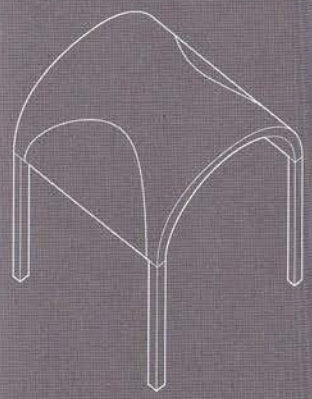
systems which are composed of curved ribs and surface elements that
ribs and planes, and have greatest efficiency when resisting evenly distributed
built of stone, masonry, thin grid-shell steel-reinforced concrete, lattice steel,
lts vary in kind according to the arrangement of the columns and arches, and
sion of the surfaces in between.
is divided into six primary subsystems: barrel vaults, cross vaults, complex rib
ed rib vaults, and cellular vaults. These subsystems are defined by the degree
ault surfaces. Subdivision of the vault surface increases the overall structural
pth to the surface. It should be noted that system considerations have not
d resistance to lateral loads.

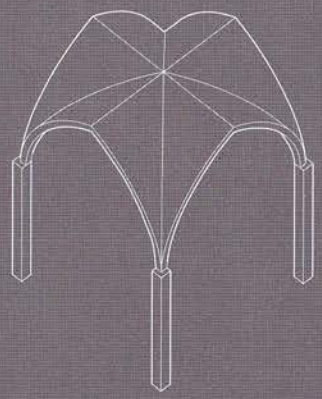
ute the lines of force along a continuous surface.
de the surfaces by distributing the lines of force both along
the resulting ribs located at the seams of each subdivision. This subsystem
tersection of two perpendicular pointed arches extruded across to meet at

further increase the degree of surface subdivision and the number of ribs
d apex points to a pointed arch configuration.
he subdivision of the vault's surface and the number of ribs by means of
ches with differing profiles, with the ribs and surfaces between them forming

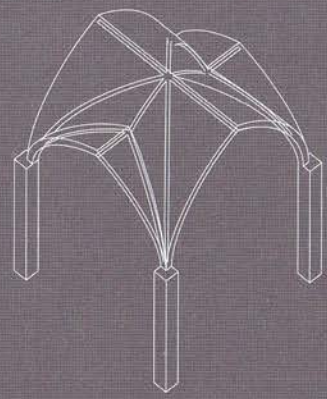
crease even further the degree of surface subdivision by replacing the ribs
es that distribute the lines of force.
bute the lines of force primarily along a highly subdivided surface that
r ribs and distributes the loads along the surface of each facet.



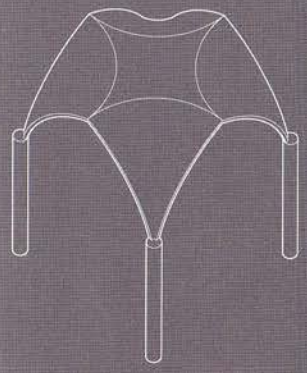
Barrel Vault



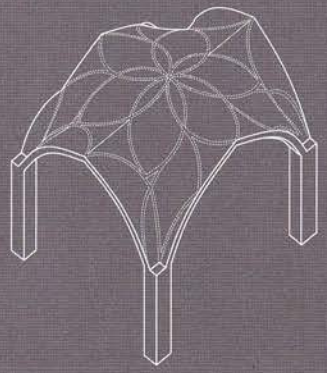
Cross Vault



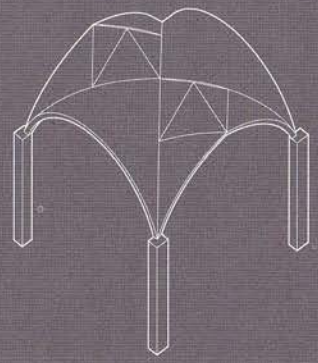
Complex Rib Vault



Fan Vaults



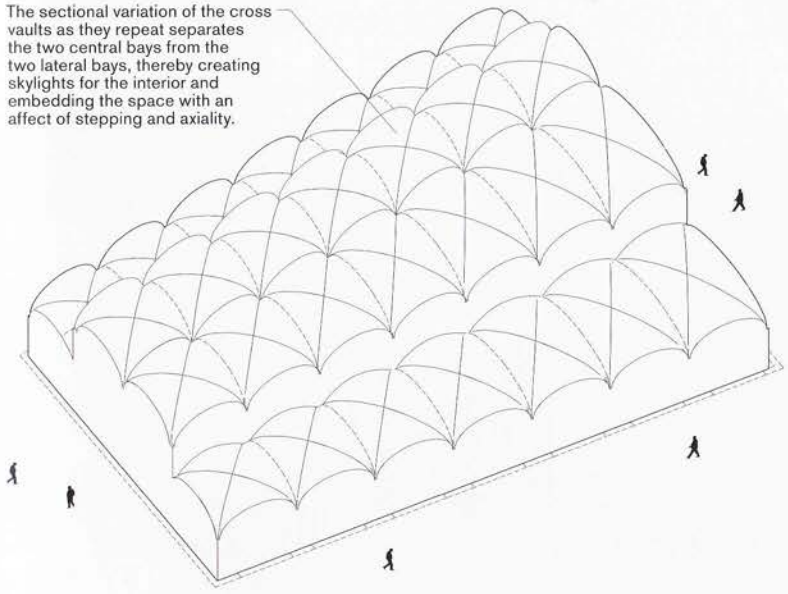
Curved Rib Vault

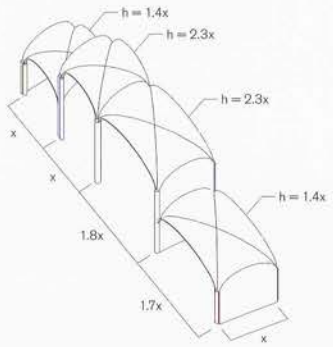


Cellular Vault

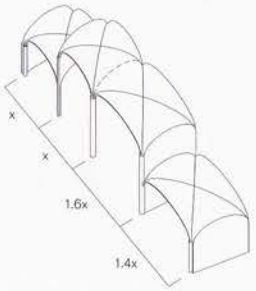
Horizontal / Cross Vault

The sectional variation of the cross vaults as they repeat separates the two central bays from the two lateral bays, thereby creating skylights for the interior and embedding the space with an affect of stepping and axiality.





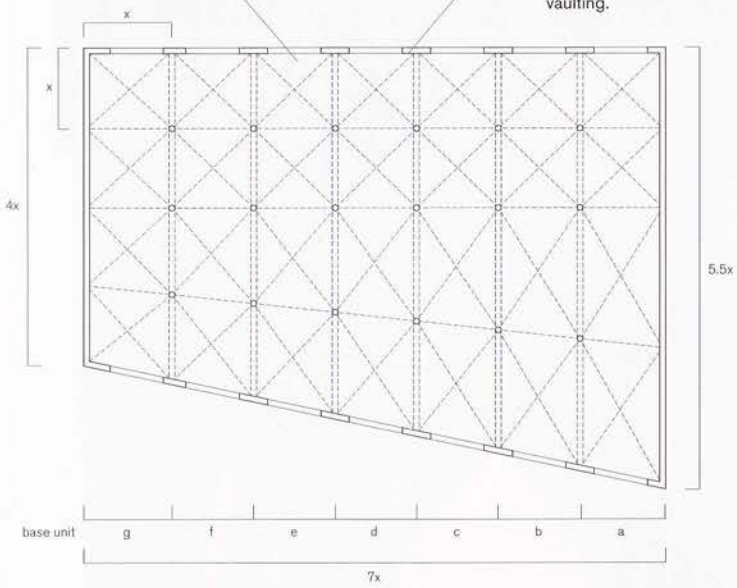
base unit a

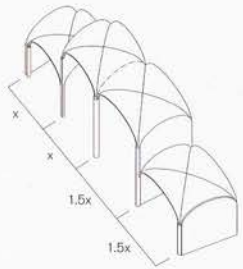


base unit c

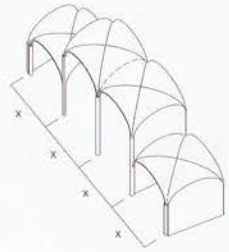
This space defined by a horizontal, cross vault structure that transmits an acoustic affect of diffusion.

Geometrical variation of the cross vaults as they repeat creates an interior with an irregular plan and transmits an affect of crystallinity and vaulting.





base unit e

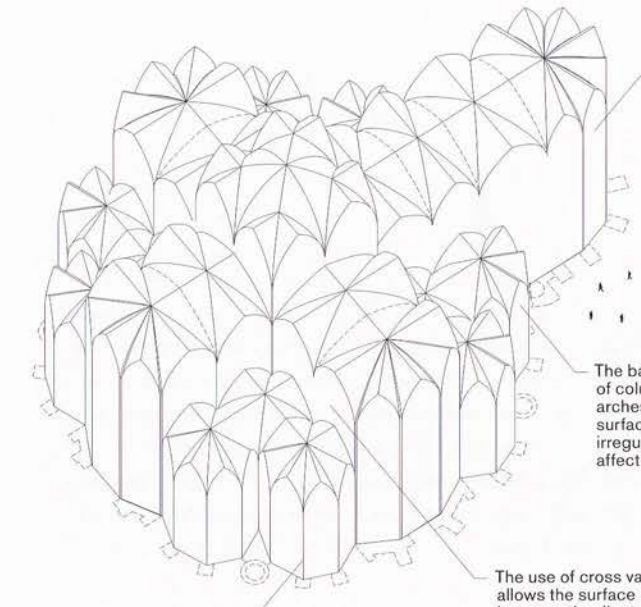


base unit g

This horizontal form is produced by the horizontal tessellation of a series of cross vault base units repeated and interconnected to form a series of changing bays. The base unit repeats while gradually changing in width along one axis, increasing the width of the bays in plan as they grow. This assembly transmits an optical affect of crystallinity, vaulting, stepping and axiality, and an acoustical affect of diffusion.

Horizontal / Cross Vault

CHURCH OF OUR DEAR LADY | ARCHBISHOP T. VON WIED | TRIER, GERMANY | 1180–1260

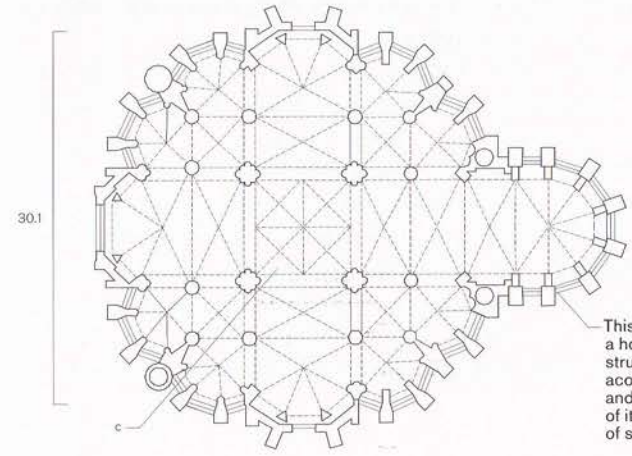


Tessellation of five variations of the base unit of a cross vault forms a space that is round in plan and taller in the central bays, transmitting affects of roundness and verticality.

The base unit composed of columns and pointed arches subdivides the surface of the vault irregularly, transmitting an affect of crystallinity.

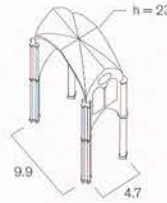
The use of cross vaults allows the surface between the ribs to be hollowed out to admit natural light; this is repeated where there are differences between the height of the bays.

Clustering of the vaults helps to alleviate the problems of lateral thrust that commonly occur in churches with a linear form, eliminating the need for extensive buttressing.

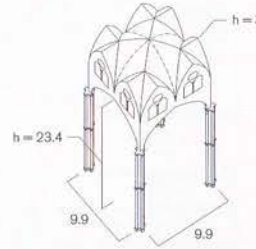


This space defined by a horizontal cross-vault structure transmits an acoustical affect of diffusion and also, on account of its large dimensions, of slowness.

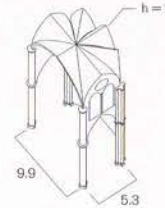
base unit a



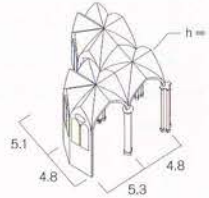
base unit b



base unit c



base unit e



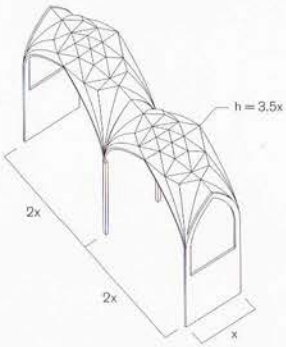
base unit f

The nave of the Church of Our Dear Lady is formed by the horizontal tessellation of a series of cross-vault base units that are repeated along the length of the nave. Changes in the arrangement of the base units in plan, from linear in the center to curved along the edges, vary the profile of the nave to give it a mostly rounded plan. Changes in height between the nave and the side aisles allow for the introduction of openings along the elevation. The nave of the Church of Our Dear Lady transmits an optical affect of roundness, verticality, symmetry and crystallinity, and an acoustical affect of diffusion and slowness.

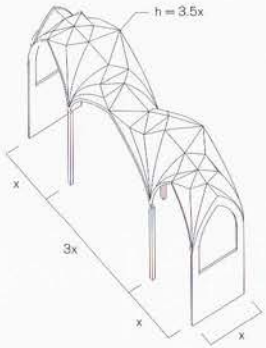
Horizontal / Complex Rib Vault

The tessellation of three variations on the base unit of a complex rib vault adds articulation to the surface of the vault, contributing to affects of reticulation and crystallinity.

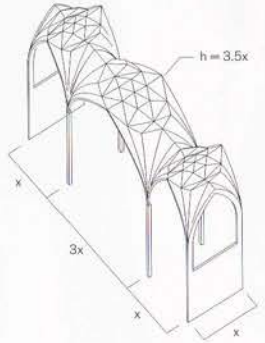
The tessellation of the base unit of a complex rib vault comprising three vaults, equal in height, which have different numbers of ribs, forms a horizontal, shed-like structure of which the rows involve different degrees of reticulation, contributing to an affect of lateralness and crystallinity.



base unit a

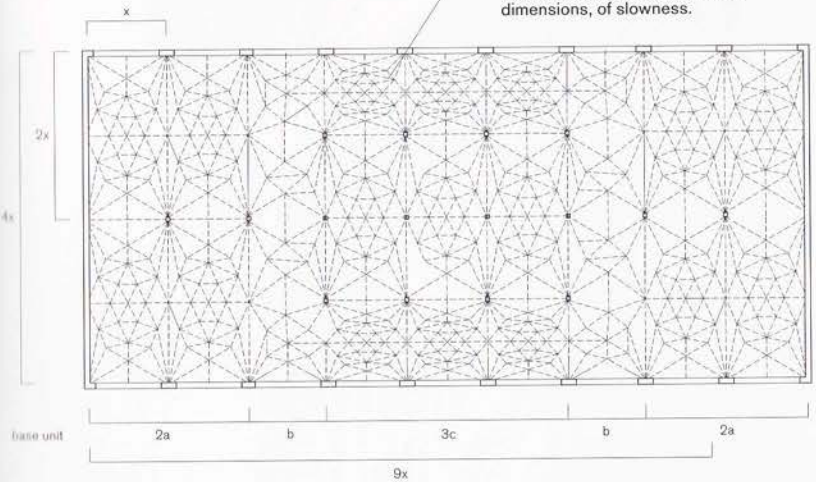


base unit b



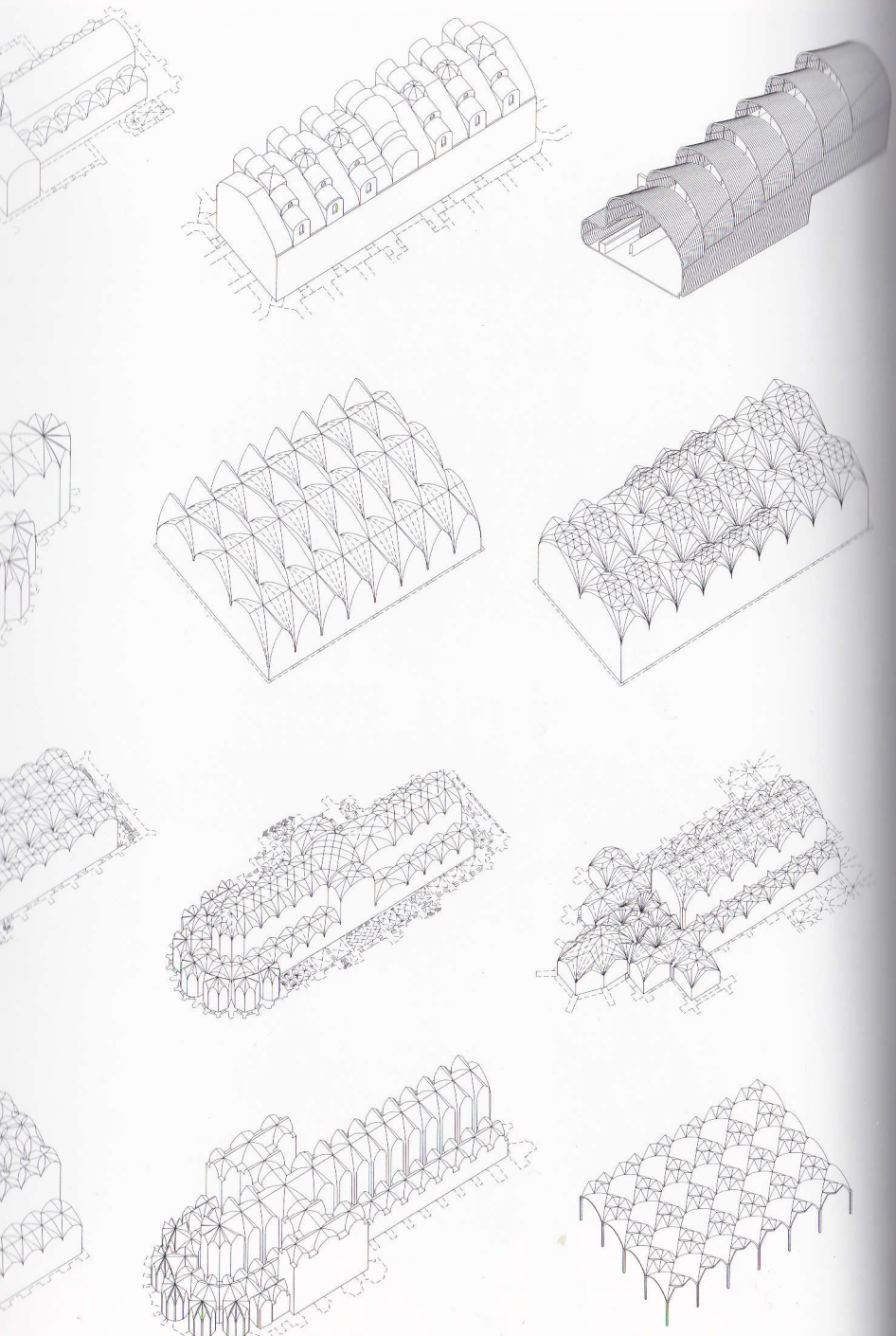
base unit c

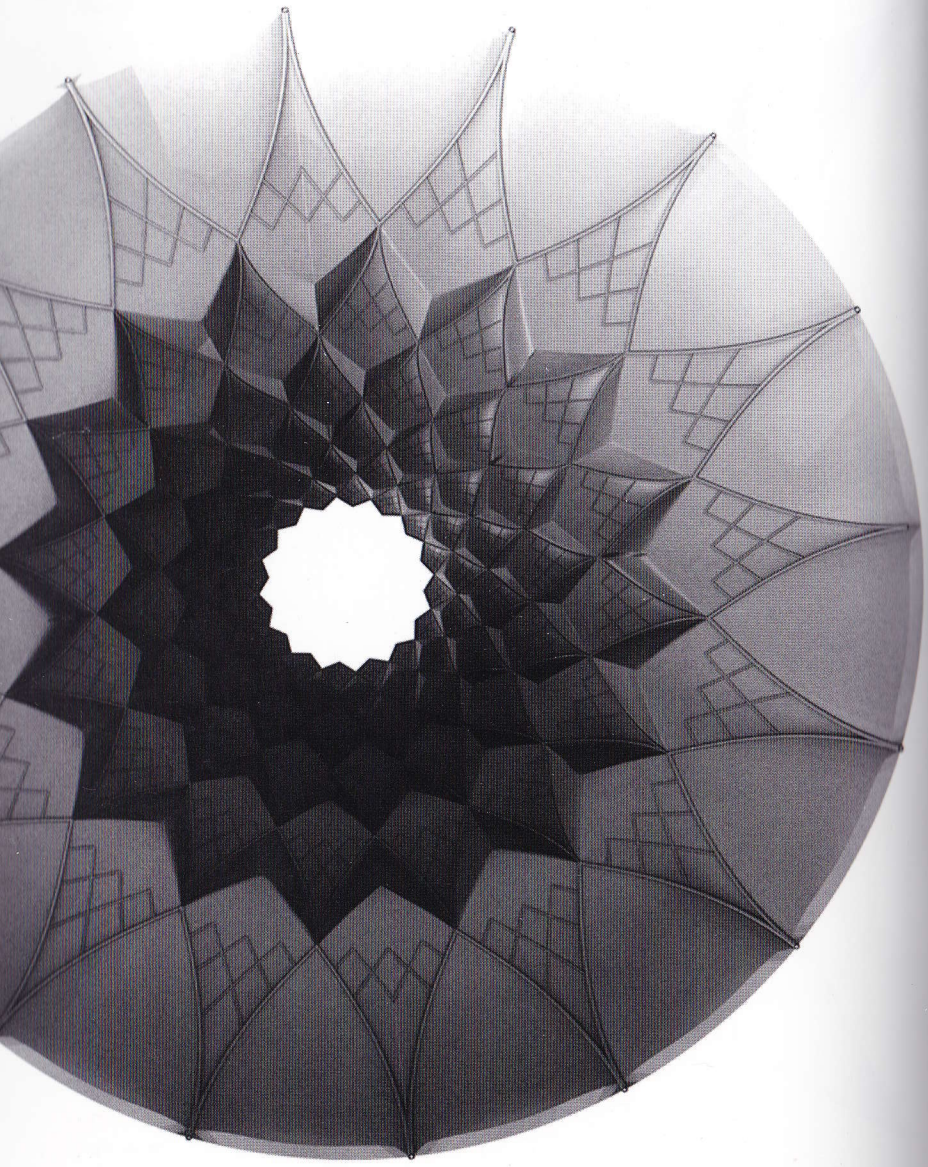
This space defined by a horizontal complex rib vault structure transmits an acoustical affect of diffusion and also, on account of its large dimensions, of slowness.



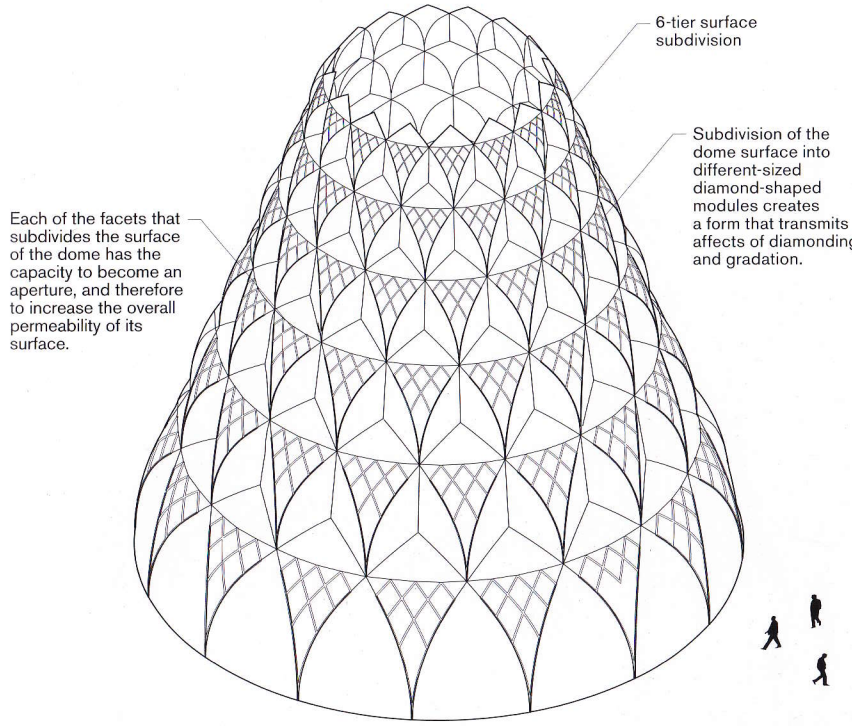
The introduction of liernes and tiercerons creates a web of arched ribs, which allows for a smooth transition from a three-bay to a two-bay vaulting system.

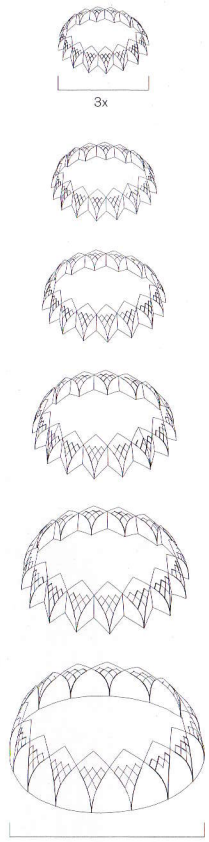
This horizontal form is produced by the horizontal tessellation of a complex rib vault base unit, repeated and interconnected to create a series of bays. The introduction of a large number of lierne and tierceron ribs subdivides the surface of the vault into a correspondingly large number of facets that together create a star-shaped pattern. In such cases the vault can be referred to as a stellar vault. Changes in the widths of the bays vary the scale of the subdivisions, although the degree of subdivision remains the same. This assemblage transmits an optical affect of reticulation, crystallinity and lateralness, and an acoustical affect of diffusion and slowness.

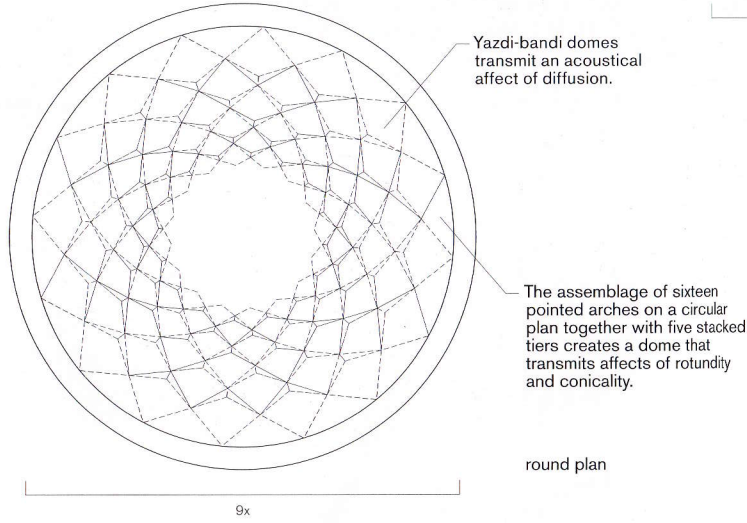




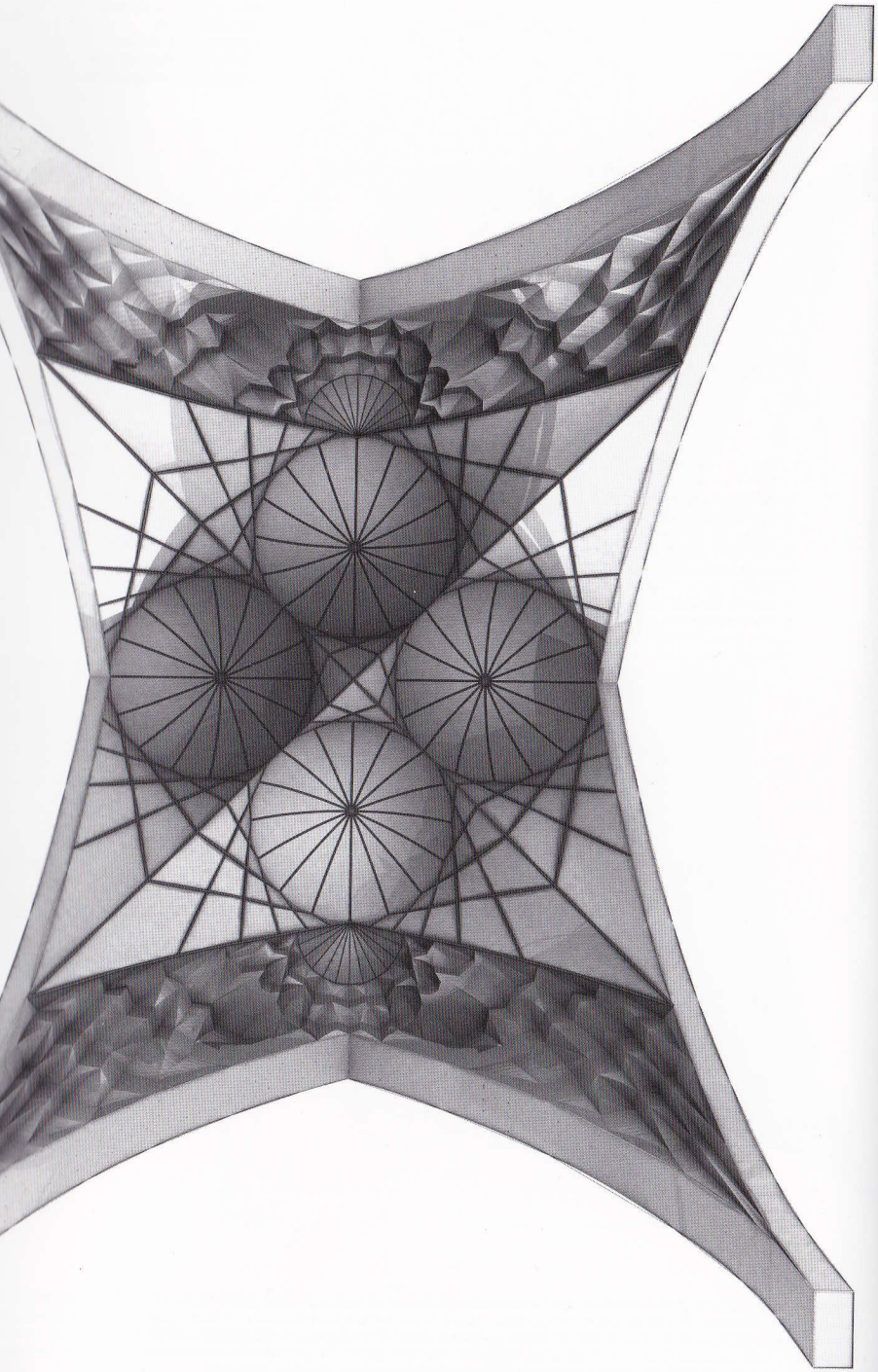
Vertical / Yazdi-Bandi Dome







This dome is formed by the vertical tessellation of a horiztontal tier composed of a surface that spans symmetrically from a round plan with sixteen pointed arches on the perimeter to a circular top in the form of a compression ring. The resulting surface is subdivided into a triangulated diamond grid in which each of the facets gradually diminishes in size towards the top. The scale of subdivision of the pendentive surface is set by the diamond grid, the scale and density of which changes gradually, through a series of horizontal tiers, to adapt to the contours of the surface. This yazdi-bandi dome assemblage transmits an optical affect of conicality, rotundity, gradation and diamonding, and an acoustical affect of diffusion.

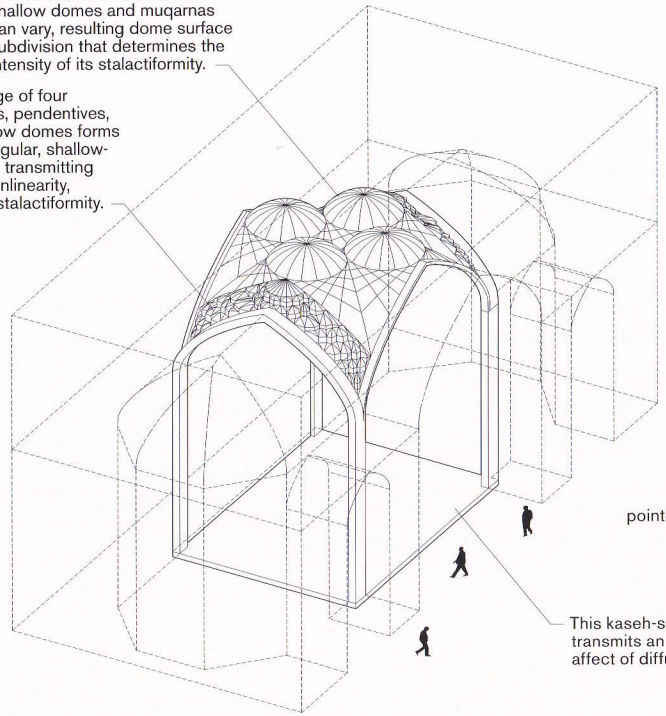


Horizontal / Kar-Bandi, Kaseh-Sazi and and Muqarnas Dome

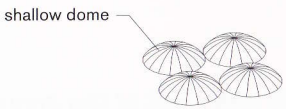
MOSHIROLMOLK MOSQUE | UNKOWN | SHIRAZ, IRAN | 1770

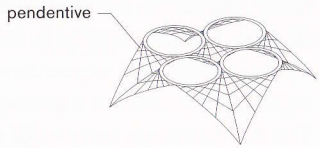
The number and scale of the shallow domes and muqarnas can vary, resulting dome surface subdivision that determines the intensity of its stalactiformity.

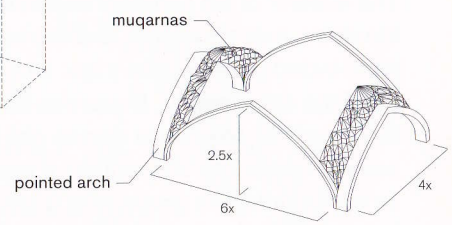
The assemblage of four pointed arches, pendentives, and four shallow domes forms a large, rectangular, shallow-domed space, transmitting affects of rectinlinearity, rotundity and stalactiformity.

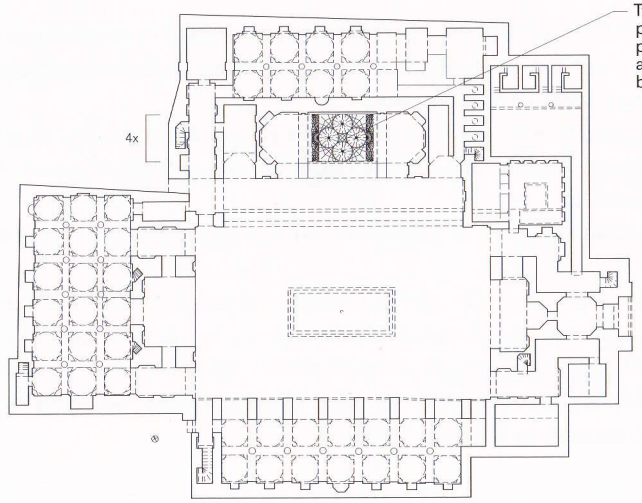


This kaseh-sazi dome transmits an acoustical affect of diffusion.



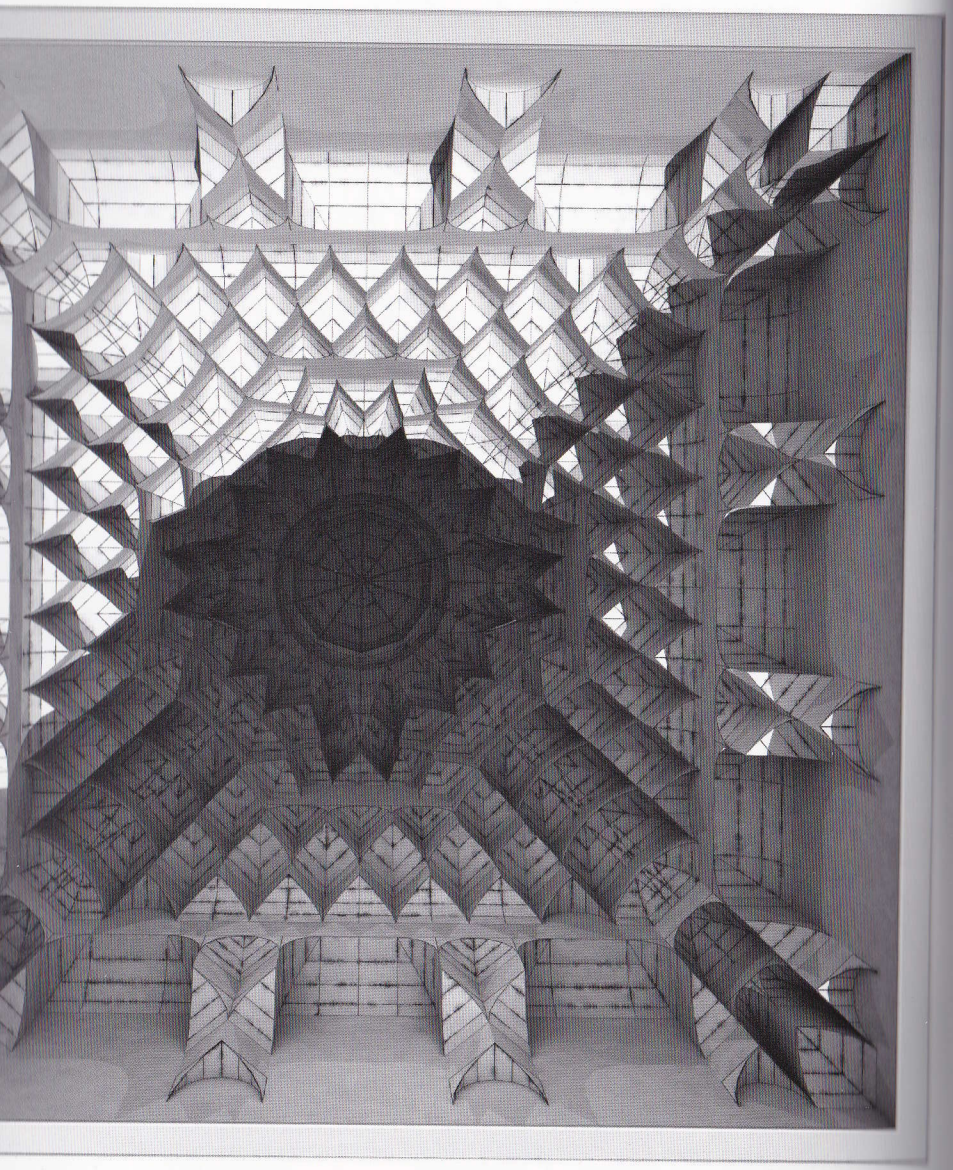






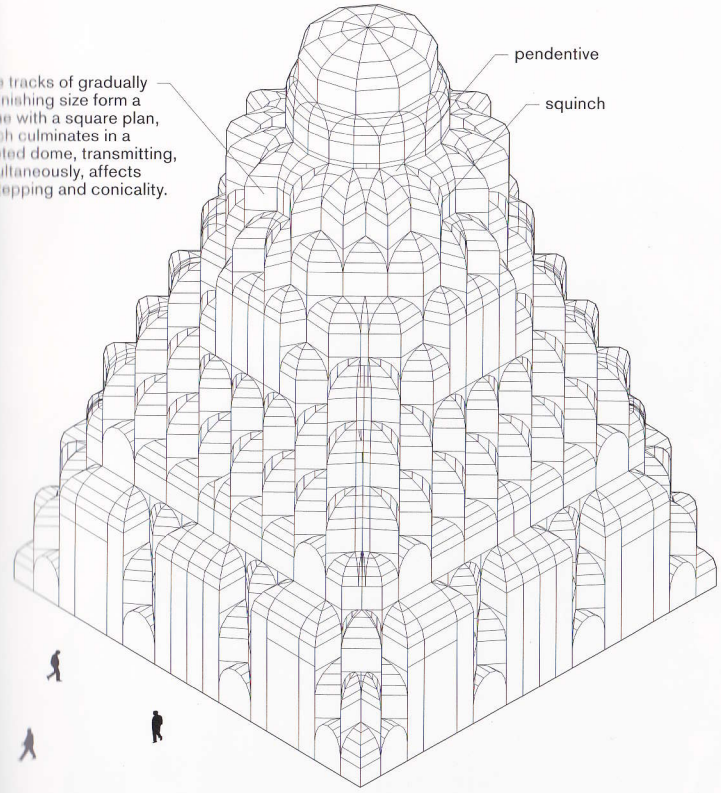
Two sets of differently sized pointed arches along the perimeter of the dome form a rectangular plan with bilateral symmetry.

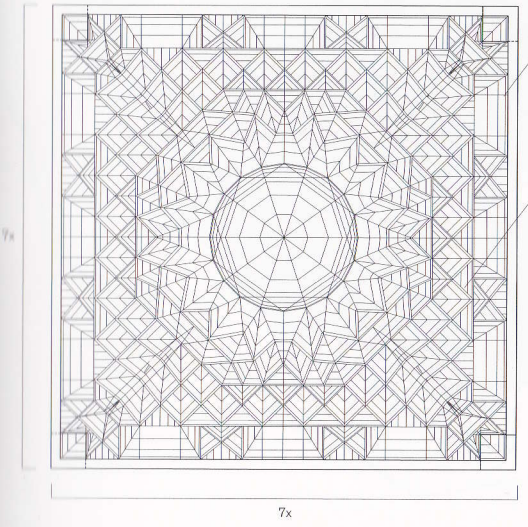
The Moshirolmolk mosque is a hybrid formed by the horizontal tessellation of a kar-bandi, a kaseh-sazi and a muqarnas base unit. Together they form an assemblage of arched ribs and infill surfaces around a central area covered by smaller domes, combined with four larger pointed arches and two side areas with muqarnas. The base unit, which forms a square plan, is composed of four pointed arches and four pendentives supporting an upper surface in the form of four shallow domes. The degree of subdivision of the dome surface is determined by the number of arches and infill surfaces that are introduced. The Moshirolmolk mosque transmits an optical affect of rectilinearity, rotundity and stalactiformity, and an acoustical affect of diffusion.



Vertical / Muqarnas Dome

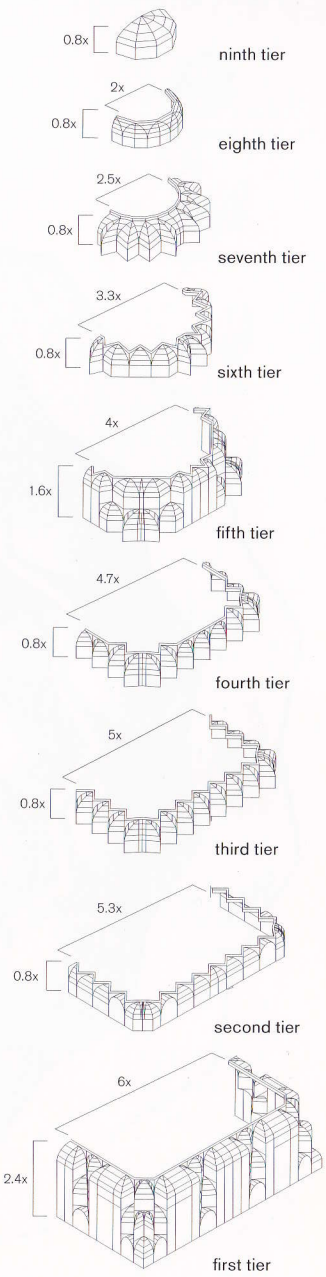
Nine tracks of gradually diminishing size form a dome with a square plan, which culminates in a faceted dome, transmitting, simultaneously, affects of stepping and conicality.





This muqarnas dome transmits an acoustical affect of diffusion.

The assemblage of nine square-shaped tracks of progressively smaller size forms a large dome without the need for a circular dome to enclose it, transmitting affects of enclosure, and conicality.



This dome is formed by the vertical tessellation of a base unit, or a "track", composed of a series of similar units arranged along a horizontal contour. The base unit varies as it repeats vertically to produce nine different tracks, with a combination of straight and narrowing squinches following the corrugation of the plan and reducing in scale as the surface of the structure rises. The overall corrugation of the dome surface is proportional to the number of units that form the tracks, and the degree to which they fold in plan. The perimeter of the plan changes from a square at the base, to a star-shaped polygon at the top. This assemblage transmits an optical affect of enclosure, stepping and conicality, and an acoustical affect of diffusion.