XI CENTURY BAGHDAD OSTOMAXION AND THEIR FORMS CREATED WITH THE ELEMENTS

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АННОТАЦИЯ
Илмий мақола Абул Вафо Бузжоний (940 – 998) нинг "Ҳу-нармандга..." номли китобига номаълум муаллиф томонидан илова қилинган "Мадохил..." номли рисола мазмунини илмий тилда қисқа баён этиб чиқишга бағишланган.

Калитсўзлар: Бағдод, Байт ал-Ҳикма, Абул Вафо, Архимед стомахиони, "Пифагор" бошқотиргичи, танграм, Колумб тухуми.

АННОТАЦИЯ
Научная статья посвящена краткому научному изложению содержания трактата "Введение...", приложенного неизвестным автором к книге "Ремесленнику..." Абул Вафа ал-Бузджани (940 – 998).

Ключевые слова: Багдад, Дом Мудрости, Абуль Вафа, стомахион Архи-меда, головоломка "Пифагор", танграм, Колумбово яйцо.

ANNOTATION
The scientific article is devoted to a brief scientific presentation of the content of the treatise "Introduction...", attached by an unknown author to the book "Artisan..." Abul Wafa al-Buzjani (940 – 998).

Keywords: Baghdad, the House of Wisdom, Abul Wafa, Archimedes' stoma-chion, the Pythagoras puzzle, tangram, Columbian egg.

One of the ten books written by Abul Wafa Buzhoni (940-998), who spent his life after the age of 20 in the presence of Bait al-hikma in Baghdad, is called "About what a craftsman needs from geometric constructions" [2]. The theoretical and practical importance of this book for us - specialists in engineering graphics is immeasurable. Another important part of this book is that one of its copies is accompanied by a treatise entitled "Fi madohil al ashkol ilmi tashbih wa al kodikat" ("Introduction to the Doctrine of Similar and Corresponding Forms") written by an unknown author (the book is in the National Library of Paris, in the "Iranian Manuscripts" section) stored under number 169).

The appendix contained 20 pages of text in the page sizes of books of that time and about 60 drawings, some of which were placed within the text on numbered pages, and others were drawn outside the text on unnumbered pages. In this article, we would like to dwell on some of the problems that were solved in relation to geometric constructions in the treatise "Introduction to the Doctrine of Similar and Corresponding Forms".

Seeing that the description of the ideas on the basis of creating drawings in the pamphlet reminds us of the processes typical of the geometric pastime "ostomaxion" discovered by Archimedes (287-212 BC), we

understood the meaning of the title of the pamphlet to be "Baghdad ostomaxion and the forms made using its elements". Etymologists note that "ostomaxion" is a combination of ancient Greek words, which in translation means "inciter of anger".
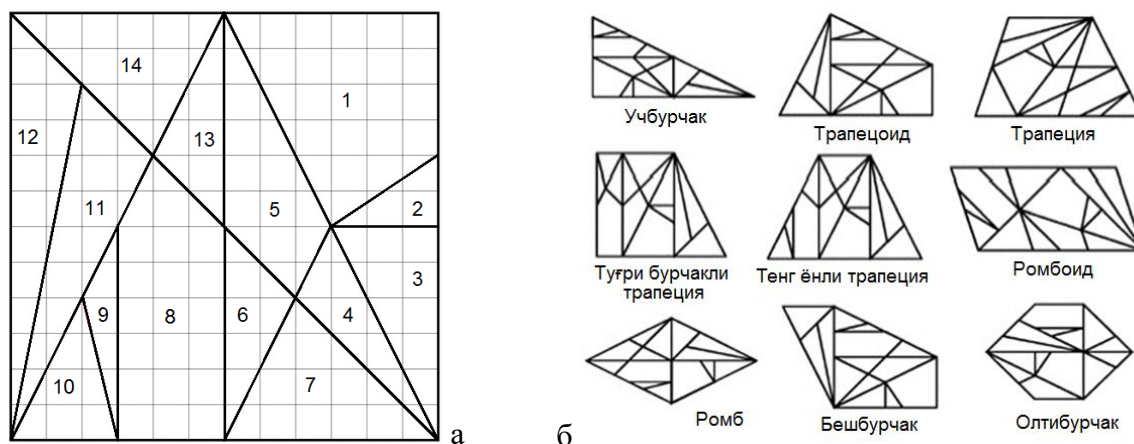

Figure 1: a - Archimedean ostomaxion, b - standard geometric shapes made from the elements of Archimedes ostomaxion.
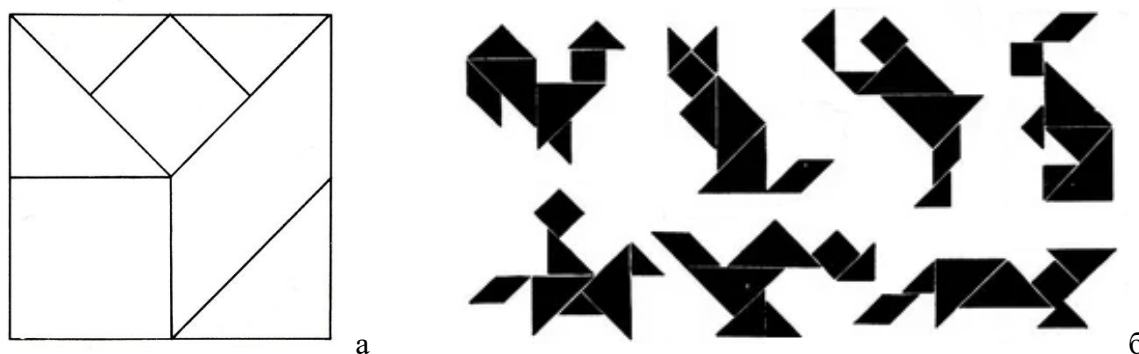

Figure 2: a - elements of "Pyfagoras" geometric fun, b - "Pyfagoras" silhouettes of various animals made from fun elements.

Ostamaxion is a view of a cell consisting of rows and columns of 12 squares, both wide and tall, divided into 14 geometric shapes based on certain dimensions (Fig. 1, a). In order to have fun, a supermaxion square and corresponding shapes are drawn on a cardboard sheet. Each shape is cut out individually with scissors and divided into 14 pieces that are used in the hobby process. The condition of the problem is to make a new shape from those 14 pieces (without leaving any of them out) with exact dimensions. Figure 1b shows examples of standard geometric shapes assembled from the elements of Archimedes' orthomaxion. Assembling shapes like these from the elements of the Pythagorean ostamaxion was certainly not easy. A lot of people may have been very nervous when trying to get new results. It is precisely because of this that this pastime was called "ostomaxion" ("inciter of anger").
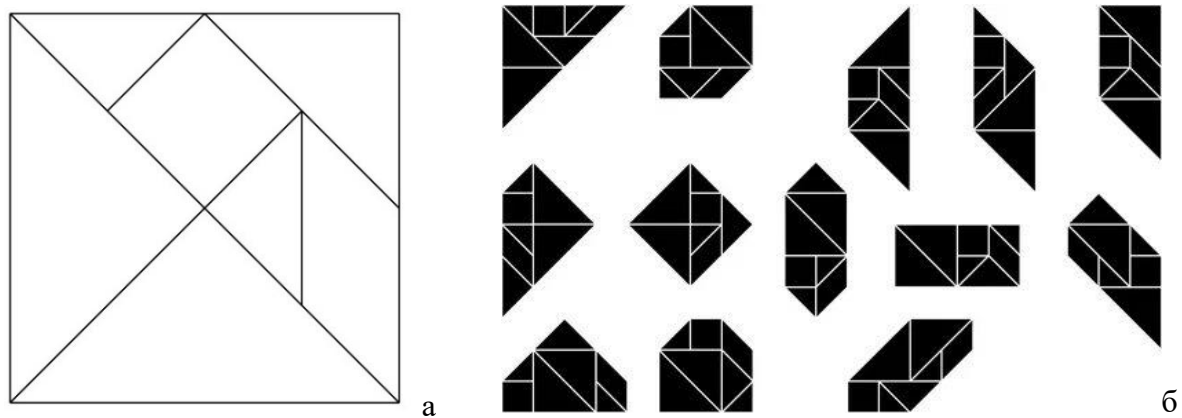
а   б

Figure 3: a - "Tangram" geometric fun elements, b - "Tangram"
various other geometric shapes made up of fun elements.

а   б
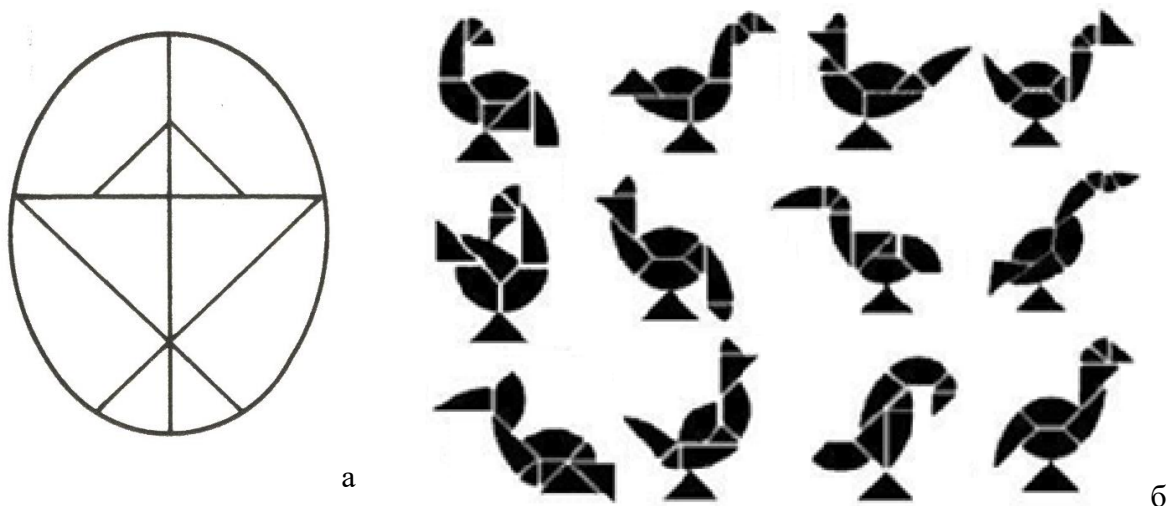
Figure 4: a - elements of "Columbus's egg" game, b - silhouettes of birds made from
"Columbus's egg" game elements.

Archimedes' ostomaxion is considered one of the most popular geometrical pastimes in ancient times. Using its elements, the experience of creating not only geometric shapes, but also shapes reminiscent of images of various animals (wolf, camel, dog, birds, etc.) is widespread.

In our time, "Pythagoras" (Fig. 2), reminiscent of Archimedes' ostomaxion, Chinese "Tangram" ("Seven boards of skill", Fig. 3), "Columbus's egg" (Fig. 4), a wide range of dozens of geometric amusements known as "Mosaic" widely known.

Returning to the topic of the article, the author of the pamphlet "Madokhil..." expressed his ideas about geometric creations as a process of working with the "Ostamaksion" hobby and its elements. For this, he first introduces the reader to his "Ostamaxion". We call it "Baghdad Ostmaxion".
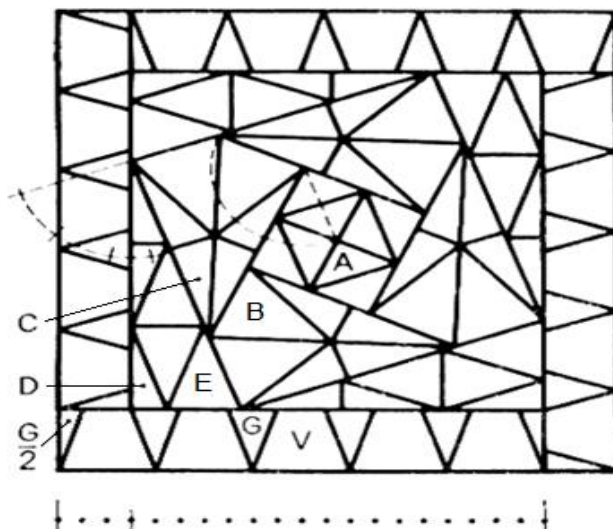
Figure 5. Baghdad Ostomaxion.
It is made of one small square and pieces of octagons, nines, and tens one large square.

""Baghdad ostamaxion" was created on the basis of a square with a width and height of 24 squares. The following shapes with specific dimensions are placed inside the square:

8 triangles A - 45°; 45°; 90°.

12 E triangles - 40°; 40°; 100°.

8 triangles B - 45°; 67°30'; 67°30°'.

16 G triangles – 36°; 72°; 72°.

16 C triangles - 90°; 67°30°'; 22°30°'.

8 G/2 triangles – 90°; 18°; 72°.

12 D triangles - 90°; 70°; 20°.

20 V trapezoids - 72°; 72°; 108°; 108°.

Having found a place for each, the shapes were placed next to each other in such a way that there was no space between them and no part of one fell on top of the other (Fig. 5).

Throughout the pamphlet, examples of how eight-pointed, nine-pointed and ten-pointed stars can be made from the elements of the "Baghdad Ostomaxion" are given [1, 17-18-18]. Similarly, the pamphlet focused on solving problems such as dividing a triangle into four equilateral triangles, changing a regular hexagon into regular equilateral triangles in various variants, and changing a regular octagon into an equilateral square [3, 319] -, pp. 320, 323].
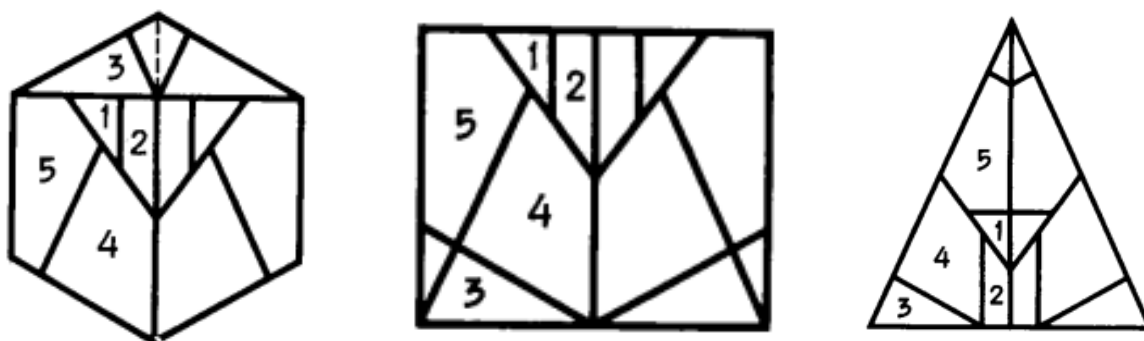

Figure 6. Divide the regular hexagon into 11 of these pieces
making right quadrilaterals and equilateral triangles.

In the pamphlet, a number of drawings are devoted to solving the problem of building a regular pentagon in different ways [pp. 4, 321, 322, 323, 324]. Many drawings show ways to create geometric patterns known as "gyrix".

In one of the drawings at the end of the pamphlet, examples of forming an "ostamaxion" of 11 elements within a regular hexagon are given, using these elements to create a right quadrilateral and an equilateral triangle with faces equal to the hexagon (Fig. 6). Another drawing shows an example of dividing a regular octagon into pieces and making an eight-pointed star with faces equal to this octagon from those pieces, another drawing shows an example of dividing a regular heptagon into 18 pieces and building a regular quadrilateral from them [3, p. 339].

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