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Front cover:

"Guanyin, Moon in Water", scroll on silk (fragment), call number X 2439, Khara Khoto, 12th century, the State Hermitage Museum. Courtesy of the State Hermitage Museum.

Back cover:

Plate 1. Portrait of Nawwāb Mīr Qamar al-Dīn Niẓām al-Mulk Āṣaf Jāh I, watercolour, gouache and gold on paper. Hyderabad, mid-18th century. Album (*Muraqqa'*) X 3 in the Fabergé collection at the St. Petersburg Branch of the Institute of Oriental Studies, fol. 4b, 15.1×24.0 cm. Inner frame dimensions: 15.1×24.0 cm; outer frame dimensions: 22.0×30.5 cm

Plate 2. Portrait of Nawwāb Mīr Aḥmad Khān Nāṣir Jang, watercolour, gouache and gold on paper. Hyderabad, mid-18th century. The same Album, fol. 3b, 11.5×21.3 cm. Inner frame dimensions: 11.5×21.3 cm; outer frame dimensions: 21.0×31.2 cm.

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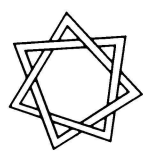

THESA
St. Petersburg

V. V. Polosin

UNKNOWN NUMERICAL AESTHETICS IN THE DESIGN OF TURKISH MANUSCRIPTS

Geometric harmony in Arabic manuscript design has been examined on several occasions by this author in *Manuscripta Orientalia* [1]. Today, this phenomenon is demonstrated using non-Arab material. In presenting to readers of *Manuscripta Orientalia* the Turkish illuminated manuscript C 133 from the collection of the St. Petersburg Branch of the Institute of Oriental Studies [2], I. Ye. Petrosyan published a series of reproductions from it. One of them — a photograph of folio 55b (see *fig. 1*) — provides us with a fine object for qualitative analysis, a specific approach demonstrated below. One should first note the complex arrangement of the text on this page of the manuscript [3]. Researchers rarely pay attention to such matters, but exhibitions of manuscripts, appendices of photographs to manuscript catalogues, and art albums provide us with rich material in this regard. In fact, the accumulated material may soon be large enough to permit the independent study of this aspect of the medieval manuscript tradition. The arrangement of text on the page is usually set in general form by the *mis̱tara* [4], although there are surely exceptions. Our Turkish manuscript shows no signs of stencil ruling (*mis̱tara*) [5]. In its place we find a unique pattern of 18 rectangles, 9 of which are filled with text. The entire construction, which encloses the nine text fractions in gold lines, underscores by its very existence that nothing on this page is accidental and that it warrants our attention.

The page indeed draws our attention thanks to this unusual division of the text and some page setting characteristics [6]. It can be viewed in two ways: both as text and collage (the picture formed by texts of varying formats, directions, etc.). The structure of the collage displays a certain order, but one that for several reasons is difficult to formulate. Since the text consists of poetic verses, its natural division into hemistiches was used to transform it from a traditional rectangular block of text into a collage structure. The gap between the hemistiches forms the vertical axis of symmetry in the collage. All constructions on both sides of this axis are in mirror symmetry. The horizontal axis of symmetry goes between hemistiches of the seventh verse. All constructions above and below it are also in mirror symmetry. But classical paired mirror symmetry is marred by the odd number of lines (13) and the choice of an odd number of rectangles to house them (9). This insignificant violation of symmetry enlivens the "dead" symmetry [7], drawing the viewer's unconscious into an analysis of the symmetrical and asymmetrical elements. The visual and logical information do not coincide; the disparity that arises from this rests, it seems, on the alternation of even and odd, a device that may be used here intentionally. All of this, however, relates more to the image of the collage and the impression it makes, the depictional component of the illuminator's work. We propose here to examine only the composition of the collage, that part of the illuminator's work that without text resembles a drawing (see *fig. 2*). The latter makes a dual impression: the construction is both skilled and careless.

The basis of this construction is a square figure between two rectangles, a figure I analyzed in detail several years ago, using examples from two Arabic manuscripts [8]. As in previous examples, it consists of a 5 : 3 rectangle (see *fig. 3, a*) [9], which is divided into three parts probably using the same device [10] — A, B, and C (see *fig. 3, b, c*). The proportional characteristics of the three newly created figures result from the method of construction; they are the same as those found in the illuminations from the above-mentioned Arabic manuscripts [11]. But all further constructions within the original rectangle are unique and bear no outward resemblance to the examples I have described earlier.

Despite certain inaccuracies in the drawing, visible in places to the naked eye and in other instances unnoticeable without special measurement [12], I was able to derive the ideal model the artist attempted to execute. This model is distinguished by the absolute geometric harmony of all constructions; this harmony is demonstrated below with a series of sketches that show the proportions of all components in the drawing (more than 18 rectangular figures).

In rectangles A and C, which we consider equivalent [13], the area of each is divided into three spaces. The proportional characteristics of two are 4 : 3 (1.333) and the third is 3 : 1 (3.0) (*fig. 4, a*). Merging the two adjacent spaces in these rectangles (*fig. 4, b*) gives yet another proportion — 5 : 3 (1.666), already familiar from *fig. 3, a*.

The breakdown of squares in rectangles is more complex, and significantly more interesting. There are many rectangles, and in order to see all of them, one must "deconstruct" the figures within the square (*fig. 5, a—e*). We do this in a fashion that aims to clarify the matter.

In empty square B, as in *fig. 3, c*, we draw the first vertical line (*fig. 5, a*). It divides the square into two unequal

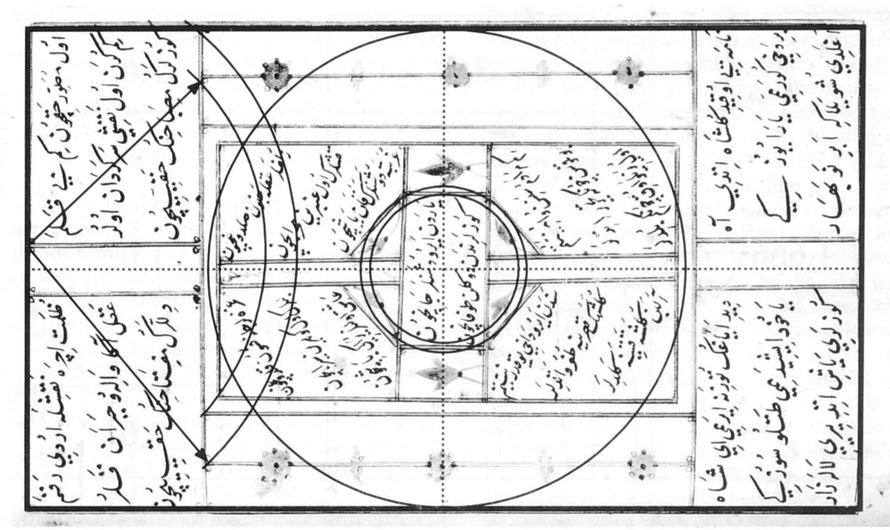

Fig. 2

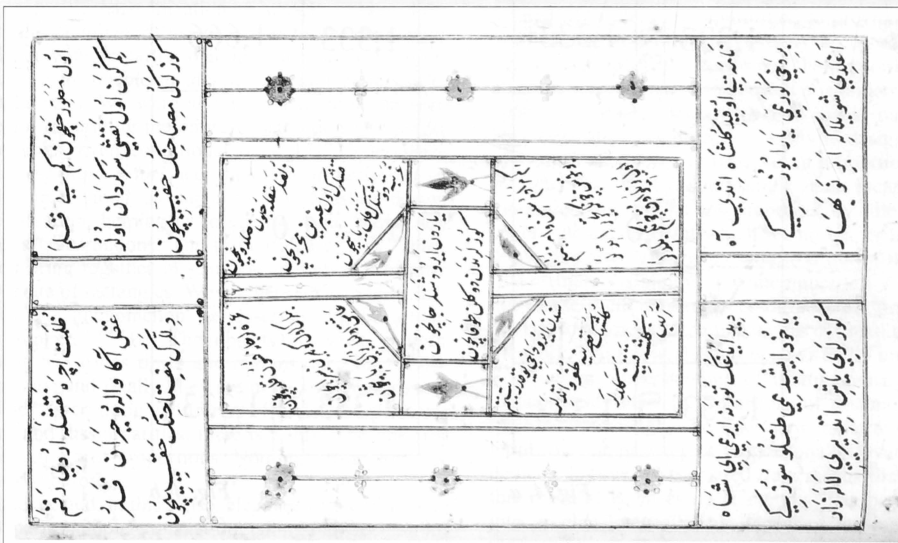

Fig. 1

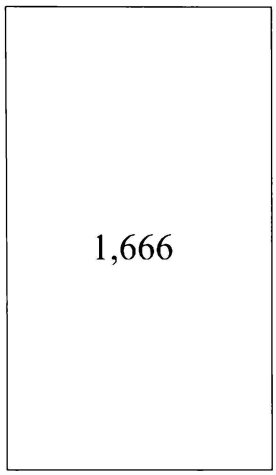

Fig. 3, a

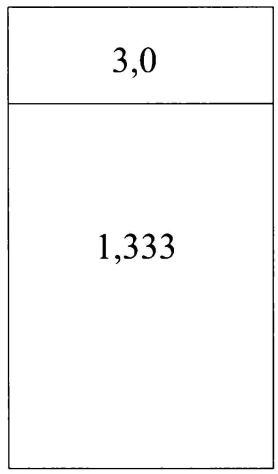

Fig. 3, b

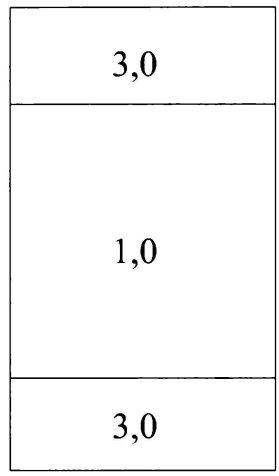

Fig. 3, c

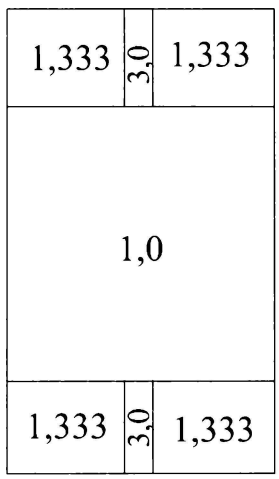

Fig. 4, a

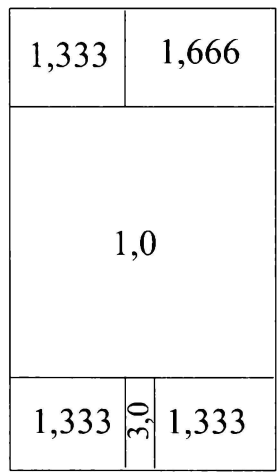

Fig. 4, b

rectangles. The smaller of them is 10 : 1 (10.0), and the larger 10 : 9 (1.111). We add another vertical line symmetrical to the first. Between these two vertical lines a new 5 : 4 (1.25) rectangle emerges (*fig. 5, b*). The addition of a third vertical line (either to the left or right) produces (*fig. 5, c*) a 10 : 7 (1.4285714) rectangle; merging the two rectangles adjacent to the left of it into one produces a 5 : 1 (5.0) formation (*fig. 5, d*).

A fourth vertical line produces a 5 : 3 (1.666) rectangle, the last in this series (*fig. 5, e*). It contains, however, yet another rectangle, $4^2 : 3^2$ (1.777) and with its own substructure that produces another series of dimensions (*fig. 6, a—e*).

The area of this last rectangle is broken down in a fashion as complex as the square, which must be demonstrated as well.

Fig. 6, a shows the breakdown that is evident at first glance: four equivalent 5 : 3 (1.666) rectangles; three dividing rectangles of formats 5 : 3 (1.666), 9 : 5 (1.8) and 5 : 3 (1.666); two very narrow vertical 6 : 1 (6.0) rectangles. If we remove from these constructions first one, then the other dividing line, we produce several more rectangles. They also display geometrically harmonized formats (see *fig. 6, b—e*), and two of them (*fig. 6, c*) are of new proportions: 7 : 5 (1.4) and $3^2 : 2^2$ (2.25).

We can now systematize our results. The rectangles constructed by the illuminator follow either multiplicative forms (1 : 1, 3 : 1, 5 : 1, 6 : 1, 10 : 1) or the proportions 3 : 2, 4 : 3, 5 : 3, 5 : 4, 7 : 5, 9 : 5, 10 : 7, 10 : 9, $3^2 : 2^2$, $4^2 : 3^2$. These proportions return us to the hypothesis of a certain aesthetic based on the numerals 1 to 10 [14]. All of the proportions revealed in the construction analyzed above conform to this hypothesis. One should also note that the material gathered here is added to the results achieved earlier on the basis of Arabic manuscripts, giving us the first formal basis for discussing numerical aesthetics in Muslim manuscripts.

The geometric harmonization so clearly evident here testifies to the illuminator's use of a ruler for measurements in accordance with an earlier plan and calculations. Unfortunately, we were unable to identify the unit of measurement that he used. We were also unable to come up with a module for describing the entire construction in a single system of units, even conditional ones [15]. Under these circumstances, the *a priori* acceptance of an entire set of proportions understood as canonical for Muslim design saves the situation, helping us to see the logic behind the illuminator's constructions. The proportions of the "Turkish" sketch bring together in seamless numerical harmony a conglomerate of rectangles. We see here repeated in a different form the phenomenon we described in the article "'All is numbers'?" [16] The objects analyzed in both cases belong to various times and regions; they have various parameters; and finally, they are in no way reminiscent of each other. Everything is different! But despite all of the differences and dissimilarities, there is a link. The link lies in an identical set of proportions. Nothing of the sort has been observed before.

The unexpected, in this sense, elegance of the illuminator's work defies simple explanation, taking into account its not evident nature. Why or for whom did the artist go to such lengths, if the result cannot be seen and appreciated? We still lack an answer to this question, but our observations of an entire set of design decisions, including those contained here, allow for several assumptions.

What is the nature of the designer's task in the last of the examples known to us? Geometrically, it solves the problem of dividing the rectangle's area into a series of subordinate figures. We found varied solutions to the same problem in other illuminations. The repetitive nature of this problem and its solution suggests that this was the primary, and likely the decisive, principle for creating geometrically harmonious illuminations. At this early stage, and no later, the illuminator likely hit on a compositional solution for his work and executed it. The artistic element (the second component in depictive art) in geometric adornment is sufficiently autonomous and secondary in order of execution. In the case at hand, for example, the rectangles without text within the overall rectangular border were not filled in with the arabesques so familiar in the Muslim art. They were merely given a modest brush of colour in accordance with the overall style of the illumination.

But we see that these decorative elements were added to the illumination at the end and that their location was determined not only by the general conception, but by the concrete limitations imposed by the lines of the sketch. If these empty rectangular cells had been ornamented with arabesques, then no matter how complex and impressive they might have been, they would nonetheless have occupied a strictly defined place in the general composition. In other words, their role in the illumination would have been predetermined (and, in a sense, limited) long before they appeared. Of course, it is the artistic element in an illumination (the final stage of work) that impresses the viewer. But this impression is usually, if not always, controlled (in more or less intrusive ways) by earlier compositional decisions (and constructions) of the artist [17]. The organizational principle appears at this early stage of work, when the geometric skeleton of the illumination is created.

We are gathering more and more evidence that the problems solved by Muslim manuscript illuminators began with the division of a rectangular space and ended with a finished product that conformed to previously set conditions. These conditions, apparently accepted by all members of the profession, concerned the proportionality of the constructions. Taking into account this understanding of the creative technique, the artist's goal in our manuscript may have been the creation of a non-trivial design with the aid of a small, shared (i.e., trivial) set of proportional decisions. In other words, by successfully and meaningfully surmounting the limitations imposed by the proportional canon, the existence of which we no longer have reason to doubt, the artist apparently endowed his work with a creative element visible to his contemporaries. An understanding of these circumstances could possibly provide us with the key to medieval design, a means of "reading" the plot of the work. Until now, this has been virtually impossible.

Such an understanding of illuminations and approach to their study adds to the history of aesthetics (and other fields of knowledge, of course) new, hitherto unknown material. But the primacy of proportionality over other artistic devices that we have posited here means that geometry in this material is, in essence, merely "numbers transformed into graphic images". This aspect of the medieval artist's work and his aesthetic views remains the most mysterious.

The specifics and meaning of the case examined here show that the illumination, on the one hand, forms a purely geometric construction with no adornment to accompany or mask its outlines; on the other hand, it is distinguished by a large quantity of interrelated numbers [18] which reveal "Pythagorean" proportions we have already discussed

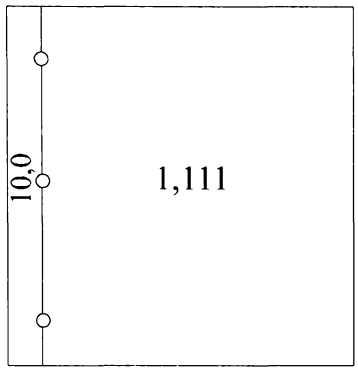

Fig. 5, a

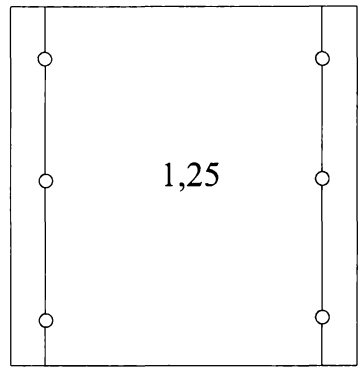

Fig. 5, b

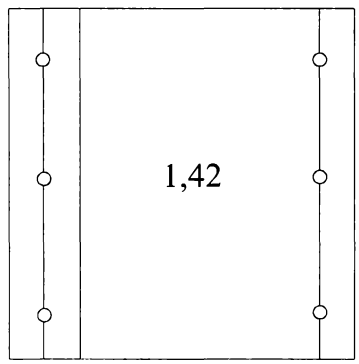

Fig. 5, c

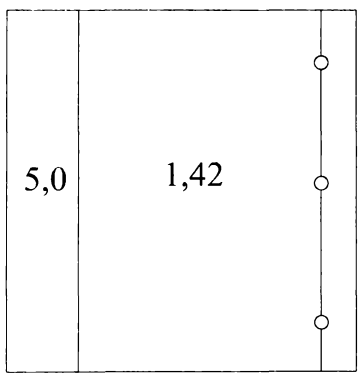

Fig. 5, d

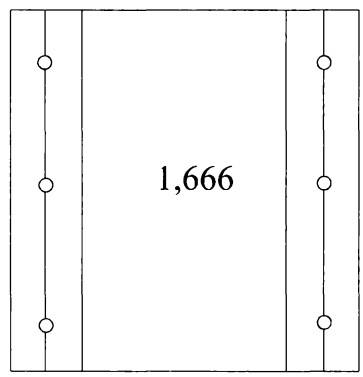

Fig. 5, e

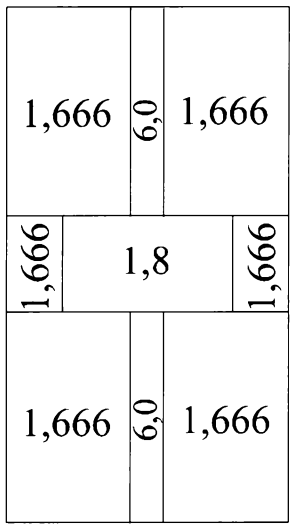

Fig. 6, a

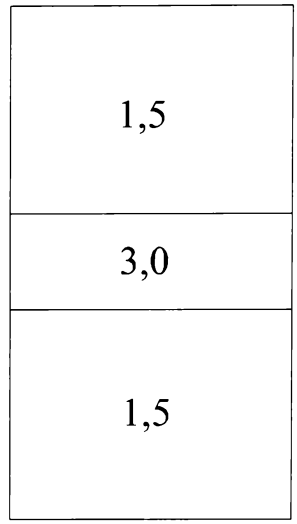

Fig. 6, b

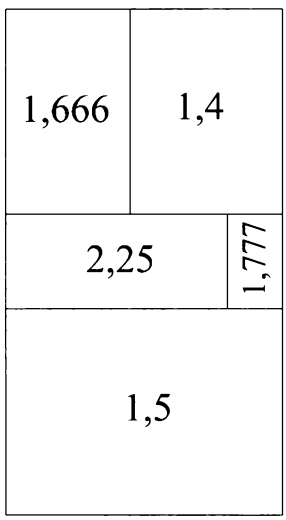

Fig. 6, c

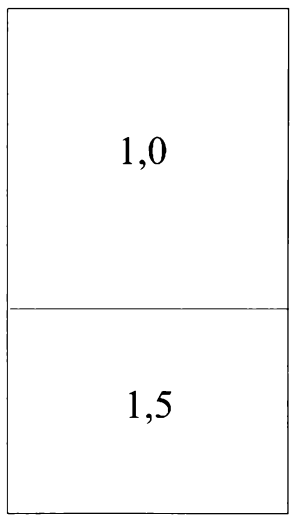

Fig. 6, d

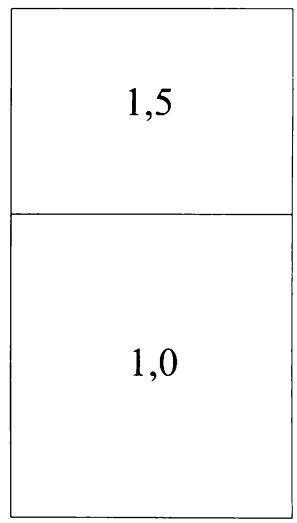

Fig. 6, e

elsewhere as an as yet unknown component of medieval Arabic book design. Clearly evident here, these characteristics are of much use in determining the further course of study in this area. Special attention should be paid to revealing repetitive figures in design and their proportional dimensions. In the future, once there is sufficient confirmation of our hypothesis of a numerical basis for book and manuscript design, we will be able to test our luck with the methods of historical metrology. As the complex, mutually harmonious constructions of manuscript C 133 can only be created with the use of a ruler (and the corresponding units of measurement), a metrological reading of the illumination promises a deeper understanding of the aesthetic unexpectedly revealed by the analysis of manuscripts employed here.

Notes

1. See Valery V. Polosin, "To the method of describing illuminated Arabic manuscripts", *Manuscripta Orientalia*, I/2 (1995), pp. 16—21; *idem*, "Frontispieces on scale canvas in Arabic manuscripts", *ibid.*, II/1 (1996), pp. 5—19; *idem*, "Muslim bindings with *al-Khālidiyānī* double borders", *ibid.*, II/2 (1996), pp. 9—12; *idem*, "'All is numbers'? An unknown numerical component in the design of medieval Arabic manuscripts", *ibid.*, V/1 (1999), pp. 7—11.

2. I. Ye. Petrosyan, "An illustrated Turkish manuscript of 'Iskender-nāme' by Aḥmedī", *Manuscripta Orientalia*, I/2 (1995), pp. 47—61.

3. The page lacks the customary unbroken text field (see *fig. 1*). Instead, the text is broken into nine fractions (three lines each, with one exception of two lines). Each fraction is enclosed in a rectangular border (five horizontal rectangles and four that stand vertically).

4. For more on this, see V. V. Polosin, "Arabskie rukopisi: plotnost' teksta i ee konvertiruemost' v kopiiakh sochineniia" ("Arabic manuscripts: text density and its convertibility in copies of a work"), *Peterburgskoe vostokovedenie*, iss. 5 (1994), pp. 207—10.

5. This does not mean that it did not exist. It may be that not all paper retains traces of embossed ruling over the centuries (an issue that no one has yet studied).

6. There are nine of them: varying sizes of the rectangles (three gradations: large, medium, and small); horizontal or vertical rectangles; large or small handwriting; and horizontal or inclined lines of text.

7. The vertical gap axis between the hemistiches is suddenly interrupted in the middle by text; the horizontal axis is also text, rather than a gap between the constructions above and below it. There are other indications of asymmetry: we find 5 rectangles with horizontal text lines in the collage, and 4 with inclined lines; 4 with large text, and 5 with smaller text; 5 horizontal rectangles and 4 vertical ones.

8. V. V. Polosin, "K opisaniiu arabskikh illiuminovannykh rukopiseĭ" ("The description of illuminated Arabic manuscripts"), *Peterburgskoe vostokovedenie*, iss. 3 (1993), pp. 153—67, especially pp. 155—63. For the same in English, see *idem*, "To the method of describing", pp. 16—21, especially pp. 17—20.

9. The sides of this rectangle are not quite parallel, as one sees from a measurement of the perimeter performed directly on the manuscript (from left to right): 18.6 + 10.8 + 18.4 + 10.9 cm.

10. Described in the work referenced in n. 8.

11. In the rectangles the sides stand in a ratio of 3:1, in the square, 1:1 (see *fig. 3, c*).

12. See, for example, n. 9. Some errors in the illuminator's construction are revealed with the aid of additional constructions (see *fig. 2*).

13. In fact, rectangle A is constructed with a slight error: its left short side is longer than the right, and the right, in turn, is somewhat longer than the corresponding sides in rectangle C. This may have been necessary to keep the lower side of rectangle A away from the text.

14. See Polosin, "'All is numbers'?", pp. 7—11.

15. This is the only reason the beginning of the article discusses the reconstruction of a mathematical (ideal) model, and not an illumination, that evidently inspired the illuminator. If the construction contained fewer errors (some of which permit dual interpretations), however, then the unit of length and the model of construction could be establish with certainty.

16. See n. 14.

17. For more on this, see V. V. Polosin, "Musul'manskie pereplёty s parnym bordiurom *al-khalidiyani*" ("Muslim bindings with a paired *al-Khālidiyānī* border"), *Peterburgskoe vostokovedenie*, iss. 6 (1994), pp. 391—2.

18. We mean here the numbers that describe the dimensions of the sketched constructions in the illumination.

Illustrations

Fig. 1 Aḥmadī, *Iskandar-nāma*, manuscript C 133 from the collection of the St. Petersburg Branch of the Institute of Oriental Studies, fol. 55b, 25.5 × 16.0 cm.

Fig. 2 Same manuscript, fol. 55b, with additional constructions to make a graphical analysis.

Fig. 3 Creation of harmonious spaces in initial constructions:
a — general border;
b — division of the rectangle into two spaces;
c — division of the rectangle into three spaces.

Fig. 4 Harmonious divisions of the rectangles A and C:
a - constructions within the top and bottom rectangles;
b same construction with one of the upper lines removed.

Fig. 5 Harmonious divisions within square B:
a, b, c, d, e — square B shown in the process of gradual filling in with the constructions lines.

Fig. 6 Harmonious divisions within the central rectangle filled in with text in the manuscript:
a, b, c, d, e — gradual dismantling of the construction within the central rectangle.