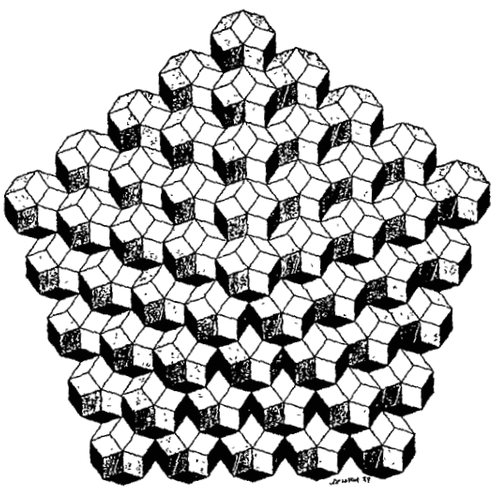
Symmetry of STRUCTURE

an interdisciplinary Symposium

Abstracts

II.



Edited by Gy. Darvas and D. Nagy

Budapest

August 13-19, 1989

hungary

PRINCIPLES OF SIMMETRY IN TOWN PLANNING

Razin A.D., Ignatieff Y.A., Melikhov A.V., Jarigina O.S., Voitenkova I.Y.

Mechanical Engineering Research Institute of the USSR Academy of Sciences (Moscow, USSR)

The principles of symmetry in the organization of natural landscapes, humanized by man, we can differ at the earliest stages of the creation of human settlements (25000 years ago) and later in the urban space (8000-7000 years B C). In the majority of plans of these settlements we can find a center and an axis of symmetry.

In the Mesopotamian and Persian architecture (3100-2700 years B C) buildings had as a rule rectangular plans. The same we can say in relation to the planning of settlements in the Ancient Egypt, where we can find a collection of symmetric fragments in the majority of town plans.

In the Ancient Greek architecture Plato and Aristotile defined an ideal city planning system as a regular and correspondingly a symmetrical. After Plato the form of a plan of the Ideal City should be a circle with concentric districts (one symmetry axis of an infinite order). After Vitruvi (Cæsar's architector) the Ideal City should have an octagonal plan (one axis of symmetry of the 8th order).

Later in the Middle Ages and the Renaissance the plans of the Ideal City had strictly symmetrical structures of a rectangular, octagonal or other polyhedral shape, which could be inserted into a circle or a sphere.

In general the planning of modern cities is based upon the principles of symmetry. While formalizing the processes of town planning in accordance with the modern theory of symmetry we can imagine them in a Cartesian system of rectangular coordinates. Let the axis OX, OY and OZ be the coordinate system axis. If we place any build-up area of a city into the given system of coordinates (we consider a plane city) we can neglect the coordinate OZ. The change of coordinates in the

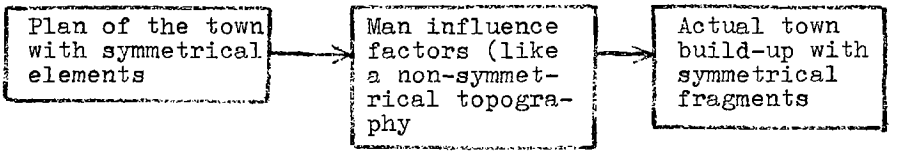
vertical direction OZ in the urban space is considerably smaller than in the horizontal directions. As a result of consideration we recieve one plane (XOY) where the transport ways are symmetry bands together with the build-up areas. They are represented as symmetrical polygonal nets. These are the so-called plane isogones, which can be complete and incomplete. The whole system of town planning is represented as a one-sided plane continuum Thus we can distinguish the following elements of symmetry in the town planning: symmetry bands, symmetry polyhedrons, symmetry tesselations.

In the reality all the symmetrical ideal planning systems are transformed, in general, into a non-symmetrical planning system, but with the symmetry fragments of the build-up.

The main factors, which transform the ideal symmetric systems into a real architectural medium, are: natural landscape forms, variation of the seasonal temperatures, dominating winds, solar radiation and gravity.

Actually, on the one hand, the influence factors destroy partly the ideal symmetric planning system, on the other hand, the same factors promote to create the symmetric forms of the prehistorical intuitive settlement planning. Obviously, many things depend on the balance of influence factors on the planning structures. The topographical forms as mountain heights, dimensions of river valleys and the forms of the coastal planes transform in the greater extent the symmetric systems of planning. We can consider an example - the project by Leonardo da Vinci to straighten the Arno river bed in order to make it an axis of symmetry of the regular polygonal plan of Florence.

As a result of our study we propose the following scheme of the process description going from an ideal to real project of town build-up:

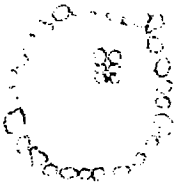


BIBLIOGRAPHY:

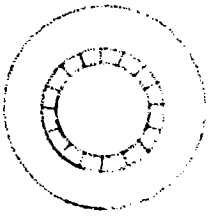
1 Roseman H The ideal City in its architectural evolution, London, 1959

2 Guedes P Encyclopedia of architectural technology, New-York, 1979

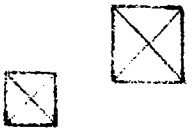
3 Razin A D , Ignatieff Y A On the problems of computer simulation in the architectural design - Proceedings of the V111 International Conference "Compcontrol-87" (USSR,Moscow, 20-23 October 1987), Part 11/1, pp 31-34



Plan of typical paleolite settlement

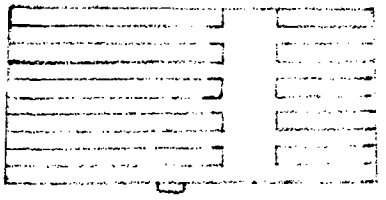


Horesm castle settlements

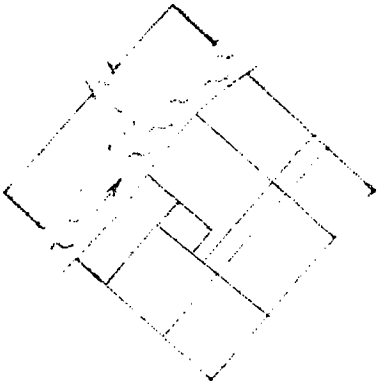


Egyptian pyramids

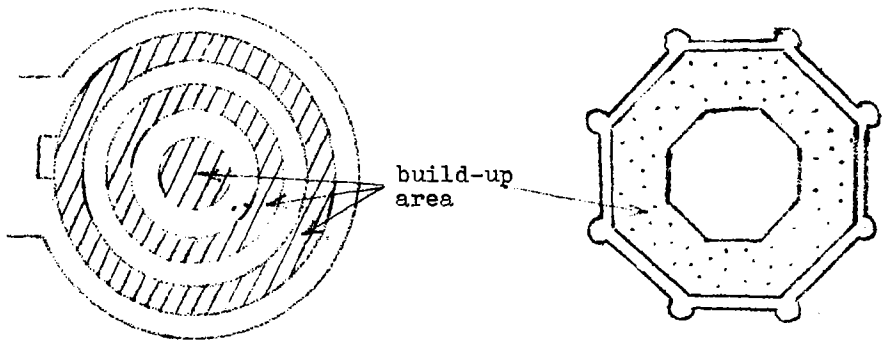
Stownhendge



Egypt: Kahun (2000 years B C) fragments of settlement

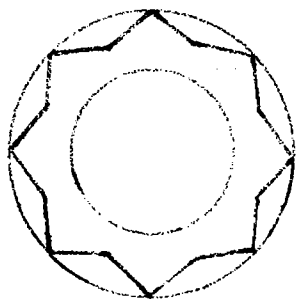


Mesopotamia: Borsippa plan

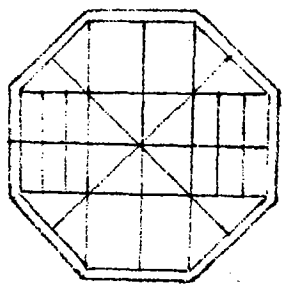


Plato's plan

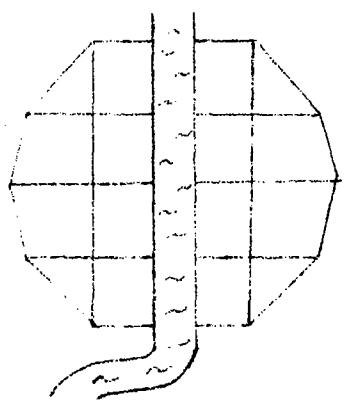
Vitruvi's plan



Averlino's plan



Vasari's plan



Leonardo da Vinci's proposal