_i, \beta|\}$; a set of points equidistant from a pair of intersecting planes. Such a set is in the form of a pair of mutually perpendicular planes, the common line of which coincides with the line of intersection of the previous two planes.

Parabolic cylinder – $\{\Pi: |P_i, p| = |P_i, \pi|\}$; a straight line and a set of points equidistant from the plane in a position parallel to it. The para-ball cylinder is reminiscent of a tarn. A set of points equidistant from a point and a straight line also represents a parabolic cylinder– **$\{\Pi: |P_i, F| = |P_i, d|\}$**.

Parabolic hyperboloid (Hyperbolic paraboloid) – **$\{\Pi: |P_i, a| = |P_i, b|\}$**; a set of points equidistant from a pair of non-intersecting straight lines. Such a plurality of dots resembles a horse saddle (Fig. 3).

Elliptical cone – **$\{\Xi: |K_i, k| = |K_i, \kappa|: k \cap \kappa\}$**; a straight line of intersection and a set of points equidistant from the plane.

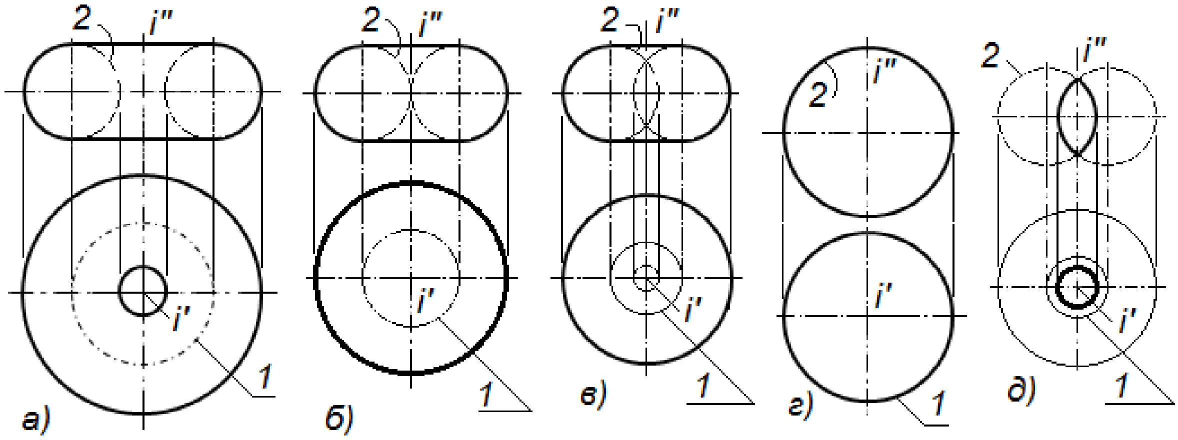

Figure 4

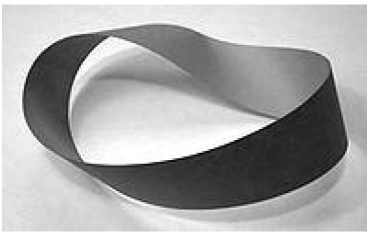

Figure 5 Figure 6 Figure 7

Ring surfaces (Narrow). Among the point sets, the ring surfaces are distinguished by their colorful appearance: the open ring surface is formed by rotating such a surface around a straight line lying outside it but in the plane of the circle (Fig. 4, a). The surface of the open ring resembles a "hole cake". A narrow circle with a point hole is formed by rotating the circle around its attempt (Fig. 4, b). Fruit narrow - is formed as a result of rotation of a segment of the circle with a central angle greater than 180º around its core (Fig. 4, c). A sphere is formed by the rotation of a circle around its diameter (Fig. 4, g). The convex narrow is formed by the rotation of a segment of a circle with a central angle less than 180º around its circumference (Fig. 4, a). Many wonderful geometric shapes can be created by means of loxodromes of ring surfaces. For example: Myobius belt (Fig. 5), closed prismatic screw surfaces (Fig. 6), closed petal screw surfaces (Fig. 7).

In this way it is possible to construct a variety of point sets by setting different additional conditions. Such work provides students with a significant development of spatial geometric imagination, which is important in design activities.

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