

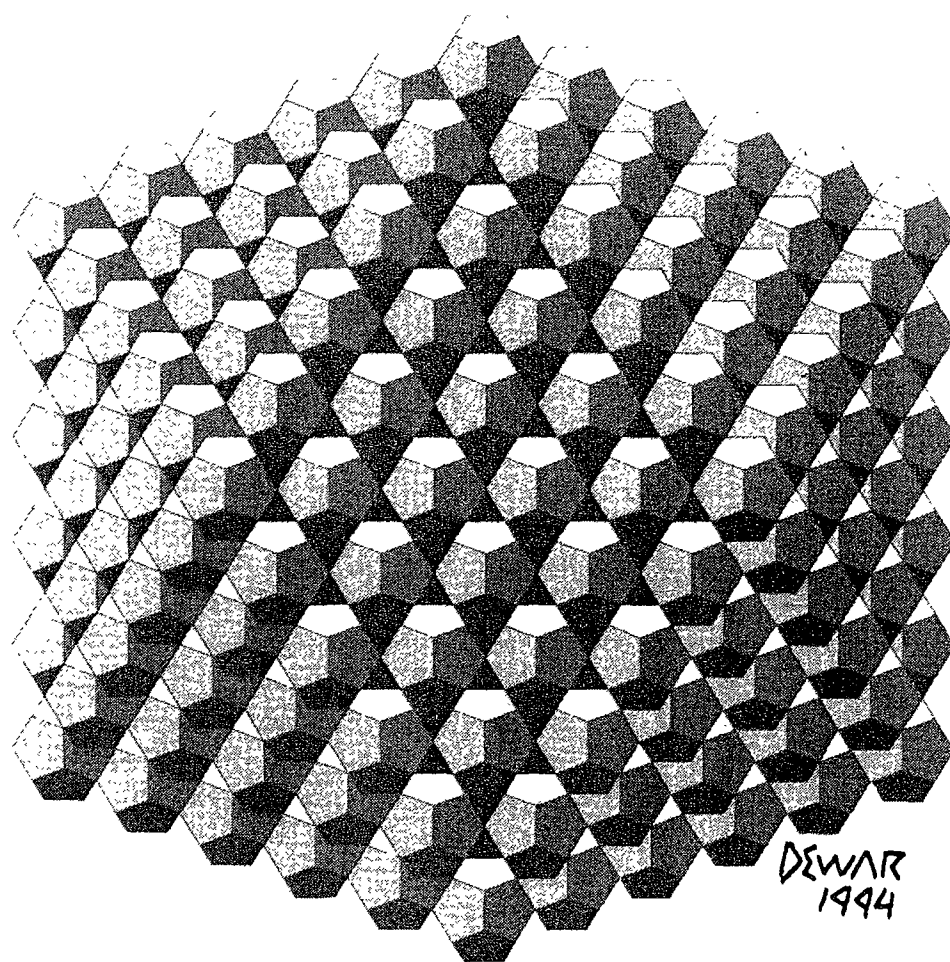
Symmetry: Culture and Science

Symmetry:
Natural and Artificial, 1

The Quarterly of the
International Society for the
Interdisciplinary Study of Symmetry
(ISIS-Symmetry)

Editors:
György Darvas and Dénes Nagy

Volume 6, Number 1, 1995



Third Interdisciplinary Symmetry Congress and Exhibition
Washington, D.C., U.S.A. August 14 - 20, 1995

**ETHNOMATHEMATICS AND TECHNOLOGY I.
COPPER, BRONZE AND IRON-TO-STEEL SMITHSWORKS
FROM THE GREAT EURASIAN STEPPE-BELT
AND WESTERN EUROPE**

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Ethnomathematics may use up knowledge from metalwork technologies from two important aspects. One is: the algorithm of the operation of production, which may be connected - as in the case of other material-producing technologies - pattern formation of the final product. Other is: the ornamental art, which adorned the mounts and weapons of highly appreciated warriors, who used the products in defense of the community.

Both kind of knowledge is present in metal industry, which developed during the Copper, Bronze and Iron Ages in the Eurasian history. The birthplace of these industries is around Asia Minor and Mesopotamia. We could see, that copper and bronze industry was somehow copied, when iron-steel industry developed, but the role of the heavenly metal: meteoritic nickel-iron always played a triggering role in these developments. Contrary to this multi-step development of European iron-industry, on the Far East melting and alloying was ready at the early stages of iron industry.

Parallel to the technology developments we show in the exhibition that how ornamental art expressed intuitive mathematical inventions on bronze and iron age weapons and mounts of mostly royal persons. Their heritage could be found in the rich kurgans and other tombs from Eurasia. Bronze Age will be richly represented from the Celtic and Saka (Central Asian Scythia) archaeological finds. Iron Age is also represented by Celts and Scythians, and other later steppe peoples as Sarmatians, Huns, Avars, Onogurians, Hungarians (Árpád's people) and Normanns (Vikings).

Our work and exhibition will show not only the great flow and continuity of myths and ideas reflected by the rich "Animal Style" on the Great Eurasian Steppe, taken by Celts and Normanns, too, but the intuitive geometrical variations of goldsmiths who were artists of this not so well know age of human culture.

CULTURAL TRANSCENDENCE: PATTERN AND COLOR IN ORIENTAL CARPETS

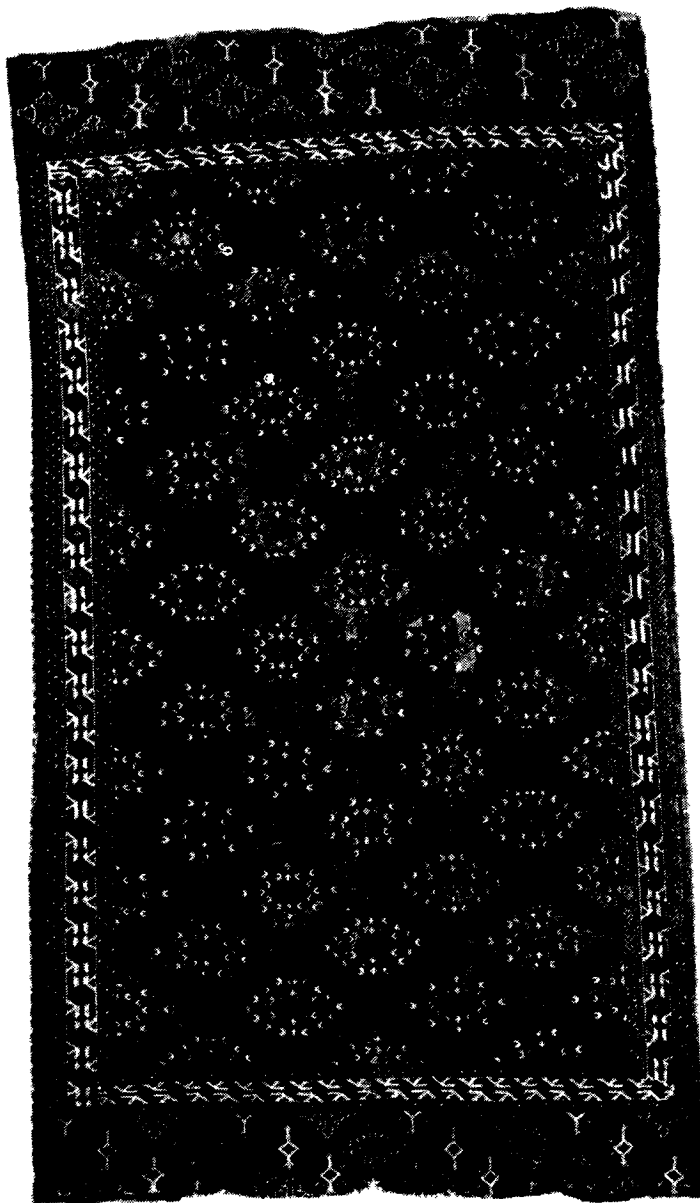
Carol Bier, Curator, The Textile Museum, Washington, D.C.

Oriental carpets comprise a unique category of art characterized by cultural transcendence. To consider what an Oriental carpet is at its point of origin is to realize a difference of cultural perspectives. No one sets out to weave an Oriental carpet. As expressed in a local language, one weaves a carpet. Oriental carpets as a group, then, are the products of one large and diverse cultural area that have achieved wide popularity in another large and diverse cultural area. Their cultural transcendence from the Islamic world to the West may be attributed in large part to the successful combination and utilization of pattern and color in ways that are aesthetically pleasing and, at the same time, functionally appropriate to their use as floor coverings.

Historically from Spain to Indonesia in the Islamic world, two-dimensional repeat patterns have served as a primary vehicle for the organization of color and space. Oriental carpets fall within the rubric of Islamic art, having been made in regions of the world that fall within Islamic domain, although carpets per se have a much longer history as documented by a unique surviving specimen [1,2] and representations [3,4].

Two-dimensional in the appearance of surface design, Oriental carpets are constructed, however, in three dimensions. They are products woven on a loom, incorporating a set of warp yarns and a set of weft yarns that interlace to form a ground weave that is hidden as weaving progresses by the introduction of a supplementary set of weft yarns that are wrapped around pairs of warps and then cut to form pile. In carpets, the ground weave is usually a plain weave with an interlacing sequence of warp and weft, over-one-under-one. Depending on regional traditions, the warp and weft of the ground weave are dyed or undyed. But it is the colored yarns of the supplementary weft that carry the design of a carpet, the patterns being formed by the juxtaposition of cut pile segments that are referred to as knots.

Most Oriental carpets share a design format that contains a main central field, rectangular in layout and surrounded by borders. In the central field, there is often an infinitely repeating pattern that is arbitrarily cut off and contained within a main border surrounded by subsidiary borders, each of which bears a repeat pattern. Typically, the central field



Yomut main
carpet, Central Asia, 19th
century. 126.5 in. x 73.5 in.
The Textile Museum
R3751. Acquired by
George Hewitt Myers.

exhibits one or several symmetry groups. Many carpets are designed with patterns that may be perceived on multiple levels in the central field, while each border relies on an independent line symmetry.

Research carried out by this author over the past ten years has addressed several aspects of the uses of symmetry in Oriental carpets. The study of pattern in Oriental carpets has revealed relationships among design, structure, and technology [5], beyond that described above:

- relationships between the complexity of designs and their means of transmission [6] suggesting an approach for corroborating social origin
- speculation about a spiritual dimension associated with notions of infinity and finiteness that are embedded within carpet patterns [7]
- identification of all symmetry operations, with the appearance of patterns complicated by color alternation, the representation of interlace, and the introduction of secondary and tertiary motifs [8].

In consideration of several hundred carpets studied at collections in Europe and America as well as in Asia and the Middle East, several general conclusions may be offered regarding symmetry in Oriental carpets. The study of symmetry in carpets often reveals the presence of asymmetry. Imprecise patterns may be attributed on the one hand to weaving errors, or on the other to intentional imperfections. But it seems more likely that minor differences within a repeat pattern may reflect a deep appreciation of the significance of both symmetry and asymmetry. It is the appearance of symmetry rather than its precision that makes a carpet fascinating to contemplate. Imperfections make the patterns less insistent and more playful. Removed from the realm of predictability, and, hence, boredom, carpet patterns contain small surprises that continually delight the viewer. It is this aspect of pattern that seems to operate effectively on our perception: the approximation of symmetry is more pleasing than actual symmetry. Imprecision rather than precision seems more interesting at least in terms of visual appreciation, as it pleases the eye and teases the brain.

This paper will further explore aspects of pattern and color in Oriental carpets produced in major rug-weaving regions of the world, including Turkey, Iran, the Caucasus, Central Asia, India, western China, and historically, Egypt and Spain. Discussion will focus on the identification of underlying grids and plane symmetry groups, viewing these in relation to regional cultural preferences within the Islamic world. All carpets, to be illustrated with slides, are drawn from the rich and diverse collections of The Textile Museum in Washington, D.C.

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