

Axiality In The Process Of Space Organization In Architecture

By

Özgür DİNÇER

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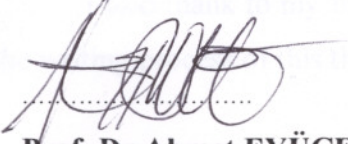
**Izmir Institute of Technology
Izmir, Turkey**

June, 1999



We approve the thesis of **Özgür DİNÇER**

Date of Signature



Prof. Dr Ahmet EYÜCE

Supervisor

Department of Architecture

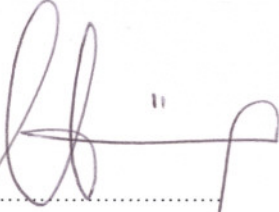
21.06.1999



Prof. Dr. Akın SÜEL

Department of City Planning

21.06.1999



Prof. Dr. Orcan GÜNDÜZ

D.E.Ü.Faculty of Architecture

Department of Architecture

21.06.1999



Prof. Dr Ahmet EYÜCE

Head of Department

21.06.1999

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REKTÖRLÜĞÜ
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ABSTRACT

The scope of this study, tries to explain the definition of the architectural axis and its influences in the process of space organisation with all due aspects to the strong relationships between geometry and architecture. In doing this, the roles of the architectural axis in the spatial evolution of the architectural history are also explained in accordance with its various characteristics in different eras.

The study tries to reveal the direct and primarily effects of the architectural axis in development of the architectural form in parallel with the spatial evolution throughtout all the history of architecture. Some invariable concepts are explained by means of the geometrical characteristics of the axis to make these effects more obvious to understand.

All these explanations are aimed to be enriched with the historical examples to justify the conceptual statements.

As a result, the whole study tries to reach the idea that the axiality which is born with different use of the architectural axis in the process of space organisation has different meaning and it is interpreted differently in parallel with the social economic and cultural characteristics of the era that it belongs. This idea is shown as a main reason of the changes in building forms and their spatial characteristics in all architectural history.

KEY WORDS: Geometry, Point, Line, Axis, Plane, Volume and Form, Space, Meaning, Verticality and horizontality, Power, Symbol, Symmetry, Asymmetry, Balance, Perspective, Aperspective

ÖZ

Bu çalışma, mimari aksı tanımlamanın yanında, onun mekan organizasyon süreci içerisinde etkilerini mimarlık ve geometri arasındaki güçlü ilişkiler çerçevesinde açıklamaya çalışır. Bu tanımlama ve açıklama süreci gerçekleştirilirken mimari aksın mimarlık tarihinin mekansal evrimi üzerindeki etkisi de onun değişik zaman dilimlerindeki çeşitli karakteristik özelliklerine bağlı olarak açıklanmaya çalışılır.

Yine bu çalışma, mimari aksın mimarlık tarihi boyunca oluşan mekansal gelişim ve buna paralel olarak değişen mimari formlar üzerindeki etkisini açığa çıkarmayı hedefler. Mimarlığın birtakım değişmez kavramları da söz konusu etkiyi daha açık bir şekilde ortaya koyabilmek için mimari aksın geometrik özelliklerine dayanılarak açıklanmaya çalışılmıştır.

Yapılan tüm bu açıklama ve tanımlamaların mimarlık tarihinden örneklerle zenginleştirilmesi ve dolayısıyla üretilen söylemin pratikte kanıtlanması hedeflenmiştir.

Çalışma bir bütün olarak, mimari aksların mekan organizasyon süreci içerisinde değişik kullanımlarından doğan aks organizasyonunun, ait olduğu çağın sosyal ekonomik ve kültürel özelliklerine bağlı olarak değişik biçimlerde yorumlanması ve değişik anlamlar kazanması nedeniyle, yeni bina formlarının ve buna bağlı yeni mekansal özelliklerin ortaya çıkışını açıklar

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CHAPTER 1

INTRODUCTION

1.1.DEFINITION OF THE PROBLEM:

Space concept, has been the most important element of architecture and architecture has always been defined by the space and quality of its characteristics. Consequently the organisation of space has always been the main activity of architecture. The process of design organisation has many different variables most of which directly effects the quality and the form of architectural space. Axes and axiality have always been one of the most important variables since the very beginning of the architecture.

Basically axis can be defined as a geometrical element. The strong relationships between axis (line), geometry and geometrical forms increase the importance of the axis in design process. Every form does have some axes which are its geometric necessities and it represents itself by means of these axes. The organisation process of the forms also takes these axes into consideration as a generating elements of the composition. Strong relationships between the axis, form and space make the axis very important element of architectural design process.

On the other hand, the ways of using axes in the space organisation process of architecture are not the same throughout the history of architecture. Different uses of axes can be observed in different periods depending on the general characteristics of the era. These differences in the organisation and uses of the axes in design process, bring about the new spatial schemes, characteristics and the new forms which will be the main subject of this thesis.

The main problem of this thesis is the differences in the way of using axes in space organisation process and the appearance of the new spatial schemes and its characteristics as a result of these different uses of axes .

1.2 AIM AND CONTENT OF THE STUDY

Axis basically can be seen as a single linear line. But what important thing is its role as a consistent basic element of the forms and their organisations. In this study, first of all, the concept of axis will be explained in a conceptual frame work which includes its geometric definition, relationships between forms and finally exact architectural definition. This chapter will give the sense of the study and definition of the axis which will be enlarged within the architectural use in the next chapters.

As it may be understood from the title of the study, space and its organisation process another important point of the study as well as axis itself. Since the main aim of the study is to analyse the axes within the relationships between architectural process and products, process of space organisation will be summarised in the second chapter.

Primarily characteristics of the axes will be given in the third chapter such as meaning and power. Mainly "Axiality begins the first rectangular room for it is other than square. There is always a long axis and a short axis, and longer is more important. If a door is made the most important position for it is in the centre. These things are transposed directly from our own experience of being the world in our largely symmetrical bodies. Important things go on the ends of the axes; Fire places, altars, windows, the best paintings in the room, father's seat at the head of the table and of course leader's desk. The axis gives precedence to the things can give precedence to the axis; it is a reciprocal relationship" (John ,July 1995, p:68)

Axial development of the space, especially firstly in urban space, begins with the aim of emphasising the meaning and the power in architecture. Pope Sixtus5, defined seven meaningful points and connected them by the straight axis to each other. So he tended to make Rome a meaningful whole by means of these axes. In this sense, axes

appear as the elements of connective architecture. Spanish steps and Michalengelo's La Cordonato small slope ramp connects the capitol complex to the city of Rome are different formation of the connective axes. Strong influences the meaningful axes on the space was chosen to impose the political power on society in the political life of the later century. Hitler, Stalin and Mussolini have shaped their capitals by these strong meaningful axes.

Using a meaningful straight axis as a main element in space organisation brought about new characteristics for space such as symmetry and perspective. Etymologically perspective means clear seeing, picture or design is calculated to be valid for one station or observation point only, this was the complete revolution in medieval space concept. This new perspective space was also symmetrical. It was inevitable, because of the power of the single axis in the centre.

This strong axis has begun to dominate all the spatial scheme. So meaningful straight axis brought about longitudinal linear perspective space and is similar schemes. So symmetrical urban space has appeared within their symmetrical axial longitudinal spaces. Fourth chapter tends to explain the later situation after longitudinal space schemes. Using more than only one axis or increasing the number of dominant axis in the space organisation process brings about new spatial schemes which are different from the medieval longitudinal schemes. These new schemes are not symmetric anymore. They are asymmetric as well as aperspective. These new characteristics bring about a new space concepts such as fluid, intersected aperspective spaces which are the most important element of organic architecture. Variation of the axis will be tried to be explained on the projects of the selected pioneers of modern architecture. In doing this explanation some comparison will tried to be achieved.

In the conclusion, the axial development of the space will be criticised in terms of the relationships between process and product. And these two main space concept perspective and aperspective space will be compared to one another.

1.3 METHOD OF THE STUDY

The explanation of this problem primarily can be expected in a chronological way in architectural history. This is the very stereotype approach for such a thesis research.. Instead of this, this thesis research tends to analyse directly the axis, and its definition from geometry to architecture. Chronological and historical development of the axes will be added to this analysis. These analyses will be carried out by sampling of the basic characteristics of the architectural axis from related literature. Some of these examples will be schematised if necessary. The sampling area will not be restricted by any period.

In doing these analysis some necessary concepts which will help the explanation of the subject will be detailed under the related topic.

So, in this thesis research axuality and the axes will not be explained under the architectural history. On the contrary, architectural history will be used to help to explain the subject of the study accordingly. So, some similar uses of axes and similar schemes can be observed as well as differences. In analysing the spatial schemes, according to axial characteristics, simple drawings will be used.

CHAPTER 2

AXIS IN ARCHITECTURE

2.1 GEOMETRICAL DEFINITION OF THE AXIS.

Architectural theory tries to determine the abstract principles underlying architectural form. These principles most of which have been mathematical since at least Greek times, enable the architects to design good architecture. Sometimes these mathematical principles have sometimes been numerical and some other times geometrical.

“The former assert that order in architecture arises from the regularities in which numerical ratios can be combined. They lead to proportional and modular systems which synthetic in that they provide ways of generating forms. The later assert that the architecture must emulate the underlying geometrical order of nature and tend to produce schemes for the analysis of finished forms. Mathematics has always seemed the only hope for constructing a theory of order.” (Stevens. 1990. P:18)

Combinatorics and *Algorithmics* are two important discipline for the relationships between architecture and mathematics as well as geometry. *Combinatorics* deals with the problem of how forms may combine with each other, and *Algorithmics* can be explained as a creation of procedure for carrying out mathematical task. (Stevens, 1990)

Geometry is the organising discipline of architecture and inevitable relationships between mathematics make the architecture a scientific art. Basically geometry is necessary for the arrangement of structure. Almost the man made structures are geometrical and they stem from the nature. In other words, geometry regulates the natural structural systems according to scientific necessities of the mathematics.

Generally, geometry deals with the forms and their consisting elements. Some basic elements on which some geometrical rules are based are defined by geometry such as point, line, plane and volume. Then geometry defines the geometrical forms by means of the peculiarities of these simple elements. In doing this, geometry also put some strict rules which define the characteristic of the form.

Each form does have its own characteristic which directly effect their geometrical relationships and the ways of combining with each other. In other words, geometry can be defined as a control system in evaluation of the forms and their combinations. If we need more architectural definition, we may define the geometry with following sentences .

“Geometry is a formative idea in which the concepts of plane and solid geometry are used to determine built form.” (Clark and Pause 1985. p:182)

“Geometry is also means of relating all the parts of a building to one another.”
(Baker 1990, p:30)

The Greeks were very engaged in mathematics and geometry in the history. Plato and Euclid were two of the famous Greek philosopher and mathematician. They lived at about same time. Both had own book which has enlightened the era. Plato's book was *Timaneus* which includes his dialogs with Socrates and Euclid's book was *Elements* which can be defined as a handbook of the mathematics of the time, and as a model of clarity of proof.

“Plato divides everything in universe into two groups: Forms and Particulars ... any particular square is a sort of imperfect realisation of this ideal, or form, to use the technical term or take the example of blue objects, of which there are no end in the world, skies, jeans, rivers, smarties. Each is a particular each of these has the property of blueness but none of them is blueness itself. So, there are the particulars and particulars have properties. It seems we cannot have particulars without properties nor properties without particulars to have them. How can something be blue if there is not blueness for it to be... He constructs an entire universe of forms, love, hate, elegance,

ornament, curiosity, sweetness, smoothness attraction unity all have forms. There are also forms for cats and dogs, trees, fishes and people.” (Stevens 1990, p:59)

If these forms do really exist we can ask the questions of is that a good building? Or is it a dog?. We just have to compare the particular instance with the form itself to resolve the issue. “ The forms provide stable, knowable, standards of value against which the things of this world can be measured.” (Stevens 1990, p:59)

“These theory was also a powerful influence on medieval architecture, and even architecture of our own time. How seductive is the idea that there is a particular way to design buildings, a way absolutely guaranteed to be the only way, because it is close to an eternal pure standards of building form. The greatest architectural platonists of our own day, perhaps of all the time, was Mies van der Rohe. His rectilinear forms, straight lines, simplicity and purity, refinement and precision, how they strain to emulate the form of Architecture! He believed as did may others, that is architecture was the ultimate. It was not a style, it was Architecture. Pure and simple, truth itself.” (Stevens 1990, p:60)

Euclid’s geometry was more scientific. His book *Elements* was used as a handbook of the mathematics of the time. What Euclid did was starting from a set of obvious statements that no one could dispute their truth. Then he used rules of inference that was as obvious as the statements to arrive at other conclusions. We call these rules as *theorems* and the book elements consists of hundred of these.

Euclid starts with 23 definitions of point, line, circle and angle, and then he lays down the initial statements which we call *axioms* or with his own words postulates and *common notions*.

Euclid’s definitions about the simple geometrical elements were almost the basis of today’s geometry. In other words, the geometry of today still use his basic geometrical elements according to his following definitions;

1. A point is that which has no part.
2. A line is breathless length.
3. The extremities of a surface are lines.
4. Straight line a line that lies evenly with the points itself.
5. A surface is that which has length and breadth only.
6. The extremities of a surface are planes.
7. A plane surface is a surface that lies evenly with the straight lines on itself

...

19. Rectilinear figures are those that are contained by straight lines, trilateral figures being those contained by three, quadrilateral those contained by four, and multilateral those contained by more than four straight lines.

As we may see the primarily definition of the axes or lines directly generating from the points or dots. Points can be seen as a basic element of design, and they can be accumulated together to form textures or lines. The group of lines form planes, and planes can be structured into volumes.

Euclid's following postulates help us understand the characteristics of the geometrical axis.

1. To draw a straight line from any point to any point.
2. To produce a finite straight line continuously in a straight line.

In order to understand the geometrical meaning of line, first we should learn the characteristics of the single point. Theoretically a point has neither shape nor form. A point has no length, width and depth. It is a static, centralised and directionless geometrical element, and it marks a position in space. A point can serve to mark the two ends of a line, or to point the intersection of two lines. It also can serve to mark the meeting of lines at the corner of a volume or to mark at the centre of a field.

Two points describe a line which connects them. So, connective line stem from the existence of two single points and their relationships. Power of the line, depends on degree of this relationships between two points.

A line consists of points. In other words, a point extended becomes a line, which has length but no width or depth like a point. A line differs from a point with its dynamic impression. Whereas a point is static, a line, express the direction movement and growth.

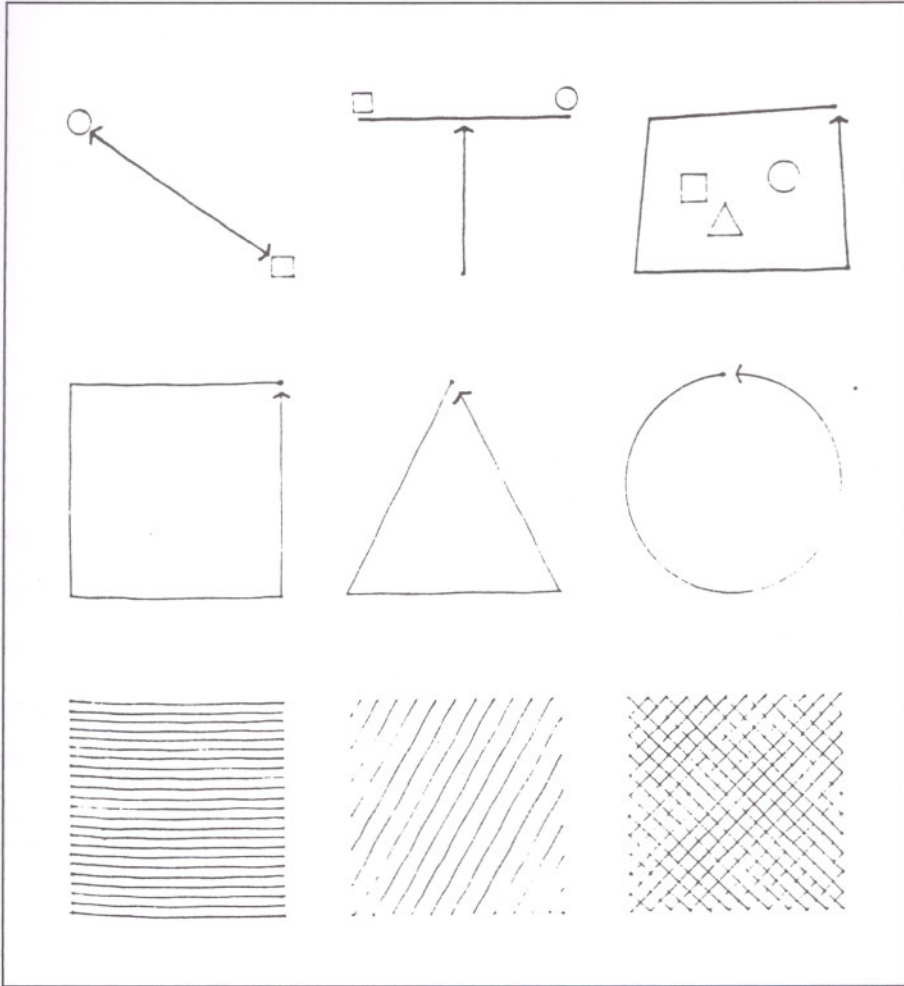


Figure 2. 1 Different use of the line. (Source: Ching,1996)

In the history, the proportional system was used to assist both the ordering and the perception of buildings. Especially Greeks used the mathematical proportional systems in their temples. They also evolved a proportion relationship which is the *Golden Section*.

“The Golden Section is based on a subdivision in which the lesser portion of a line is to the greater is to the whole or, $x/y = y/(x+y)$. If a square be drawn within a Golden Section rectangle the remaining also has Golden section proportions. The Golden section was also used during the renaissance and the medieval masons used a

variety of sophisticated proportional systems to ensure harmonic relationships in churches and cathedrals.” (Baker, 1996,p:30)

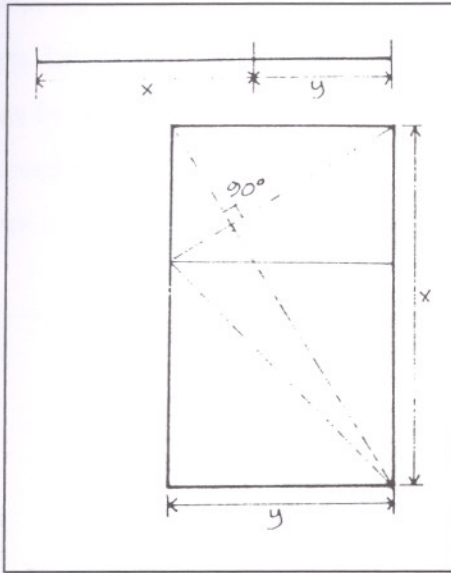


Figure 2. 2 Golden Section Rectangle (Source: Baker, 1996)

The Golden Section proportion of the line is also important for the way of using it. Le Corbusier, as an architect was very engaged in architectural history, especially Greek and Roman architecture. Therefore, he was also engaged in proportion systems, and he discovered some new proportion systems which are directly related to the human body, such as *Blue* and *Red Series*.

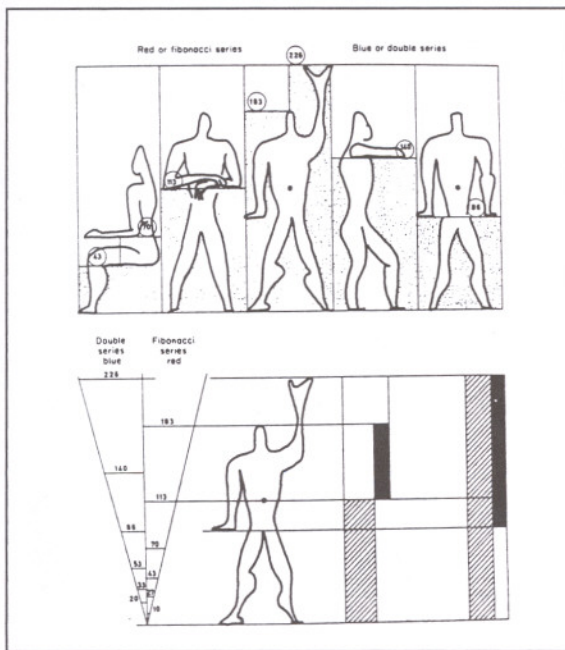


Figure 2. 3 Corbusier's Proportioning system (Source: Stevens, 1990)

Using Geometrical Schemes both on plans and facades was very widespread in Greek Architecture. The Greeks tried to regulate their temple's facade geometrically. They believed that the pure beautifulness was stemming from geometrical regulation of buildings. Le Corbusier tried to reveal the geometric beauty of the facades of historical buildings by his *regulating lines*. According to him regulating lines is the lines "which have served to make very beautiful things and which are the very reason why these things are so beautiful. (Corbusier 1989 p:75)

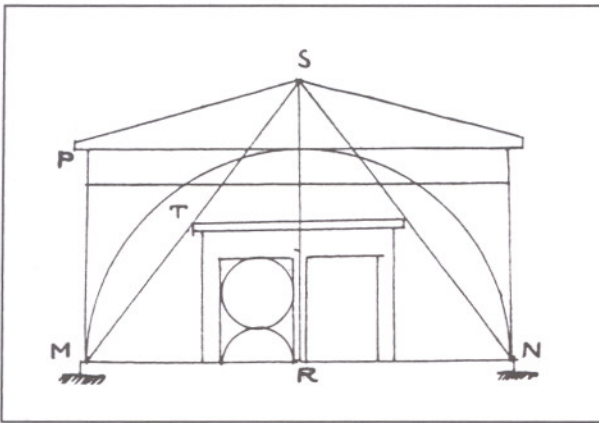


Figure 2. 4 Corbusier's *Regulating Lines*. Arsenal of the Pirenes.
(Source: Stevens, 1990)

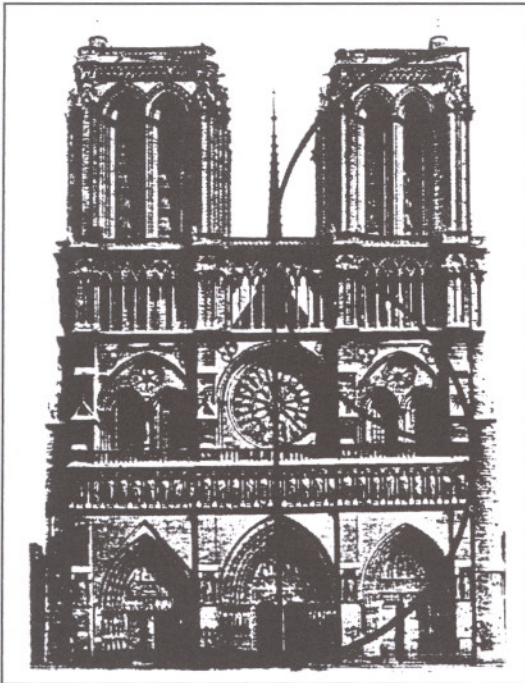


Figure 2. 5 Corbusier's *Regulating Lines*. Notre Dame de Paris.
(Source: Stevens, 1990)

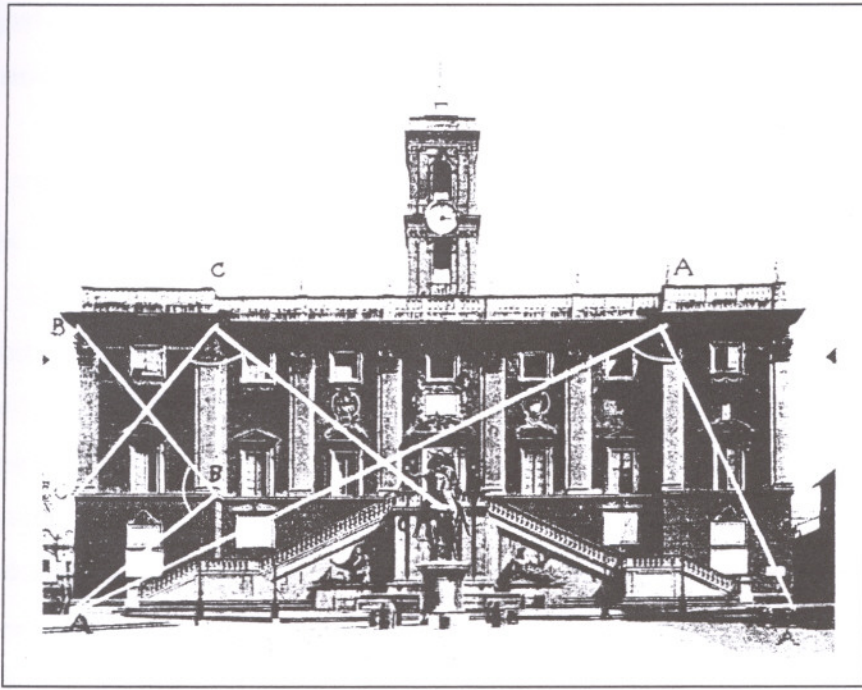


Figure 2. 6 Corbusier's *Regulating Lines*. Capitole Complex in Rome
(Source: Stevens, 1990)

The roles of regulating lines also occur in the Aristotle's concept of *taxis* in architectural history.

"In his poetics Aristotle defines the work of art is a world within the world, which is complete, integral, whole and where there is no contradiction. Nonecontradiction is ensured through functioning of Aristotle's three levels of formal organization; taxis, genera and symmetry. Taxis divides a building into parts and fits into the resulting partitions the architectural elements, producing a coherent work. In other words, taxis constrains the placing of the architectural elements that populate a building by establishing successions of logically organized divisions of space." (Tzonis and Lefaiure, 1994, p:9)

Taxis contains two sublevels; *schemata* and *triplartition*. The grid schema divides the building through two sets of lines. Rectangular grid schema in which straight lines meet at right angles was one of the most commonly used in classical architecture. The distances between these lines is often equal, cutting the composition

into equal parts. If the distances are not equal they alter regularly. But in both type the composition is sectioned into parts that vary in a coherent way.

A line serve to join, link, support, surround or intersect other visual elements. It also can describe the edges of an given shape to planes or articulate the surfaces of planes. These are the main characteristics or roles of the line in geometry. The most important characteristic of the line which defines it as a repetition of points, enable us to regard the simple repetition of similar elements as a line. This is very important geometrical peculiarity of line by which we can find or discover invisible axis in architecture , where the similar or same architectural elements are repeated. Since the axis is defined as an imaginary line along which something can be divided equally or around which it move evenly, in the following parts of this thesis word of “*axis*” will be used in place of the word line.

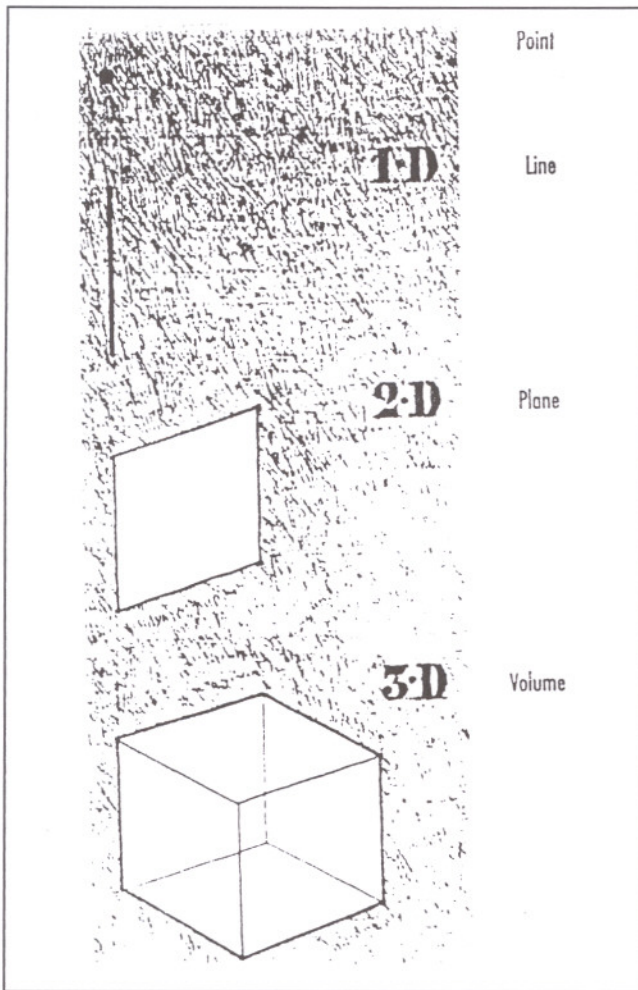


Figure 2. 7 Development of the Volume (Source: Ching, 1996)

2.2 RELATIONSHIPS BETWEEN AXIS AND FORM

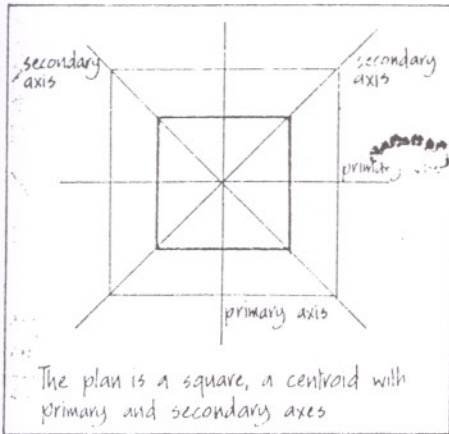
Le Corbusier, defines the “geometry as the language of man” (Corbusier.1989 p:72).In this sense, if the geometry is the language of man, inevitably, forms are the vocabularies of this language. Architects try to learn and also speak this language in a poetic way. In doing this, their success is directly depends on how do they use the vocabularies of the language and how do they combine them. Almost; all of the famous architects gain their architectural reputation by means of achieving to establish well organized sentences with the correct and well selected vocabularies. And some of them, who can speak with this sentences very fluently, are called as the master of the architecture, such as Wright, Aalto, Mies and as his friends call him Corbi or Corbu.

In the previous section, it has been mentioned that the line can serve to describe the edges of and give shape to planes. This is basic and also direct relationships between the axis and form. However, the importance of the axis is much more higher for form. “In this discussion of form, Le Corbusier is at pains to point out that the geometric laws of any particular form should be the basis for subsequent action. Once these geometric laws are understood the various axes can be traced, the properties of forms depending on whether they are linear or centroidal , static or dynamic can be charted. Le Corbusier calls these the “*generating lines*” of the form.” (Baker 1990, p:45)

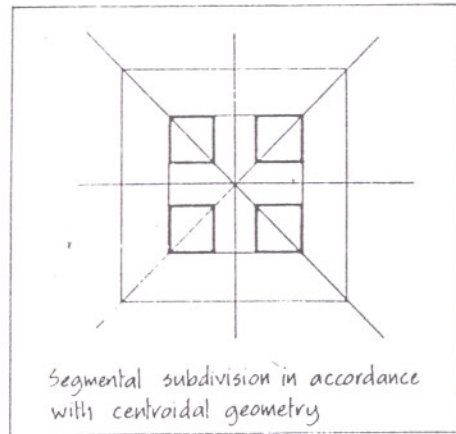
The lines of forces of each geometric figure help the architect realize the intrinsic geometric characteristics of form and use them in an efficient way, under the various circumstances of the site.

Basically, all geometric forms have central axes which have the same geometrical characteristics with the form itself. Therefore, these axes can represent for their forms.

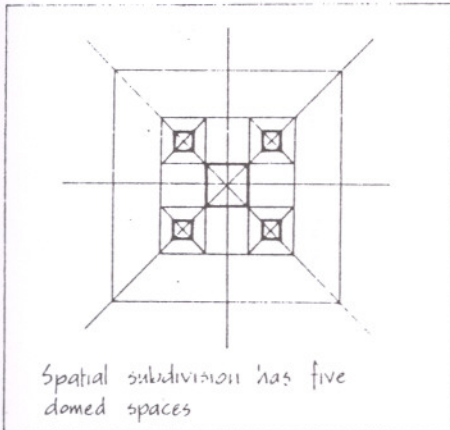
Leon Batista Alberti draw two straight perpendicular lines according to method of the geometry to which he reduces everything that he has occasion to measure. He also marks the intersection point of these axes with a nail. These are the Alberti’s representative axis, and the order of these axes brings about spatial order.



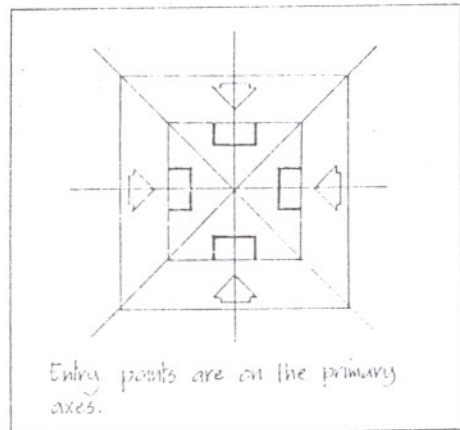
1 CENTROID



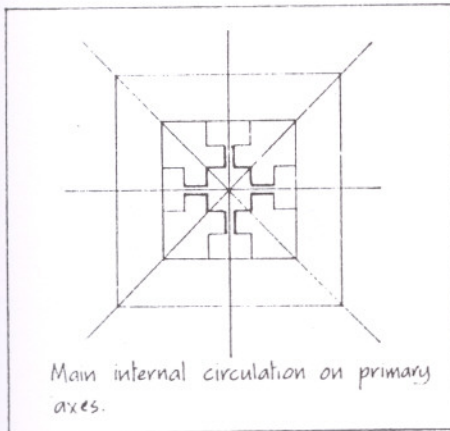
2 GEOMETRY



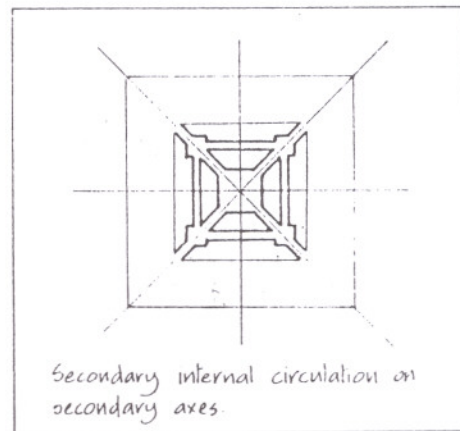
3 SPACE



4 ENTRY



5 PRIMARY CIRCULATION



6 SECONDARY CIRCULATION

Figure 2. 8 Generating Lines of Square. (Source: Baker, 1996)

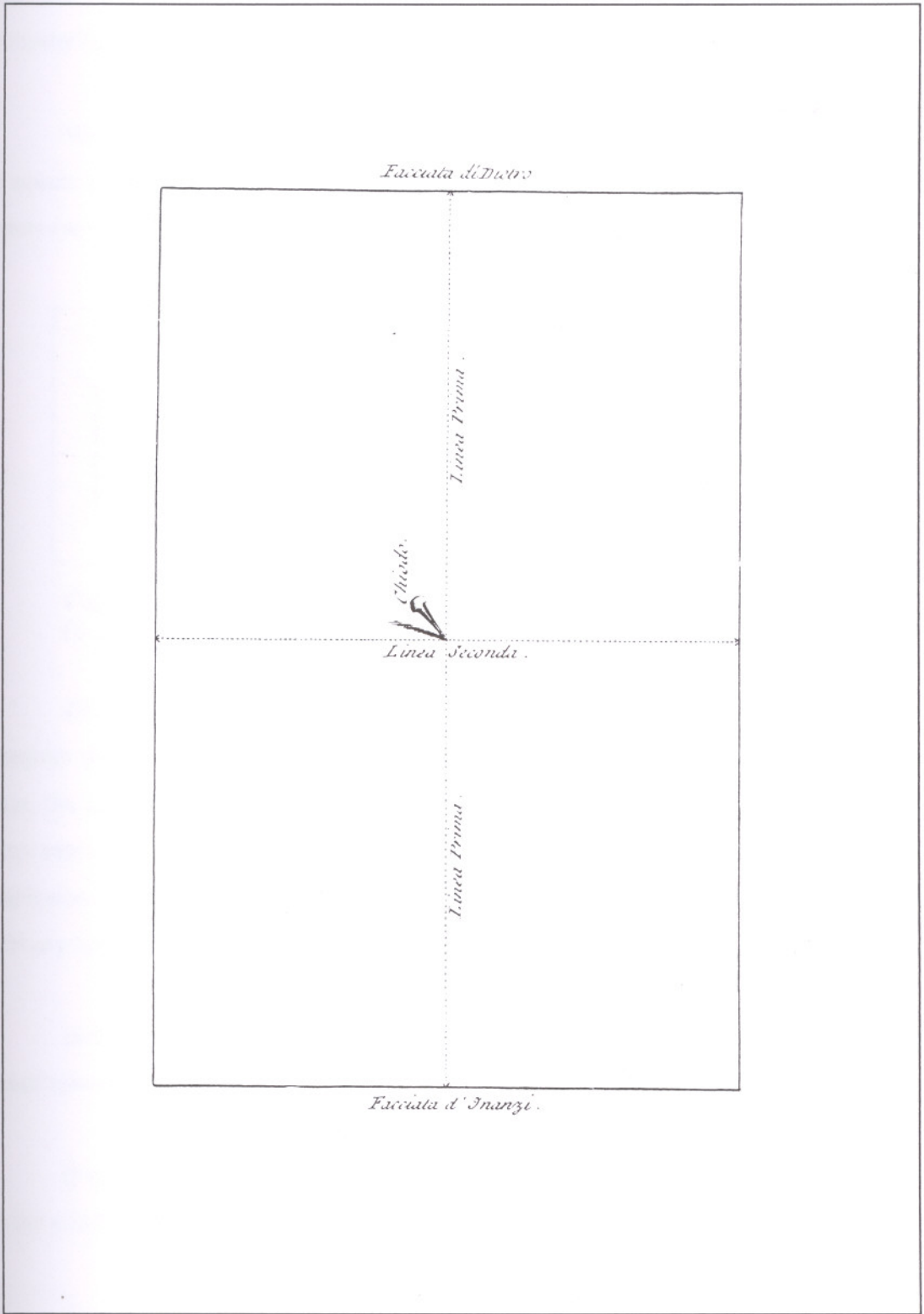


Figure 2. 9 Alberti's Representative axes (Source: Alberti,1986)

These representative axes are very important, especially in the process of getting together the forms. Because, combinations of the forms are achieved, primarily by considering the characteristics and the positions of these representative axes.

We can increase the number of these axes. For example, besides its central axes a square does have diagonal and peripheral axes, which allow us to know where to intervene to reinforce the intrinsic characteristics of square.

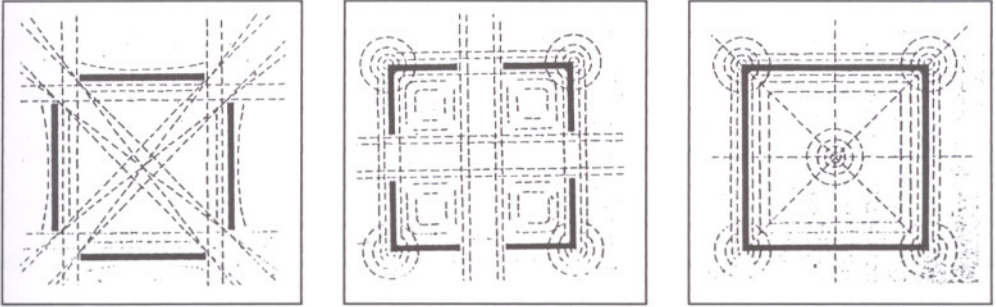


Figure 2. 10 Figure 2. 11 Figure 2. 12 Generating Lines of Square
(Source: Von Meiss,1996)

The lines of forces also help us use the different variation of form. If we consider the square again, we may take two variation of square into our consideration; first, the square which has the explicit corners and the second which has implicit. In both cases again the lines of forces help us. In the first square we may talk about the implosion of the space and it also contains implicit subspaces which reinforce the primary form by their similarity.

In the second square which has implicit corners we may see the extensions of the space towards the exterior. The primary form is less determinant.

If we compare last two squares we may discover that first square openings which in the middle of the walls emphasise centrality

As we may see in these examples *the lines of forces* can directly act on spaces, and define its characteristics depending on the potentials of form.

2.3 DEFINITION OF THE ARCHITECTURAL AXIS

So far, we tried to explain the geometrical meaning and the characteristics of the architectural axis by taking its relationships to forms into our consideration. Basically architectural axis can never be thought freed from its geometrical characteristics and meaning. We put a point as a source of geometrical axis, and we also said that a point extended becomes a line. We need at least two points to draw a line; starting and ending points. Architectural axis can also be defined by these characteristics and necessity of the geometrical line.

Architectural axis also needs a starting and ending points and from starting to ending one, it gains its direction. We may also talk about the connective function of architectural axis between two points. The power of the axis directly depends on the degree of relationships between two points and supporting elements along it. Along the architectural axis, some supporting elements are necessary to emphasise its importance, meaning and power according to degree of the relationships between starting and ending points. The most important characteristics of architectural axis is its ability in being imaginary which actually stems from the geometrical peculiarity of line which says the repetition of same or similar elements can be regarded as an imaginary axis.

Architectural axis simply is a real or imaginary line which connects its starting and ending points or delivers a message, meaning from one to other, by means of the supporting architectural elements which emphasise its power along.

Architectural axis can serve to;

- give a direction. And it promotes views along its path (Figure 2.13)
- connect two points. These points usually are starting and ending points of the axis.
- The axis also can deliver a message, meaning from its starting to its end. (Figure 2.14)
- arrange the symmetrical organisations of forms.
- give a dynamic character of form. (Figure 2.15)
- emphasise the horizontally and verticality. (Figure 2.16)
- split forms into the zones. (Figure 2.17)
- organize the circulation of users in forms.



Figure 2. 13 Axis can promotes views. Florentine street links the river Arno to the Piazza della Signoria. (Source: Ching, 1996)

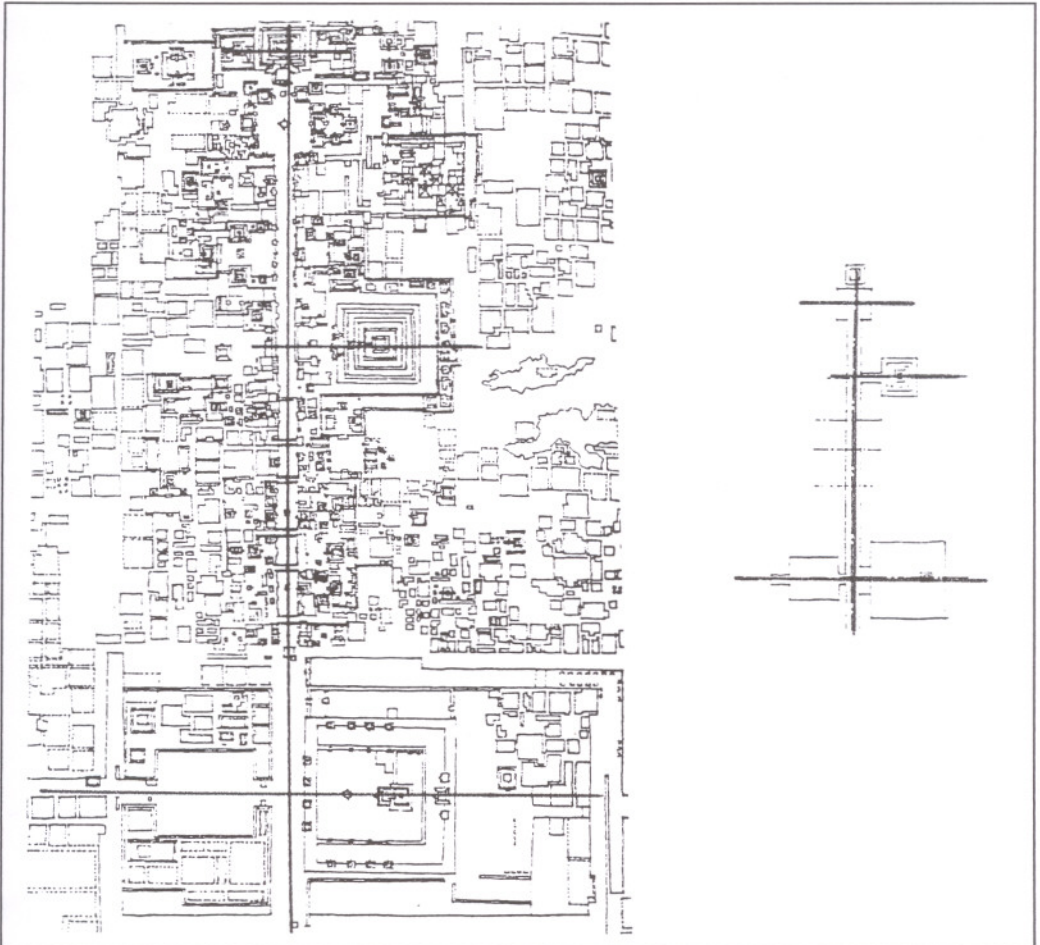


Figure 2. 14 Teotihuacan, City of Gods, Sample for connective axes

(Source: Ching, 1996)

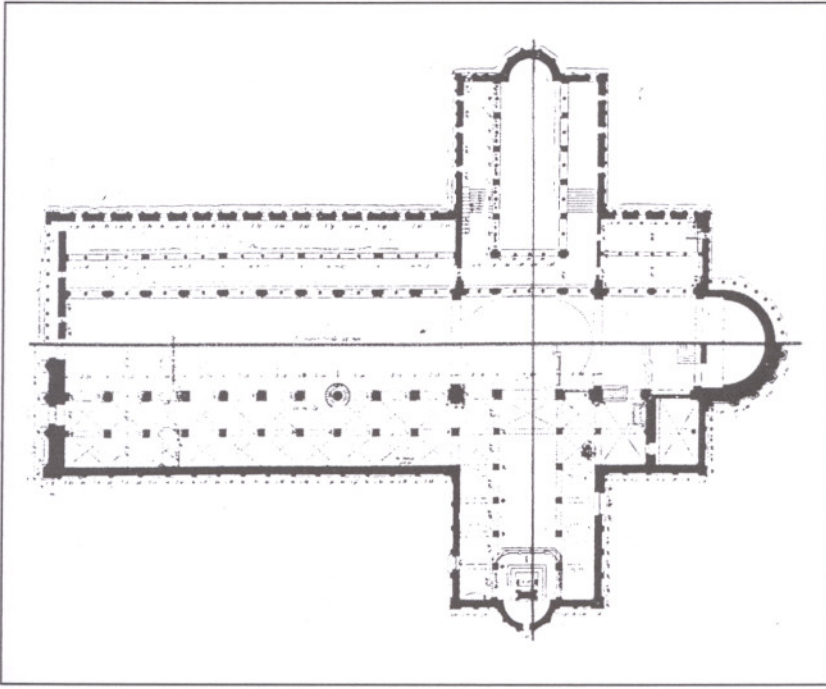


Figure 2. 15 Cathedral de Pise, Main Axis gives the dynamic character of form
(Source: Gromort, 1946)

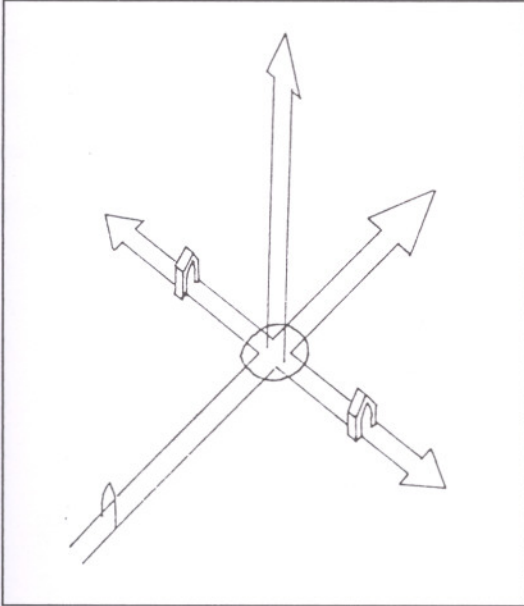


Figure 2. 16 : Vertical and Horizontal Axis (Source: Baker, 1996)

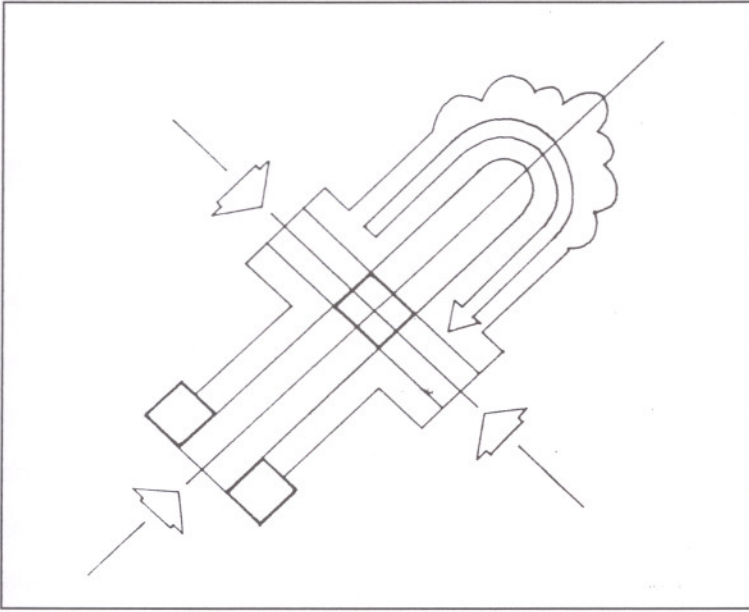


Figure 2. 17 Zonal Organisation of the axis. (Source: Baker, 1996)

These characteristics of the axis give the essence of the space and spatial development of the architecture is shaped directly depending on these characteristics. What makes the axis so important in the design process that, besides its strong relationships to forms, its big role in revealing the perceptual peculiarities of the space. Some use of the architectural axis can be merely perceptual, and it can be a magic tool to create different perceptual and visual affects. Volumes can also be effected by the characteristics and the position of the axis as well as forms and planes. Axial order of plane brings about the order of volumes, and their differentiation as well.

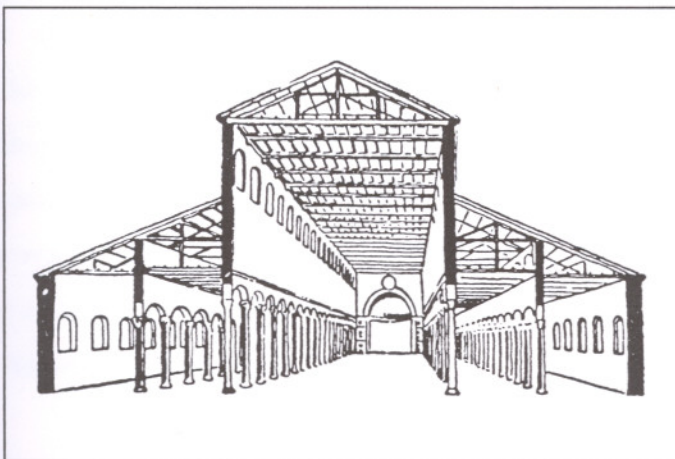


Figure 2. 18 A typical Roman basilica. Example for differentiation of the volume depending on power of the axis (Source: Gromort, 1946)

CHAPTER 3

THE PROCESS OF SPACE ORGANIZATION IN ARCHITECTURE

Space concept has always been the most important part of the Architecture, and it has always been questioned throughout the architectural history. Almost whole architectural history was filled up with various movements all of which have tried to define the concept of space and to reveal its meaning and characteristics according to economic, political and cultural circumstances of the era. It is possible to see various definitions of space in different eras.

“Aristotle defines space as a container of things- a sort of succession of all-inclusive envelopes, from what is ‘within the limits of the sky’ to the very smallest, rather like Russian dolls. Space is therefore, of necessity a hallow, limited externally and filled up internally.” (Von Meiss, 1996)

Another aspect conceives of space as a self contained entity, infinite or finite, an empty vehicle, ready and having the capacity to be filled with things. Plato defines the space in his famous Timaneus by following sentence. “ *...the mother and receptacle of all created and visible and in any way sensible things.*” (Arnheim, 1977,p:65) and he thought of it as “ *the universal nature which receives all bodies-that must be always called the same; for while receiving all things she never departs at all from her own nature and never in any way or it any time assumes a form like that of any of the things which enter into her; she is the natural recipient of all impressions, and is stirred to time by reason of them.*” (Arnheim, 1977, p:65) For Plato space was a nothingness existing as an entity in the outer world, like the objects, space would still exist, as an empty, boundless container.

Architectural space is supposed to be created by things, and it is born from the relationship between objects or boundaries. Space is experienced as the given that precedes the objects in it, as the setting in which everything takes its place. We should

pay our respects to this spontaneous and universal manner of looking at the world, in order to be able to understand the essence of architecture as an arrangement of buildings placed within a given, continuous space.

The concept of perception gives one of its main characteristics to the space. Perceptual experience of the space is usually the first step of living it. Since the architectural space is to be created by objects, experience of the space is generated only through the interrelation of objects. Space perception can only be possible with the existence of the perceivable things.

We can also define the architecture is the art of creating hallowness. In this sense a hallow which is defined both from the exterior and from the interior, and which we penetrate with not only our body but also our minds can be regard as the simplest definition of architectural space. For the architects the hallow or the gap between two defining elements is not nothingness, on the contrary it is very reason for his activity which should create the hallow in order to contain. And this hallow is formed by the architect according to physical and mental requirements of people. We know that not all the points on the limiting surfaces do play an identical role. The edges of surfaces and the intersection of a few surfaces give the essential cues for orientation and comprehension. For example a cubic space is limited by six planes each of which a single plan in the volume of *de Stijl*. Our eyes try to understand the space by using angles and corners as more precise cues.

We tried to explain architectural space by its consisting objects. Hallow as a space and the objects in it, brings about the new debate on space; which must be dominant. In other words, while the objects can be the most important element to define space, they also can reduce the priority of it. For example, in an art gallery exhibited paintings may reduce the architectural essence of the space. This is a problem that architects have been trying to come over it throughout the modern era. August Schmarsow insists on the priority of space in architecture with following paragraph in his work "Barock und Rokoko".

"... men imagines in the first place the space which are supports of symbolic significance. All static or mechanical dispositions, as well as the materialisation of the

spatial envelope, are only means for realising an idea which is vaguely felt or clearly imagined in architecture creation... Architecture is 'art' when the design of space clearly takes precedence over the design of the object. Spatial intention is the living soul of architectural creation.” (Von Meiss,1996, p:101)

Organisation process of the architectural space is the most important phase in relationships between the architecture and its core; space. Space organisation process may includes many different variables each of which directly effects the characteristics of the space. Personal characteristics of the architects, site factors and topology, natural forces and climate, cultural and economic situation of the era, the way of interpretation of knowledge, power of the authority, functional necessities, and Geometrical regulations are some of these variables.

Physical and mental requirements of the human being are the starting points of this process. Every space must provide human beings with physical and mental requirements that they need. So the process includes lots of methods each of which tries to understand the functional requirements and provide well designed spaces according to physical and mental necessities of human beings.

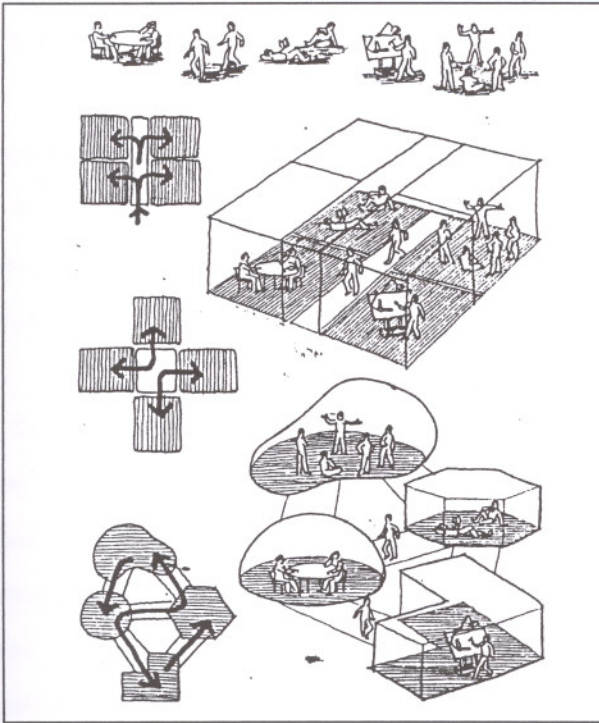


Figure 3. 1: Spatial Organisation of human requirements. (Source: Zevi, 1994)

A space is physically defined by forms. And when it is built it should be sit on the site. So, organisation process of the space should also deal with the topographic, natural and climatic forces of the site to be able to organise functional spaces for human beings.

Variables of the space organisation process can sometimes be quite abstract. Meaning is obviously one of these abstract variables. Abstraction of forms and loading some meaning on them has been the very familiar way to reflect the characteristics of the era and the society, throughout all the architectural history.

Organisation process also deals with such an abstraction and also search for the appropriate forms to be loaded by the necessary meanings. In parallel with the case of abstraction and loading meaning, power of the authority takes an important and effective role in the organisation process of space. From popes to the president all the men who got the absolute power, play an effective role in design process. Sometimes they even act as a designer himself.

Architecture has always been interacting to the current characteristics of the era and society. Circulation of the current knowledge and its interpretation by society another variables in forming the general principles of the space organisation process in architecture. We can see such a situation in all architectural movements that named the precise era in the architectural history such as Roman, Baroque, Gothic, Renaissance and Modern architecture. Besides their other peculiarities, all of these movements are well known by their spatial characteristics and relationships to form and geometry.

The personal characteristics of the architect may be the most important variables in the design process. Among the other variables some of which are abstract and some of which are concrete, personal characteristics of the architect directly effect the process of design. Architect as a designer does interpret and regulate all the other variables of design process according to his or her especially architectural characteristics, the emotions of like or dislike, most of which definitely innate. Individualism starts from this point in architecture and each designer is measured in

his or her semi abstract frame. Then the effects of the other variables can be taken into consideration.

Design methods of architecture can never be thought freed from the personal effects of the architect. Even the general trends of the era shapes the architecture and puts some individual principles in design process, the way of applying and interpreting of these principles is on the architect's own initiative.

Especially, geometrical organisation process of space can be based on the accumulation of the geometrical knowledge of the designer, and the way of its interpretation. Aalto, Fin architect, for example, explains his organic forms with the wild nature of Finland where his childhood passed. And again he admit that he was directly effected by his grandfather who was working around the big table to draw the topographic map of Finland. Le Corbusier as a leader architect of modern era never denies the reflections of his education in watch-making school and his native land Switzerland, on his architecture. May be he has pointed out the necessity of the functionally machine-like houses just because of the effects of his pre-experience in watch-making school in Switzerland.

All these variables play an important role in the process of space organisation in architecture. But what is the important and irresistible thing is the fact that all spaces must be defined by some geometrical elements according to geometrical regulations of form and architecture, at the very end of the space organisation process. So, besides all of these variables we should deal with the geometrical evolution of space and its interacted element; form. If we deal with the evolution of forms in parallel with that of space, we should pay our attention to the generating and also regulating elements of forms to realise its essential characteristics.

The axis is one of the most important regulating elements of forms and starting to design with drawing some axes consciously or unconsciously is very common way in the design process. These representative axes in fact the basis of the spatial scheme. Dynamic relationships of forms are established along these axes according to necessities of *combinatorics*. These axes may sometimes be imaginary, which are drawn by the

architect according to variables of the topography, nature, climate, or his conceptual decisions.

In the next chapters, all kinds of these axes will be explained on the related examples.

CHAPTER 4

AXIAL DEVELOPMENT OF THE BUILDING FORM

In the architectural history, we may observe different building types and also forms such as basilicas, circular temples and stoas. All these forms, and their spaces were shaped under the abstract or concrete lines of forces. Development of the building forms and space is effected by the axes inevitably. In this point, the characteristic of the architectural axes become very important. Axial development of the building forms and their spaces has very strong relationships with some abstract characteristics of the axes as well as geometrical.

4.1.CHARACTERISTICS OF THE ARCHITECTURAL AXIS

4.1.1 AXIS AND MEANING

The word of meaning should be clearly explained before starting to talk about its relationships to the axis. “ *The meaning of any object consists in its relationships to other objects, that is it consists in what the objects gathers. A thing is a thing by virtue of its gathering... In general, meaning is a physic function. It depends on identification and implies a sense of belonging. It therefore constitutes the basis of dwelling. We ought to repeat that man’s most fundamental need is to experience his existence as meaningful*”(Schultz, 1993, p:166)

The concept of meaning has always been with the architecture in all architectural history. Buildings have been built not only manipulate the nature but also immortalise some values of the past.

Generally, in all steps of architectural history, especially until the modern era, religion and religious values were equal with the meaning. Since the concept of

meaning was stemming from the concept of existence of a thing or a man, that strong relationship between the meaning and the religion was inevitable. All the societies have tried to find the answer for the question of “ what are the secrets behind our existence” in religion. That’s why religion and the religious values have become so dominant in the history.

Symbol is the most important concept for the understanding process of meaning. In other words, meaning cannot become concrete or understood without a symbol. Each concept needs the most suitable symbol to explain its potential meaning. Architecture axis has become very important as a result of this fact.

Using, architecture as a symbolic element to explain the meaning of a thing or loading a meaning to an architectural products eventually shaped all general characteristics of architecture in different periods according to their feature.

Architectural axis, is the most important element in establishing the relationships between the architectural objects to reveal the architectural meaning. We may also consider the buildings as the symbols of architectural meaning. In other words, architectural buildings can be regarded as a final step of architectural design process at which general abstract meaning of architecture is changed into concrete form. In this point besides their primarily architectural functions all the consisting elements of a building also play a secondary role to deliver the message or meaning that the building hides to the user. The strong relationship between the architectural axis and meaning become very obvious in the case of delivering architectural messages to the users. We have talked about the connective use of architectural axis geometrically, in the previous chapter. This is the most important point to explain the relationship between the meaning and axis. Axes basically connect all the meaningful elements to reach the meaningful whole. These elements may be the components of any building or building itself. So we may talk about the two connective axes; first, axes in the building and the second, axes between the buildings. Actually no one can deny the exact same characteristic of these two kinds of connective axes which is connecting related meaningful elements to reach the meaningful whole. We may talk the differences in scale case. Functionally some these two kind of axes, obviously cause the spatial or

geometrical organisation in different scale. Connective axes between the buildings effect the urban space organisation and we explain this case in the following parts of the thesis.

In some cases we can see the connective use of the axis in the meaningful frame in a different geometrical form apart from the single thin linear line. For example, Spanish Stairs of the Rome connective S Trinita Di Monti with the Piazza Spagna as a symbol of movement. Another interesting point is the slope of this axis in these steps. So, we discover the another version of the connective axis apart from the horizontal and vertical. We can see such a situation in the stair-ramp of the Michalengelo's capitol complex. which connects the center of the power to the city, again in Rome.

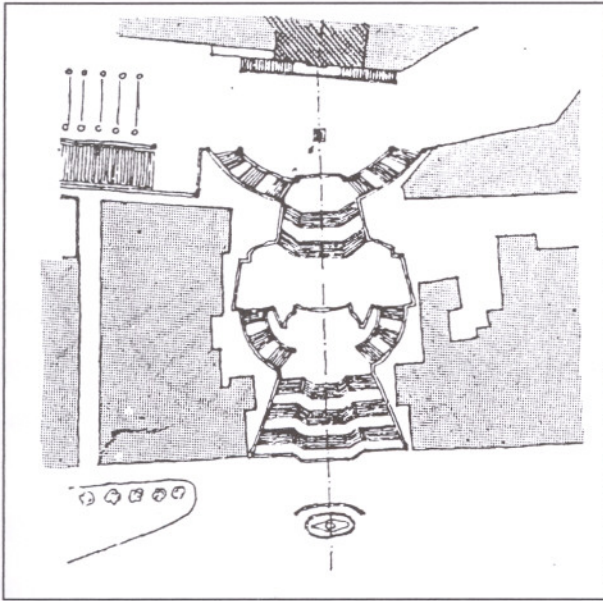


Figure 4. 1 Spanish Steps. Connective meaningful slopy axis. (Source: Gromort,1946)



Figure 4. 2 La Cordonato. Connective ramp of capitol. (Source: Bacon, 1974)

In ancient Egypt “ *the primary gods represent natural elements which were embodied through analogy with human (and animal) properties*” (Schulz, 1993). Egyptians have tried to understand basic existential meanings such as interaction between elements and nature and as a more abstract good and evil. The main aim of the Egyptian culture was protecting the experienced and desired totality against change. It may give us a clue about the questions of why pyramids were so popular form in Egypt. Egyptian axiality simply stems from the geographical structure of Nile valley. Both sides of the Nile river are bordered with the huge deserts which cause a longitudinal settlement along the Nile river. In fact, the river of Nile is an axis itself. The fields on both sides of the river Nile, which acts as a longitudinal main axis, were divided to form an orthogonal co-ordinate system that stems from the longitudinal axis of the river. Although it implies a direction, Egyptian axiality, however, is always enclosed. It does not symbolise a dynamic occupation of the surroundings, but rather seems to represent an eternal state of affairs. Orthogonal and axial organisation therefore fulfil the same purpose. The creation of a constant, eternally valid environment. (Schulz, 1993). Pyramids as the religious symbols and monuments of Egyptians architecture are ordered axially. In general orthogonal system, each pyramid as a symbol and the main object of the general religious meaning and its surroundings were planned axially.

The pyramids of Egypt were the most dominant elements in the meaning of the Egyptian architecture, because of their abstract characteristics. Their gigantic sizes also stem from these abstract characteristic and these characteristic have direct relationship to the religious values. In Egyptian axiality the meaning of the axis can be thought with the plan schemes of the pyramids. Axes are used to emphasise the meaning of the pyramids and to connect them to the general axiality organised orthogonal structure of the Egypt. Each pyramid complex has an very straight and meaningful axis which gives a direction to the complex. The pyramid as an ending point of the axis increase its importance. That is why besides its geometrical characteristics each axis needs some physical elements to emphasise its ending point, such as columns, colossus, sphinx and gates.

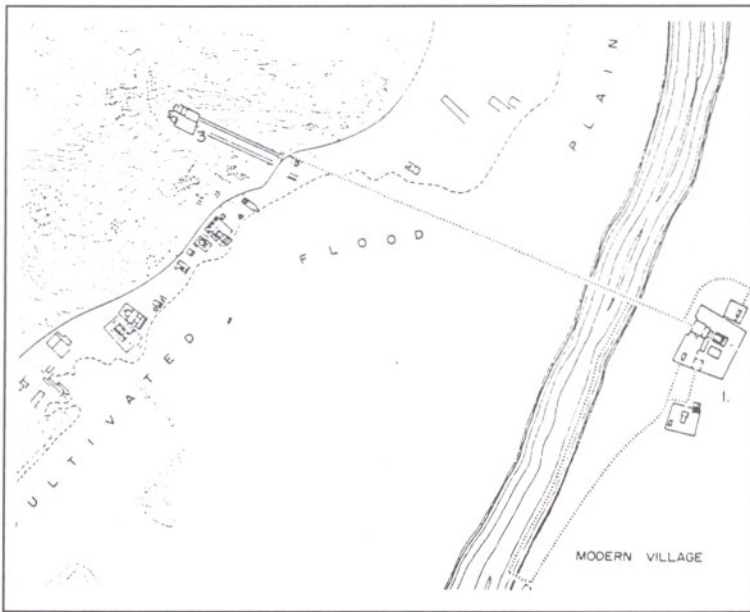


Figure 4. 3 Axial Order Of The Upper Egypt's Thebes(Source: Kostof, 1985)

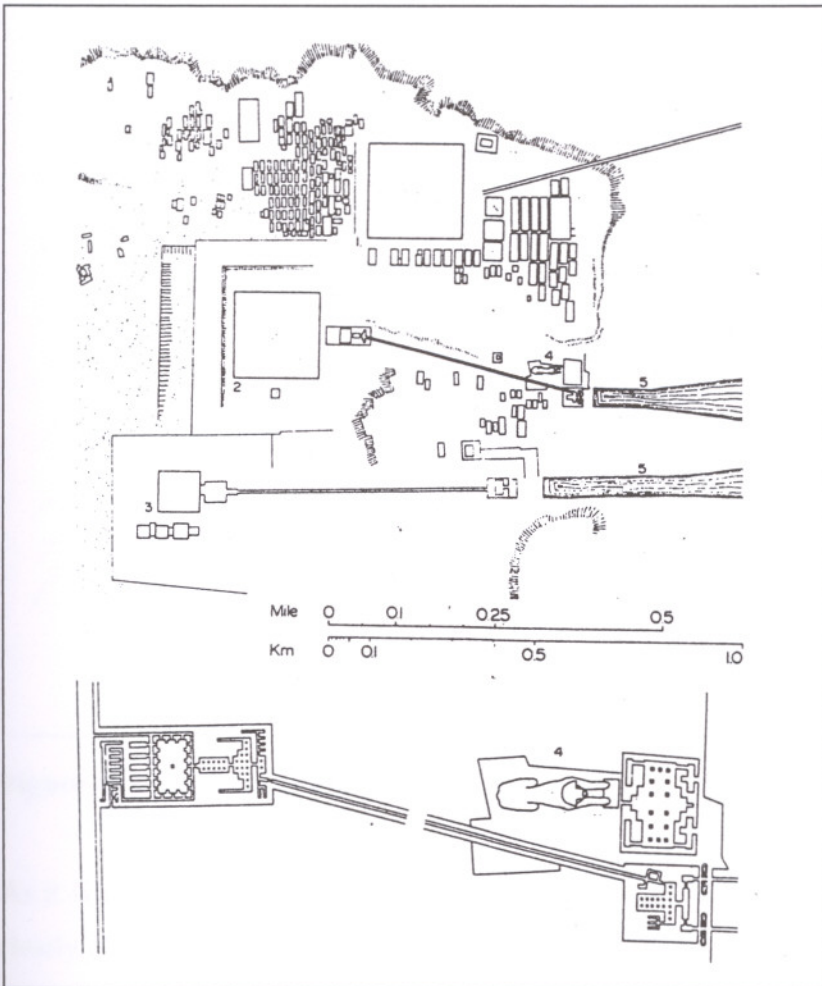


Figure 4. 4 Connective Axis Of The Giza Pyramid Group
(Source: Kostof, 1985)

Connective characteristic of the axis is very obvious in Egyptian architecture, an meaning of the connected objects make also these connective axes meaningful. Generally, Egyptian axuality and its meaning stems from the simple geographical structure and abstract religious values.

The importance of the religion and religious values is very obvious in all steps of architectural history. In other words, almost all of the important buildings of the past were built to serve the aim of the ascending religious values. The power of the religion and its abstract forces on society dominated the general values about the social meaning. So religious values have become the basic elements for creating a general structure of the social meaning

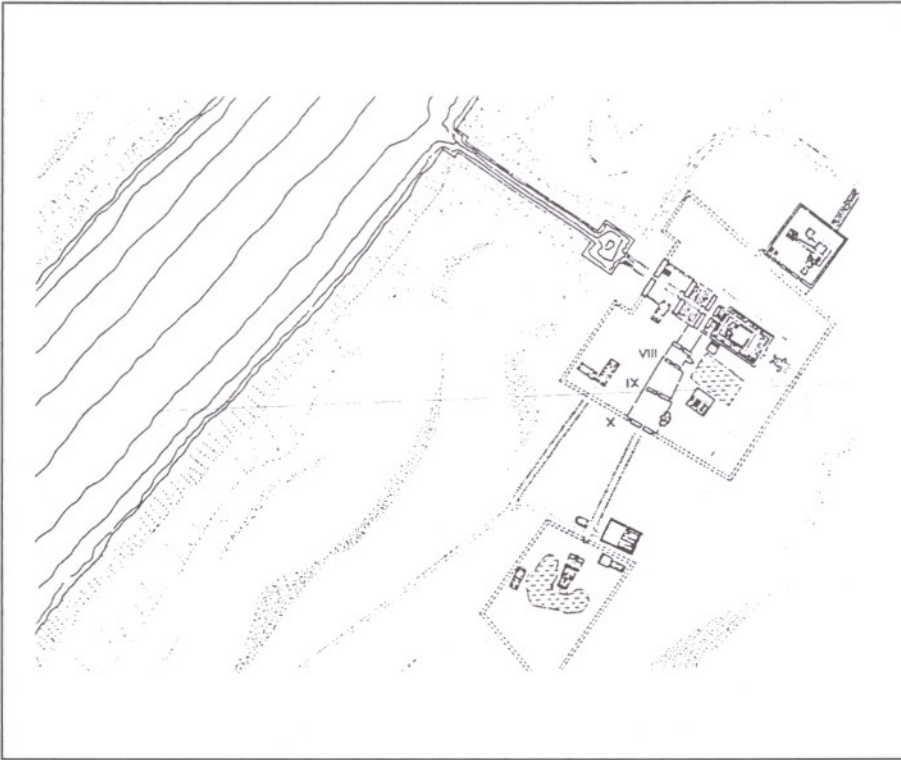


Figure 4. 5 Axial Order of Karnak Temple Site Plan (Source: Kostof, 1985)

As it is in the Egyptian architecture the relationship between axis and meaning can be clearly observed in the religious buildings of the Greek and Roman Architecture. In contrast to the orthogonal structure of the Egypt, we can see the vanishing of the dominant axis as a result of democratic structure of the society. But the buildings

especially temples still have axially organised space schemes. In Greek Architecture we can see the axis as a generating element of the new typology which was stoas. The stoas is a long columnar portico used to screen off the agora and to offer shelter from sun and rain. Stoa is the most outstanding example of the Greek architecture in which geometrical and religious meaning of the axis changes into social meaning and generates a new building type. Abundance of the orthogonal strict axial organisations inevitable result of the new democratic structure of the authority. Axially organised symmetrical buildings are no more located in the orthogonal schemes.

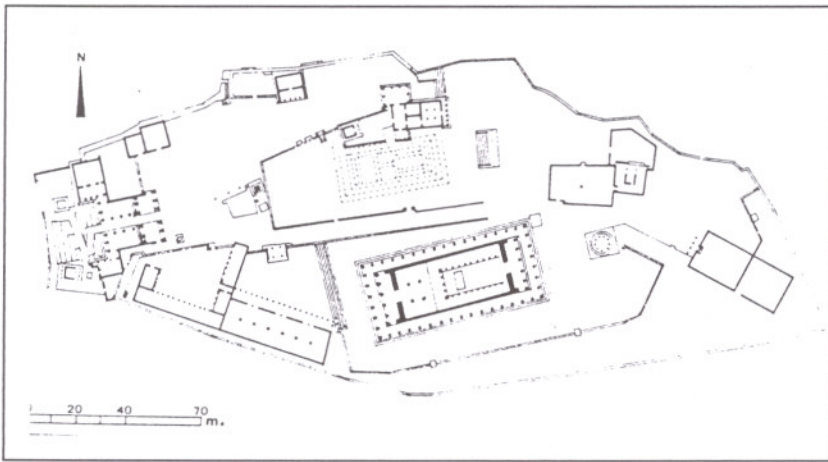


Figure 4. 6 Ground Plan of the Acropolis : More free organisation of the axial buildings (Source: Schulz, 1993)

Baroque Rome is another important example to observe the relationship between the meaning and axis and also its connective function. The role of Pope Sixtus V was very important in organisation of the Baroque Rome. Sixtus V, who was the one of the most famous pope in Rome has shaped general view of the city that still exists.

What Pope Sixtus V has done is defining the some meaningful points and then combine them with straight axis. Piazza Popolo, San Pietro, San Lorenzo, S.Maria Maggiore, S.Giovanni, S.Groce were his main landmarks in the Rome city. According to Sixtus V every church as a landmark should give their inner meaning to outside and they should be connected to each others in order to embody a meaningful whole. Sixtus V's aim was making the religion very dominant in the city whole and buildings and axis were the major components of that whole.

Roman buildings and complexes usually organised on strict axial basis, which makes the axis the distinguishing property of roman architecture. In Rome orthogonal and rational elements are combined to form complex, axially organised totalities. Roman axis is usually related to a centre, which is often defined as a crossing of axes, and the meaning of it correspondingly differs from the symbolism of the Egyptian path.

We should also talk about the *Cardo* and *Decumanus* in planning of the Roman architecture. These two interesting meaningful axes at right angles, effects the spatial plan schemes of Roman Architecture. *Cardo* runs from north to the south and it represents the axis of the world. On the other hand *Decumanus* runs from east to the west and it represents the sun. These two main axes were generating points of the Roman city plans. In some cases it is possible to see the effects of these meaningful abstract axes in Roman buildings. For example, plan in baths of Caracalla was organised according to these axes. It is possible to see similar schemes, which stem from some generating axes in other Roman baths.

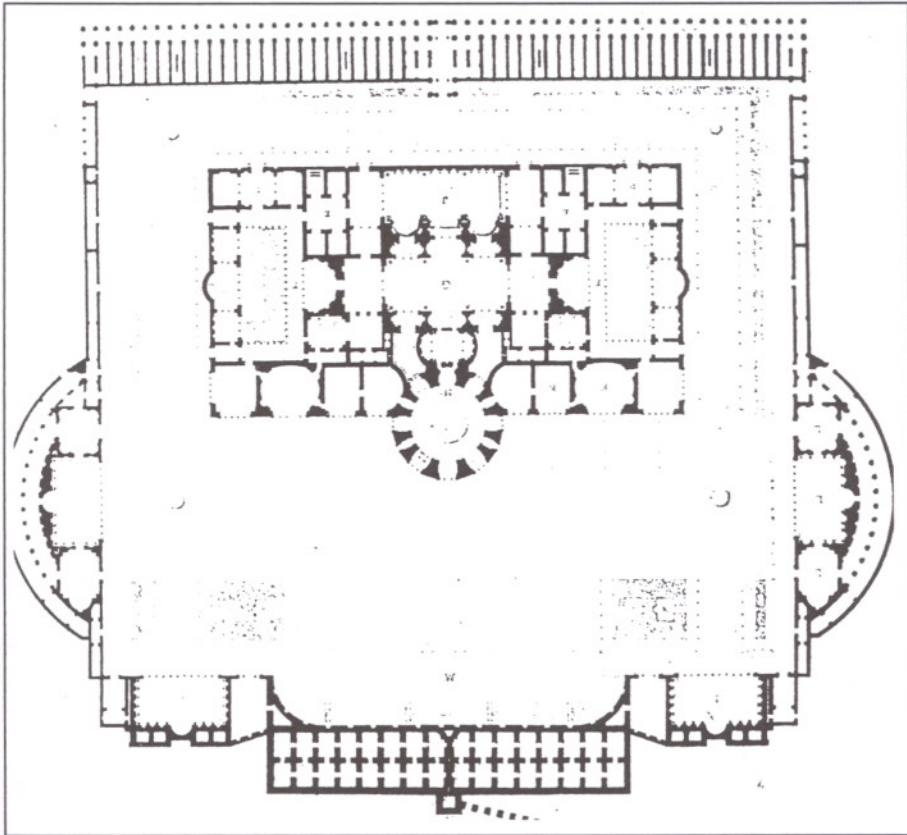


Figure 4. 7 Plan Baths of Carcalla. (Source: Gromort, 1946)

If we consider the plan of Rome we may observe some vertical elements or axis as well as horizontals. Actually using an vertical axis is another way to emphasise the meaning. Especially in the case of religion ascending upwards is very common characteristics to give its sacred form. Geometrically all there co-ordinates of the Cartesian system of space are equal in character and importance. Our earthly space, however, is pervaded by the pull of gravity, which distinguishes the vertical as the standard direction. Any other spatial orientation is perceived according to its relation to the vertical.

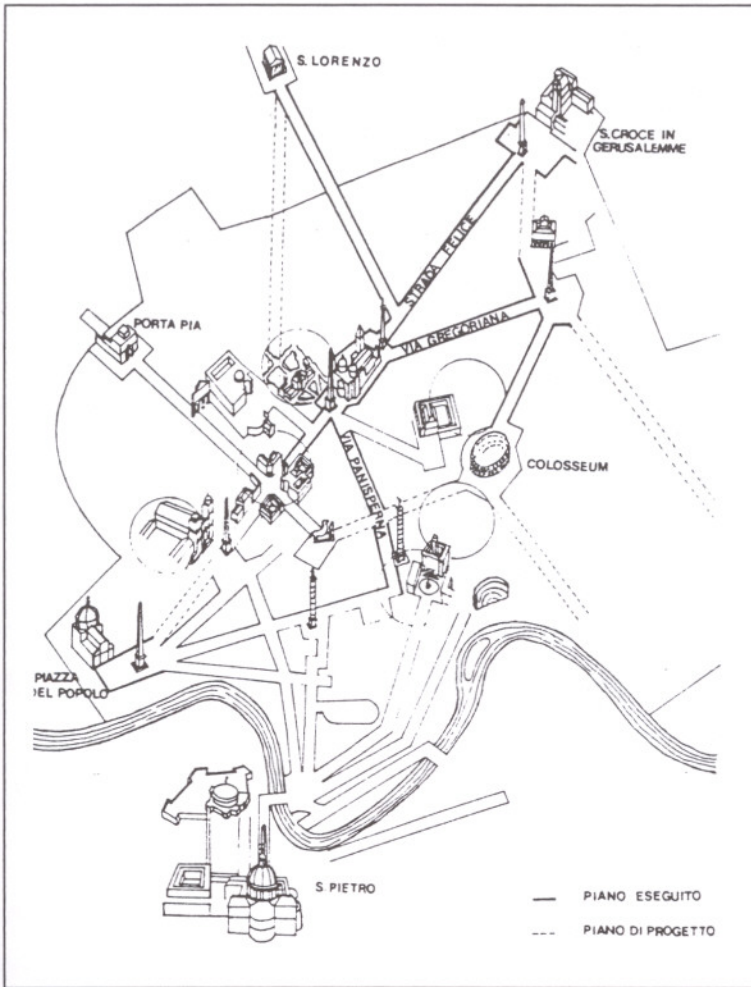


Figure 4. 8 Pope Sixtus V's Rome city and his connective axes
(Source: Giedion, 1995)

Straight, powerful, horizontal, connective axes of the Rome gives the plane effect to the city. Sixtus V was also aware of this problem. He used the Egyptian columns (obelisks) at every meaningful point or plaza which is connected to another by straight horizontal axes. So he tried to balance verticality and horizontality at least on

the intersection points of the horizontal connective axes. These columns were new symbolic meaningful elements of the Roman city.

In all religious building types, from pyramids to mosques and cathedrals, it is possible to see at least one vertical element to emphasise the direction to the sky. Colosus and tall columns were used to give this vertical effect in Egyptian architecture. Towers of the mosque or Laternas of the churches took place of columns in Islamic and Christian architecture.

To sum up, the relationship between the meaning and the architectural axis has always been shaped under the absolute power of the religious values that dominate the whole era. So, religious meaning of the architectural axis become very obvious and also important especially in the religious buildings. This was the main reason of the axially organised plan schemes. Connective and directive characteristics of the straight axis also establish the relationships between the meaning and axis. Generally, almost all religious buildings or temples have at least one obvious dominant powerful main axis which leads the user from the entrance to the most sacred part of the building. We can find different names of this sacred part in architectural history such as, absid and altar. Whatever its name it is, the important thing is ending position of this part at which the man feels himself very close to his god. There is no such a situation that makes the man feel at the center of the biggest power in the world; the power of god.

4.1.2. AXIS AND POWER

Architecture has always been the most effective way to exhibit the power and the authority to give a message or to symbolise any kind of idea. Therefore it has been used frequently by the authoritarian regimes to impose their ideology on their society. In the architectural history as we mentioned before the power and the religion developer in parallel with each others. In other words religious values generated the power of the authority . So, the men who have the religious identity also have the absolute power on society.

The ways of emphasising the power architecturally, have become very important in development of the both architectural and urban space. Geometry as a base of the architectural form has played an important role in this case. Especially, its axes were almost the unique elements.

Actually the power of the axis should be defined in parallel with the meaning and the connective characteristics of the axis. Because, these are the very interrelated concepts each of which reach the exact necessary form by means of the others.

Axiality is the simplest way to reflect the power of the authority. Of course the axis is nothing alone. As we mentioned before geometrically starting and ending points of the axis, which give the connective necessity of it are important as well as axis itself. This case brought about monumentality. If we talk about the power of the authority we should also talk about monumentality in architecture. In all architectural history the power of the authority has built monumental buildings to host itself. The main aim was reflecting the absolute power and making it dominant to control the society. On one side, the power of the authority was building monumental powerful buildings. In this act the necessity of the powerful connective axes was inevitable.

Since the religious values and power of the authority were side by side in all architectural history monumental buildings were usually religious. So the necessary axes to spread the power on society were also meaningful

In the later eras, it is possible to see the change in the centre of absolute power. Religion has lost its importance according to developing social structure of society. What the unchanged thing was the existence of the one man or group oriented power of the authority. Hitler and Mussolini were replaced for the religious man of the past. These dictators have replaced the ethnic values for religious. Even the aim was different, the way was still the same; using the axes.

Besides its geometrical characteristics and advantages, another interesting point that makes the axis so popular is totally perceptual. Straight axis provides us with perspective view along its length. The length of the axis totally effects the perceptual

importance on our minds. On the other hand, axis and axial organisation of the buildings or space has very effective role in our cognitive maps.

Using the axes with the streets or repetition of the any architectural elements is not only a way to emphasise the power of the authority. We can see the different use of the axis to shape our cognitive minds in Albert Speer's Formal architect of the Hitler works. Speer did was using and organising light beams to create a perceptual effect to make the power of the authority more dominant on society. Especially in the large social ceremonies this method was also used to unify and direct the society to Hitler's ideology that create a new super German race society in all Europe.

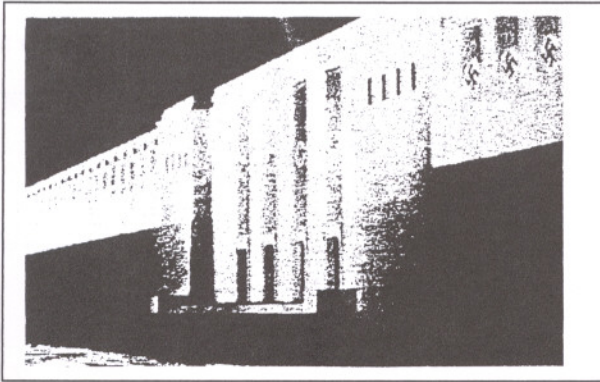


Figure 4. 9 Speer's use of axial light beams to make the building more attractive (Source: Architectural Design, 1995)

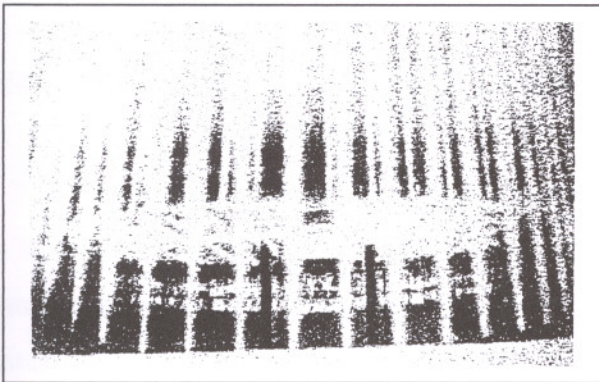


Figure 4. 10 Speer's use of axial light beams to make the building more attractive (Source: Architectural Design, 1995)

It is very obvious that the power of the axis also reflects the power of the whole, where it is organised. That is the main reason of axial organisation of the soldiers in any ceremony. The straightness of the axis on which soldiers walk also defines the degrees of discipline and power of the army.

To sum up, geometrical power of the axis makes them an important element in architecture and their geometrical characteristics in showing the power were changed into perceptual and psychological in some cases. The aim of this change was affecting the people in a more fundamental way. In other words, since the man is unique and basic element of architecture, axes were adapted to his world. Above all, in which way they used; geometrical perceptual or physiological the aim is the same and the pure what is controlling the man or dominating him by reflecting the exact characteristics of the power.

4.2. AXIS AND URBAN SPACE ORGANISATION

We put axis as an element which connects the objects and pieces to each other in order to reach the meaningful all in the process of space organisation. And we have also added to kinds of these axes; first in the buildings that combines their smaller components and the second in the urban space that combines buildings as a consisting objects of the city whole. We should also consider some intermediate spaces between the buildings as an other consisting objects such as squares.

“The building of cities is one of man’s greatest achievement. The form of his city always has been and always will be a pitiless indicator of the state of his civilisation. This form is determined by the multiplicity of decision made by the people who live in it.” (Bacon, 1974 p: 13)

As Edmund Bacon mentioned above, the process of organising urban spaces can directly be related to the social structure at degree of the civilisation of society. From this point, we can say the development of the architectural axes in the process of urban

space organisation come to our time in parallel with development of the civilisation and society.

The form axes in urban spaces are streets and paths, and their connecting characteristics are very obvious. In the process of both modern and history urban space organisation three basic theories can be observed.

1. Figure Ground Theory
2. Linkage Theory
3. Place Theory

In this classification of the Roger Trancik, linkage theory is totally related to the axiality in the urbane space organisation. This theory indicates the dynamics of circulation as a generators of urban form, and according to this theory emphasis on connection and movements is significance. (Trancik, 1986)

As it is in indoor space organisation the axes are the main may be the unique elements to achieve this emphasis. Japanese architect Fumihiko Maki addresses linkage theory as the most important characteristics of the urban exterior space in the following paragraph.

“Linkage is simply the glue of the city. It is the act by which we unit all the layers of the activity and resulting physical in the city...Urban design is concerned with the question of making comprehensible links between discrete things. As a corollary, it is concerned with making an extremely large entity comprehensible by articulating its parts.” (Trancik, 1986 p:106)

Maki also defines three different formal types of spatial linkage; Compositional of Form Mega Form, Group Form.

In compositional form, individual buildings are composed on a two dimensional plane. This type of urban form is typical of functionalist planing methods. In Mega Form, structure and individual buildings are connected to an axis in a hierarchical open ended system where linkage is physically imposed. In Group Form, linkage is naturally

and organically evolved. And group form results from accumulation of structures along communal open space.

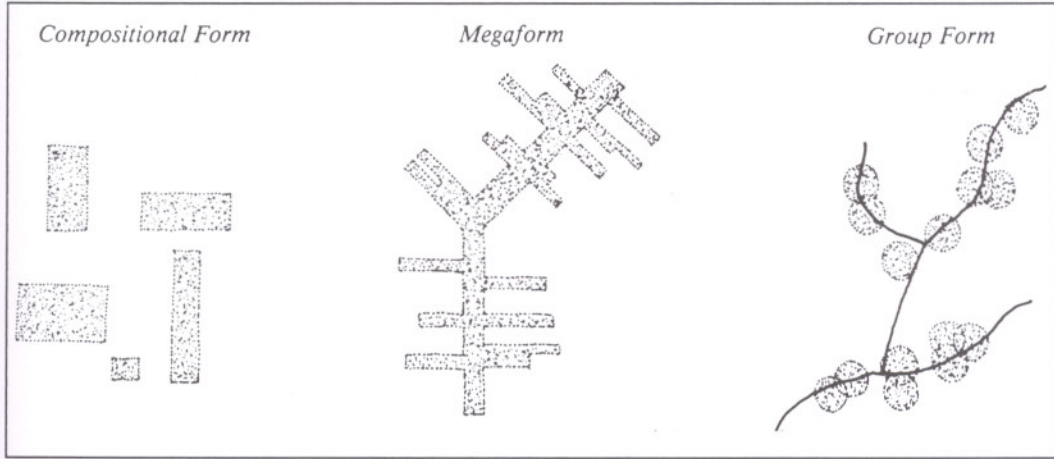


Figure 4. 11 Fumihiko Maki's three types of spatial linkage.

(Source:Trancik, 1986)

In urban space organisation especially in linkage theory the streets and the squares has become two important concepts. The traditional city was organised around a clearly defined network of interconnected streets and squares. In this organisation the spaces between the buildings were at least as important as the buildings themselves. In the of urban space development the square was probably the first organising form and the streets were its extensions as the axes of movement (Trancik 1986 p:67) . The boundaries of the square is as important as the square itself to create a spatial enclosure. In fact the classic open urban spaces are really closed spaces. We can see such as enclosure or closed open spaces in the piazza San Marco in Venice or Bernini's Piazza San Pietro. In both example boundary elaborated elements were used to create a spatial enclosure.

Street as an axis of movement is an other important element of the linkage theory in urban space organisation. Streets provide us with the essential freedom of movement on which city life depends. They form the city. But among their other function most of time they are the links between entities. We can give the traditional street in Iran as an example of using the street as a multi-functional axis. The main corridor leading through Isfahan, Iran generates some exterior spaces of richly varied uses in which functional and social activities are gathered

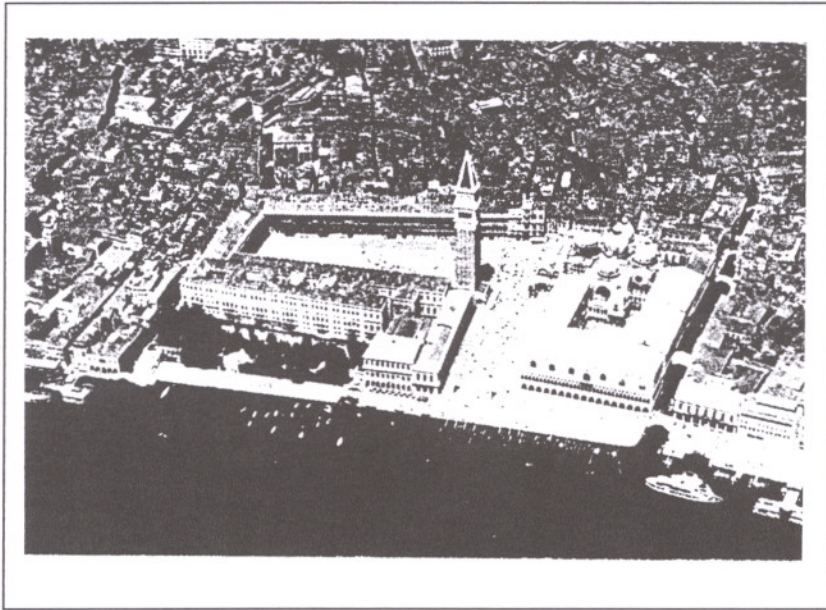


Figure 4. 12 Piazza San Marco in Venice closed open urban square (Source: Trancik, 1986)

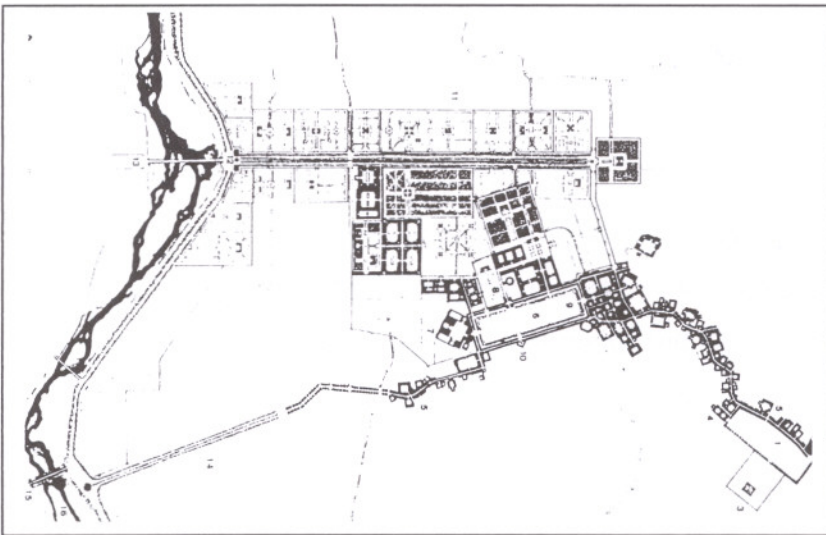


Figure 4. 13 The Main Street of Isfahan in Iran generates richly varied uses for exterior spaces (Source: Trancik, 1986)

The axes of the urban space form the city by organising the solid and the void pattern. Solid and void organisation gives the main characteristic of the city. The type of this organisation directly effects the form the closed and open spaces as well as the city. We can put the six type of typological patterns of solid and voids

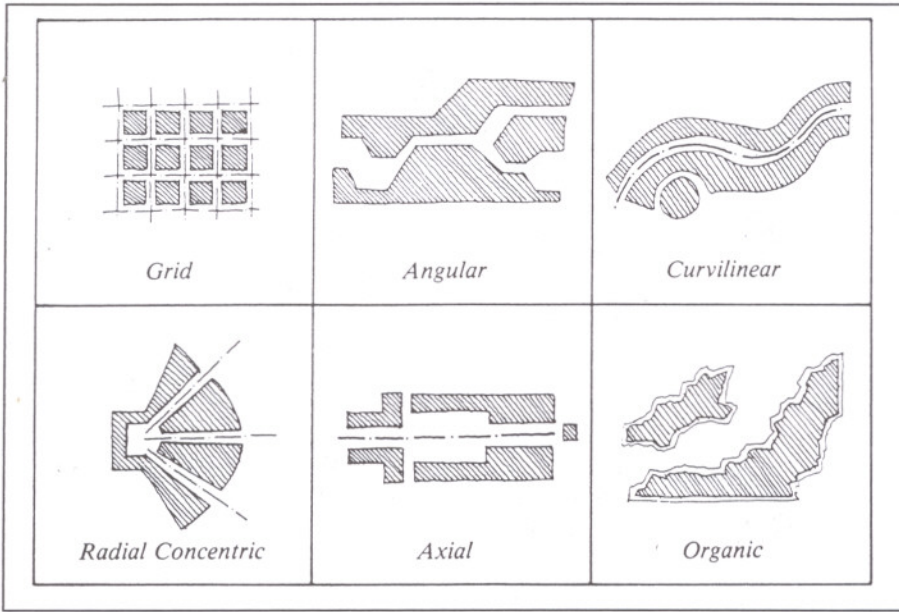


Figure 4. 14 Patterns and solids and voids (Source: Trancik, 1986)

The choice of the pattern is directly related to the social structure of the society and the general era. Even topology is defining elements in choosing the type of the pattern.

Connective characteristic of the axes in urban space were used very obvious especially in Radial Concentric and axial pattern of the solid-void organisation. As we mentioned before, the relationship between the meaning and the axes were still playing an effective role in the urban space organisation. Axial pattern shows itself especially in the Baroque Rome. In Baroque Rome the buildings are generally smaller than the great baths, stadia, amphitheatres and fora in scale. The concept of using axes was establishing an entity among these gigantic buildings and combining the vertically marked squares to this entity. The streets of this establishment were very wide and also long to serve the passing of the Pope and his cortege.

Squares were necessary along such long and continuous axes to create a spatial diversity. Using obelisks to create a verticality in these squares was deliberate attitude, which was aiming to balance strong horizontality with some vertical elements and to help creating space diversity. From this point we can easily understand the elaborate evaluation of the buildings along the main street in Baroque Rome.

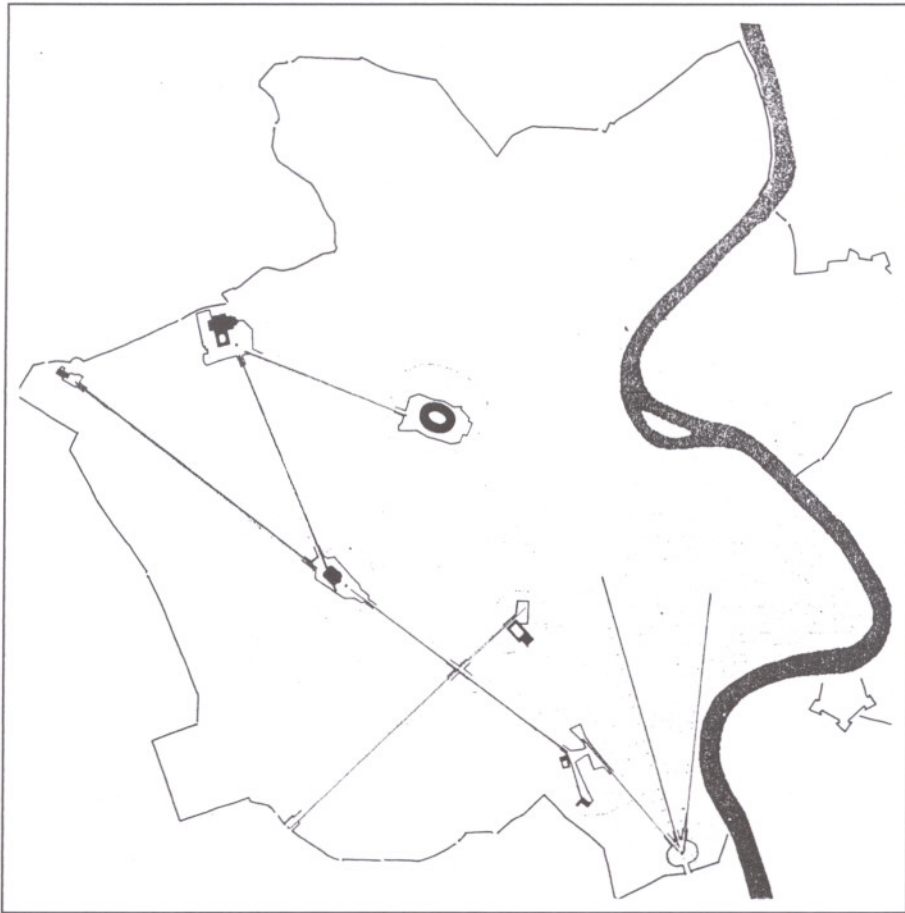


Figure 4. 15 The axial plan of Baroque Rome (Source: Bacon, 1974)

We can also see the use of axial pattern in Paris. Champellysee, the main axis of Paris which starts with the Architectural de Triumphe and end Sprechhelsen's La Grande Arch de la Defense. And it still host the national ceremony as it was in the celebration of the world championships of France's national football team in last summer.

Radial concentric pattern of solids and voids organisation shows us another type using axes in urban space. We can see such an organisation especially in Renaissance cities in history. Invention of the perspective, cause calculation of the whole picture from a single focal point from the viewpoint of a single static observer. This single point oriented organisation scheme brought about the typical city form of the renaissance; star-shaped cities. In the background of these cities stands the Renaissance

theory of the centrally organised buildings. The central building in the middle of a star-shaped city fulfils the same role, that of a symbolic observer. We are going to analyse the centralised space scheme of the building later. We can see such a pattern also in geometrical shape of the squares. Piazza del Compo Siena, can be given as an example with its one point oriented eleven running out streets (Figure 4.16). With marble stripes of the pavement shoot out like rays from a light house at the focal point of the community

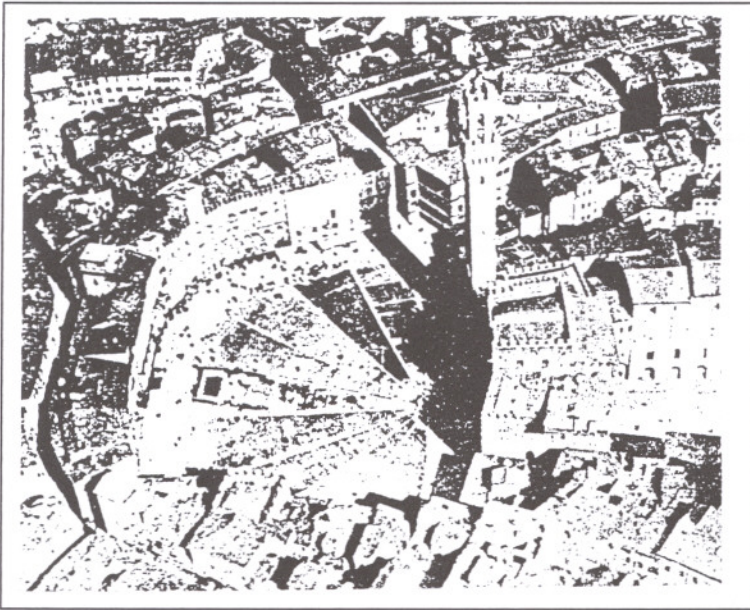


Figure 4. 16 Piazza del Compo in Siena (Source: Giedion, 1982)

Michelangelo's capitol complex is another example for star-shaped organisation (Figure 4.17). The square of the complex has twelve pointed star, on the centre of which the statue of Marcus Aerialus stands, drawn by the white marbles on the ground. This stars reflect the mathematical and also scientific enlightments of the era.



Figure 4. 17 Twelve pointed star in the Square of Capitol Complex
(Source: Giedion 1982)

Piazza del Popollo is another outstanding example of Radial Concentric Pattern. One point oriented piazza, centre of which was marked again by an obelisk vertically, is extended by three streets each of which transmits the movement of the piazza to the another part of the city. Especially, Via del Corso, in the middle of these 3 streets, hosts the main movement with its spatial richness (Figure 4.18)

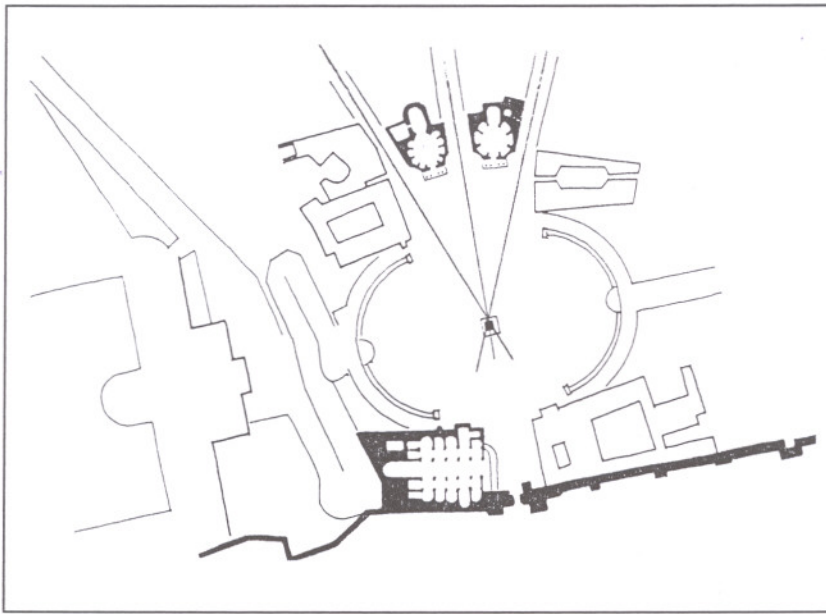


Figure 4. 18 Piazza del Popollo in Rome (Source: Bacon, 1974)

Both axial and radial concentric types of pattern in the process of urban space organisation, provide us with great visual perspectives, which was the main characteristic of the classical architecture.

Grid pattern of the solids voids organisation can directly be related to the functionalist movement of the 20 th century. The program of the architecture of this century was including pure and urbanised forms and democratic or flowing spaces. Le Corbusier, who was the precedents of the modern architecture, applied the functional grid system in urban space organisation. The grid has functioned as an easily applied mechanical method for organising separate parts. Corbu, as fellows call him, declared the house of modern architecture as a machine for living, in which all unfunctional element were eliminated. When he declared the house of modern era, he also defined the modern Cartesian urban space to the ordering of urban space, the resulting grid can be used as a method for eliminating accidental and random juxtaposition. The effectiveness of the grid directly depends on whether it is used to connect or separate different elements. According to functionalism the grid was to be used to differentiate places and activities. In Le Corbusier's Chandigarh (Figure 4.19) or in Wright's Broadacre City, this differentiation is obvious. Especially at Chandigarh government centre is set apart from the grid and not integrated into the rest of the city.



Figure 4. 19 Le Corbusier's Plan of Chandigarh, India (Source: Trancik, 1986)



Figure 4. 20 Le Corbusier's Plan Voisin, Paris 192 (Source: Trancik, 1986)

In this type of pattern in organisation solids and voids the role of the axes is totally different from their connective characteristic in other two types of pattern. The function of these axes is also different whereas in other two types of pattern the axes try to establish an entity. In grid pattern the roles of axes is creating the differences by splitting the whole into similar zones.

In some cases we can see the combination of the axial and grid pattern, in which axial connection is very necessary between the two points. We can see such a combination in Master Plan of Washington D.C. Pennsylvania avenue is the single diagonal axis of the grid plan which connects the capitol and the white house.

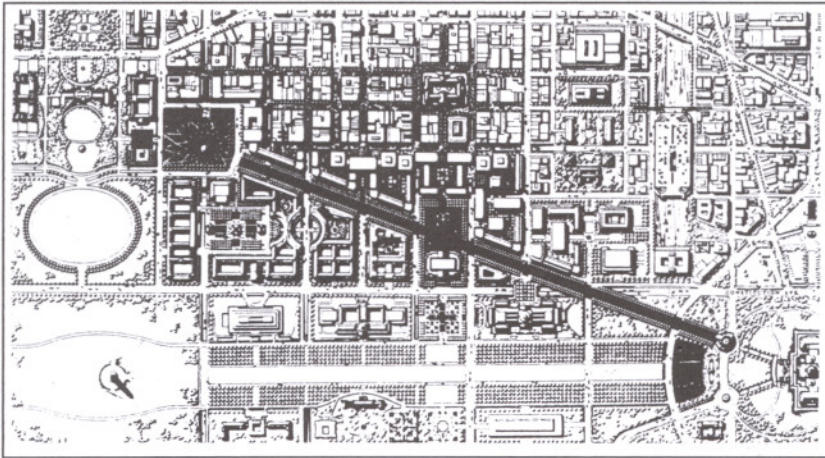


Figure 4. 21 The Pennsylvania Avenue in Washington D.C.
(Source: Trancik, 1986)

To sum up, in the process of urban space organisation, axes are important elements and they give the general shape of the city according to their roles in solid-voids organisation. Three types of pattern which are explained above defines the role of axes in urban space organisation which is connective or separate. Whatever its role an axis is still the main generator of the city shapes

4.3 AXIS AND THE CONCEPT OF SYMMETRY

Symmetry has been in use since the very beginning of architecture, and it implies a balance. Balance is the state of perceptual or conceptual equilibrium and symmetry is a specialised form of balance. What makes the concept of symmetry so important in architecture is its perceptual impact on us. Every symmetrical condition need to be organised around an axis or centre. In other words, we cannot talk about a symmetry without implying the existence of an axis or centre about which it is structured. This is what makes the axes very important for the concept of symmetry.

We can talk about two kinds symmetry according to axis or centre around which they are structured.

1. Bilateral symmetry refers to the balanced arrangement of similar equivalent elements on opposite sides of a median axis so that only one plane can divide the whole into essentially identical halves.
2. Radial symmetry refers to balanced arrangement of similar sides radiating elements such that the composition can be divided into similar halves by passing a plane at any angle around a centre point or along a central axis (Ching, 1996)

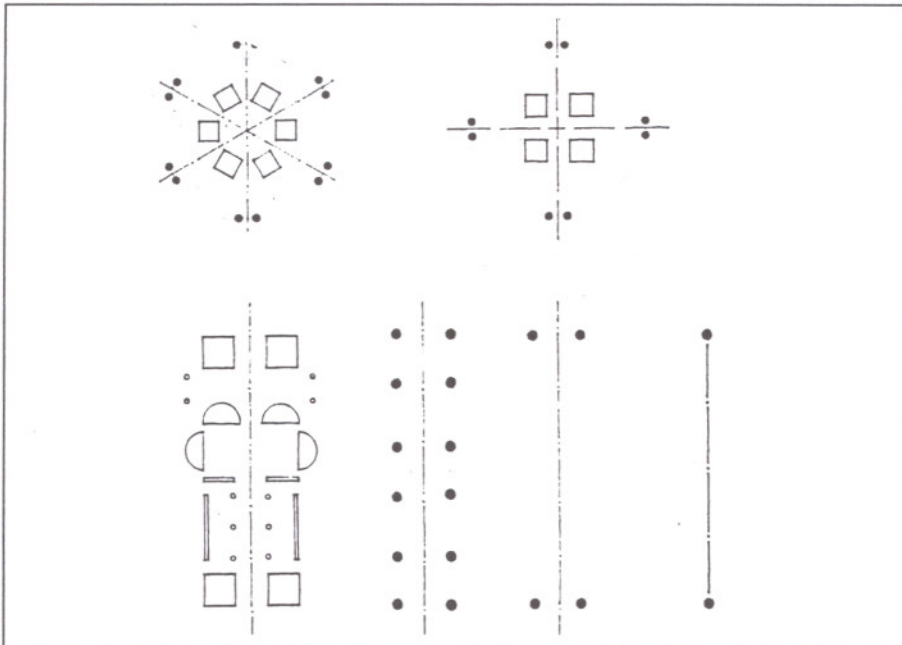


Figure 4. 22 Two Fundamental types of symmetry (Ching, 1996)

We can also define the symmetry as a special case of the principles in orientation of the elements. It is generally tend to combine the symmetrical elements into one figure. In such a condition balance occurs with the positional common factors of the elements in relation to the axis. We talked about the psychological characteristic of the axis. According to Gestalt psychology symmetry is more powerful than the similarity.

Palladio sets up the symmetry as an absolute rule in creating harmony and never left it. Symmetry provide us with absolute order and hierarchy between the elements, which directly affects the user. So bilateral or central symmetry is used in the spatial organisation of the religious and governmental buildings which symbolise the power. The symmetry, totally restrict or border our perception. Since the symmetrical organisations are well balanced and bordered we can never imagine any variation apart from their form. That's why symmetry was used to control the society by the authority in all times of architectural history.

Axes as a generator become very important in the symmetrical organisation. The axis of symmetry does always bear the main importance of the symmetrical organisation. It is unique single element in the whole. That's why its difference is very obvious. This is the main reason for putting all the important things on the axis of symmetry in a symmetrical organisation . This is very obvious in the Michelangelo's Capitol Complex (Figure, 4.23)

In Michelangelo's project the axis of symmetry is very obvious and three important part of the complex located on this axis professionally. La Cordarato, the connective steps of the complex to the city is the beginning, the Brazz Statue of the Marcus Aurelius and the centre of the twelve pointed star square at the middle, and finally the senatorial palace, the most important building of the complex at the end of the axis of symmetry. Even this axis shows itself on the tower of the senatorial palace vertically.

To sum up, the concept of symmetry is important for the axial organisation of the forms. The importance of the axis as a design element increase with symmetrical

organisation. That's why it is very obvious that the concept of symmetry is very essential part of the axially

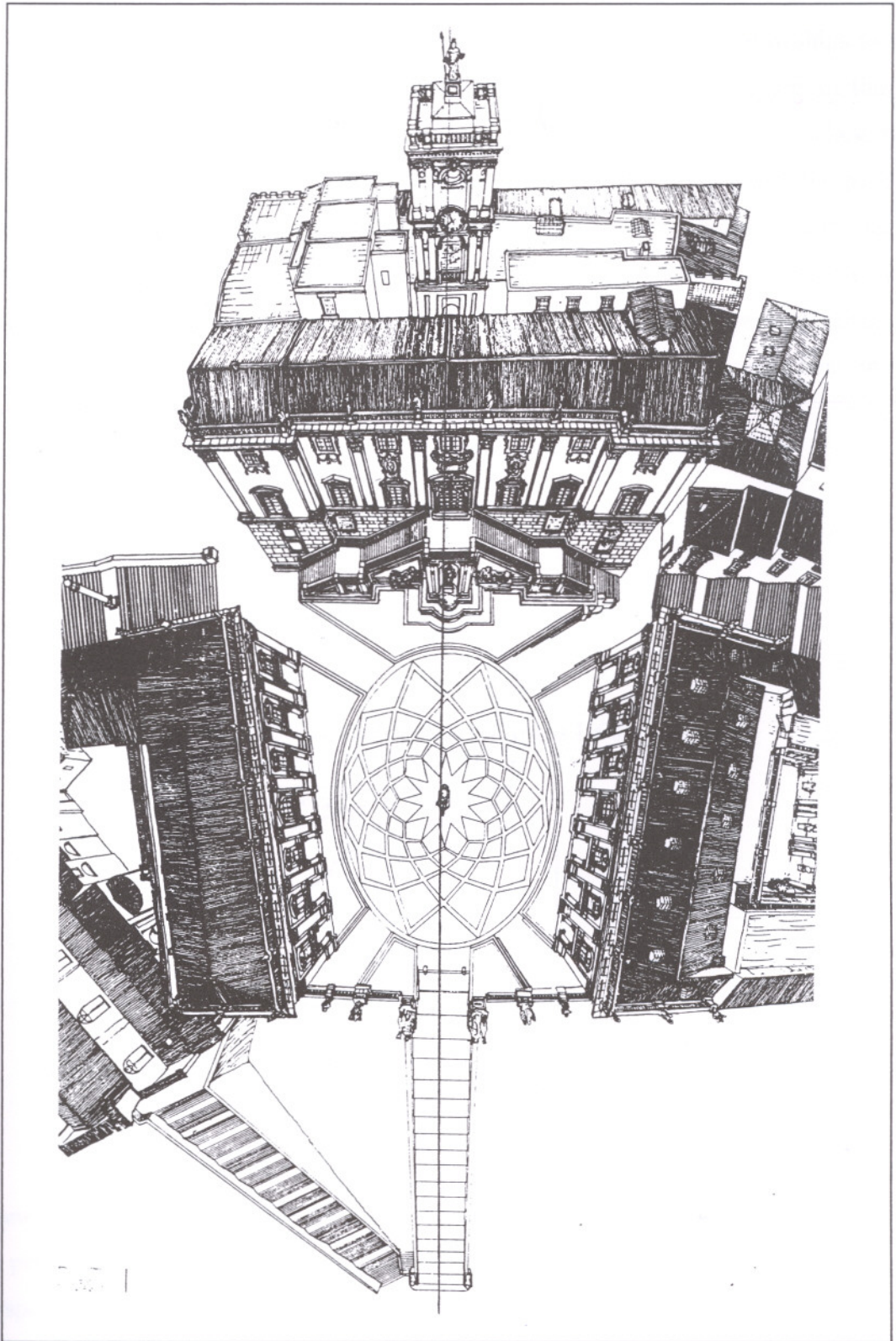


Figure 4. 23 On Michelangelo's Capitol Complex The importance of axis of symmetry (Source: Bacon, 1974)

4.4 LINEAR PERSPECTIVE

Generally perspective means clear seeing. And it has direct relationships to our perception. There are two important characteristics of our visual perception of things. First, objects become smaller with distance. Second parallel lines converge. These two characteristics shape the general rule of the perspective. The points where the parallel lines converge are called as a vanishing point and this point is always on the line of horizon. Different group of parallel lines converge in the different points. Simple cube normally has two vanishing points. It is possible to talk about third vertical vanishing point.(Fig 4.25)Very tall buildings converge upward or downward or even bend in the middle depending on our view point.(Fig.4.26)

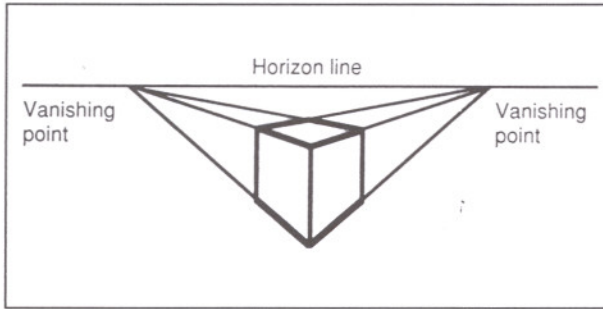


Figure 4. 24 Perspective of a cube.(Source: Stevens 1990)

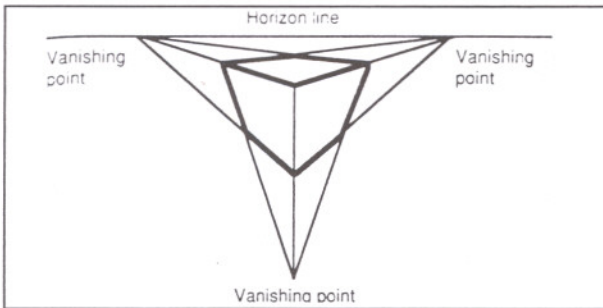


Figure 4. 25 A cube having vertical and horizontal converge (Source: Stevens 1990).

We see the first systematic use of the perspective in Renaissance. Filippo Brunelleschi, who was one of the most important architect in Renaissance, dealt with the perspective experimentally. But even Brunelleschi was engaged in the experiment of perspective, Alberti's "Treatise on Painting" was the first written work on this subject. His method, *costruzione legittima*, considers a painting or drawing as a screen or window through which a ray of light leaves each point on the object and comes to our

eyes. The important point is the image of the object on the screen is exactly the image we receive on the eye.(Fig 4.27)

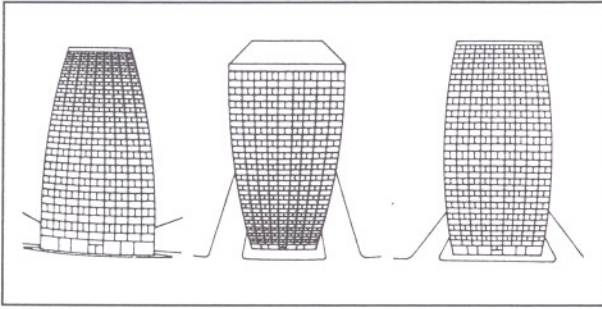


Figure 4. 26 Vertical convergence of tall buildings. (Source: Stevens 1990)

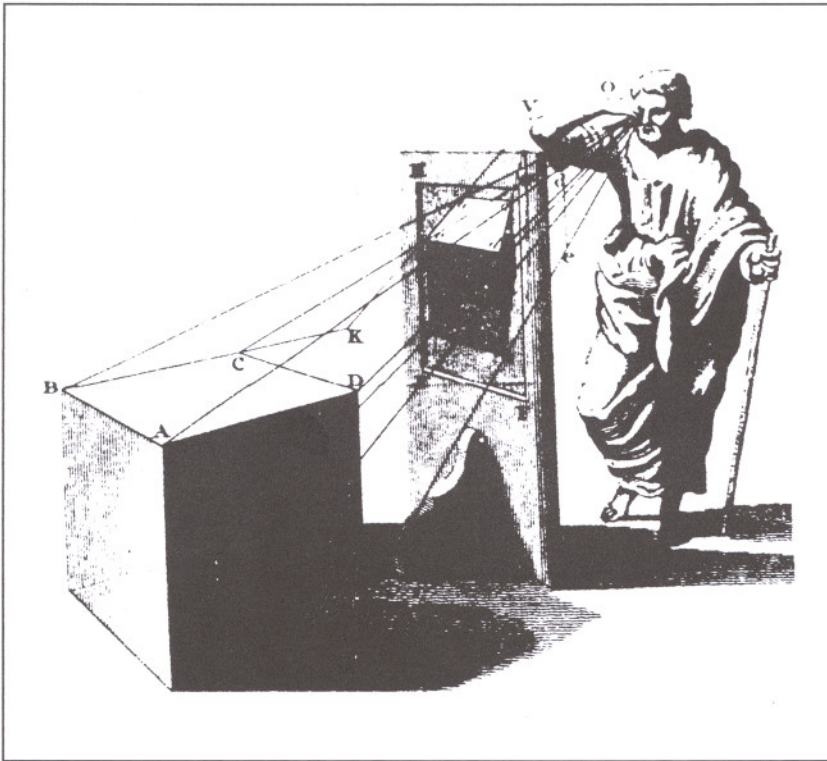


Figure 4. 27 19th. Century the diagram about the mechanism of perspective. (Source: Stevens, 1990)

The time of Renaissance, the era of enlightenment, was the period in which the science and the mathematics required their importance. In parallel with this development the visual characteristics of a man were tried to be explained in mathematical and scientific way. The concept of perspective was born as a result of this attitudes. Vignola, another precedent of the Renaissance, also tried to explain perspective in diagrammatic way.(Fig. 4.28) He also wrote a book on the subject of perspective.

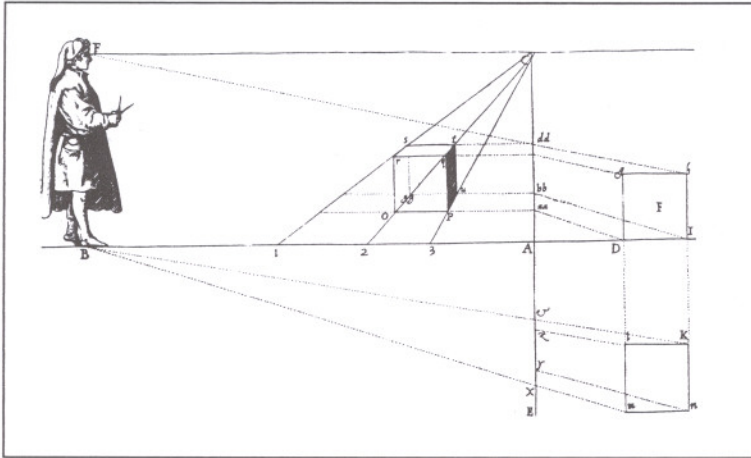


Figure 4. 28 Vignola's diagram about the perspective perception of a cube by medieval man. (Bacon, 1974)

Vignola also used the picture plane which is still the basic element of today to explain the concept of perspective.

Generally, the concept of perspective has some properties which defines its utilization is parallel with our perceptual necessities. These properties are;

- Horizontal lines parallel to the picture plane remain horizontal in perspective.
- Vertical lines parallel to the picture plane remain vertical in section.
- All points in infinity lie o a single line in perspective, the horizon line, that is the same height above the ground as the eye point.
- Horizontal lines perpendicular to the picture plane, if extended indefinitely, pass through a single point, called the principal vanishing point, that is located on the horizon line.
- Lengths farther away are foreshortened.

- In general, a set of parallel lines converge to their own unique vanishing point, the location of which depends on the angle of inclination of the lines to the picture plane. (Stevens 1990 p. 179)

In fact, we can define the concept of symmetry as a new way of seeing. As we mentioned before, especially scientific development of the society in the Renaissance brought about this new attitudes to find this new perceptual phenomenon.

Perceptual characteristics of the concept of perspective made it one of the most important variables in the process of space organisation. Naturally, there were many perspectively organised spaces until the Renaissance in the architectural history, such as typical basilicas. But, this was generally instinctive and accidental development for the space concept. What makes Renaissance different is the deliberate use of the concept of perspective in the space organisation process. Especially the utilisation of two vanishing points perspective concepts consciously, can be considered as a great difference from the typical one vanishing point perspective schemes of the early architectural history. This attitude is very obvious in the organisation of the Renaissance plazas. Three axis of the Piazza Popollo in Rome, for example, were organised according to this attitude, and Carlo Rainaldi's twin churches help to emphasise it. (Figure: 4. 29)

Strict symmetrical and longitudinal plan schemes of the typical churches provide us with perfect perspective view along the main axis which extends from the entrance to the absid of the church. All structural or decorative elements were organised to create a clear perspective seeing. This one point oriented perspective was used to emphasise the ending point of the main axis to create a powerful perceptual affect on the users. According to one point oriented perspective all the lines go one single point where is the centre of our visual scene. Longitudinal perspective space schemes of the architecture stem from these perceptual and visual characteristics of us, is architecture.

The affect of perspective mostly shows itself in the interior space organisation of the churches and basilicas. The perceptual characteristics of the concept of perspective and its direct relationships to our visual world make it one of the most important invariable in the process of space organisation in Architecture.



Photo Alinari

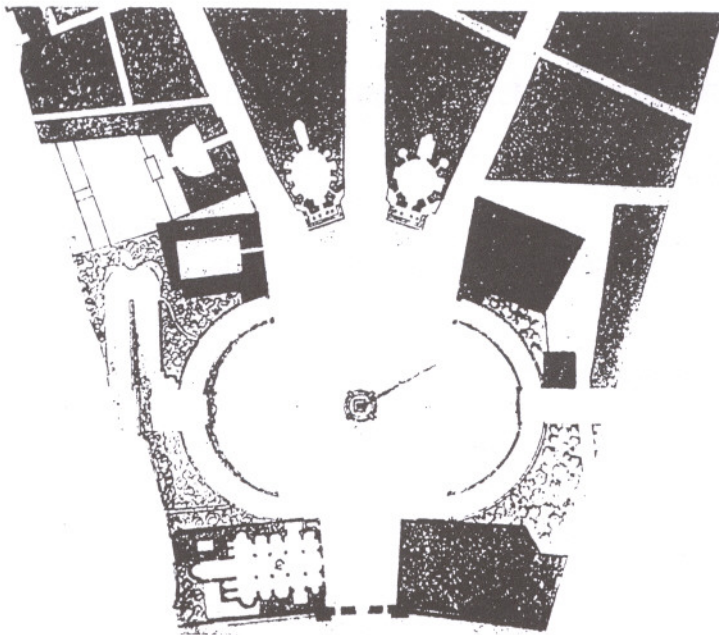


Figure 4. 29 Plan of Piazza Ropollo in Rome and Elevation of Carlo Ranaldi's twin churches. (Granart 1996)

4.5 LONGITUDINAL PERSPECTIVE SPACE SCHEMES

The evaluation and development of the longitudinal perspective space schemes have direct relationships to the geometrical and conceptual characteristics of the architectural axis. Basically we defined the axis as a line between two points. And we again put the starting and ending points as the invariable of the architectural axis. These main characteristics also effected the development of the longitudinal perspective schemes directly. Especially, connective characteristics of the architectural axis its played an important role in this case. Perspective and symmetry were another two important supporting concepts in development of the longitudinal space schemes.

Peter Blondell Jones, who is the editor of the *Architectural Review*, defines the starting point of axiality and axial development of the spaces with the first use of the rectangular form.

Two central perpendicular axis, one of which longer than the other, define the geometrical characteristics of the form. Naturally the primary longer axis is powerful and it controls the potential use of the form. So, it is inevitable that the spatial development of the rectangular forms has always been along the longer axis.

This primary main axis reflects the connective characteristics of the axis on the development of the space. Typical basilicas can be given as an example for this case; longer and powerful axis starts with the entrance and ends with absids. This was deliberately use of the main axis to effect the user and give the spiritual essence of the space that is necessary.

Under the many proportional regulations we may see two different uses of the longitudinal axis. First, single nave and the second naves, symmetrically organised on both sides of the main nave (axis) system. In both types still we can talk about the domination of the main axis on the general organisation of the space. In the plural naves organisation system main and secondary axis are separated by the range of columns, which gives a strong perspective view from entrance to the absid. Naturally secondary

naves on which people sit during the ritual narrow than the main nave. Main nave off corse on the main axis, is not open for any functional use apart from physical and visual circulation. That's why we can never see an structural or spatial element which split the visual or spatial continuity of the main axis. On the contrary, all the elements tric to increase the continuity and focus it on the ending point of the axis, by means of the symmetry and perspective

Spatial and geometrical characteristics of this main axis, also show themselves on the third dimension. The hierarchical order of the longitudinal axis in the horizontal layout, is also valid in the third dimension. In other words, horizontal power of the axis transforms into power of volume in the third dimension.

In this point we can talk about the verticality, and it becomes as important as horizontality. Differentiation in the third dimension is totally as a result of spatial hierarchy in the horizontal layout. Again, we can explain this case on the typical basilicas, which are very famous with their typical sections as well as rectangular spatial layouts.

Height of the main nave is necessary in order not to reduce the effects of the main axis both spatial and perceptual. Higher volume of the main nave also provides an opportunity to get the day lights into the building through the windows on both sides of the axis. Which increases its perceptual and mystical affect. The main axis is so dominant in the longitudinal schemes that it is possible to see its affect on the organisation of elevations, as well as volumes. Especially, the main entrance elevation of the building and its symmetrical organisation totally stem from the power of the main axis. Circular window in rose shape on the main axis is very clear evidence of this fact.

Another differentiation of volume shows itself at the end of the main axis where two perpendicular axes of rectangle are intersected. This intersection point is the centre of another important zone in typical longitudinal space schemes, where the spiritual characteristics of the main axis reaches the peak point. Naturally, this meaningful zone needs to reflect its importance in the third dimension. The domes were used widespread to achieve this reflection, because of their both structural and formal characteristics.

This differentiation is very clear on the longitudinal sections. Verticality, as a result of the mental aim of reaching the sky, is emphasised with the vertically exaggerated form of the dome, as it was in the Brunelleschi's Santa Maria della Fiore (Figure 4.30). In all horizontal development of the longitudinal space this sacred final zone where the verticality is clear in accordance with its elaborated domes. This may explain us why the master of Architects were so engaged with the elaborated domes and why they were known with them.

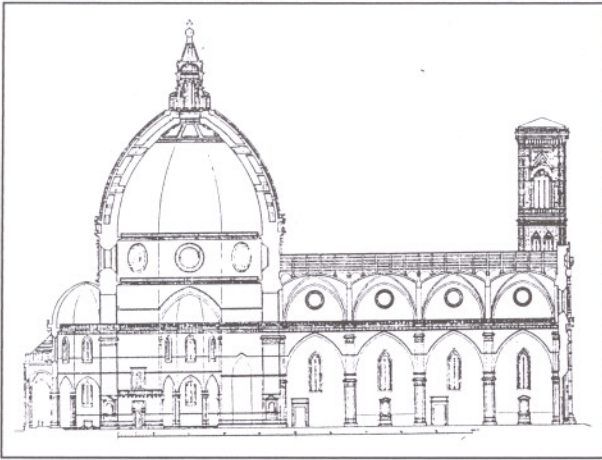


Figure 4. 30 Longitudinal section of S. M. Della Fiore and its dome
(Source:Gromort, 1946)

To sum up, we can talk about three invariable for the longitudinal rectangular space schemes; Main axis, perspective and symmetry. These three interacted factors give all the visual, perceptual, spatial and also volumetric characteristics of longitudinal space schemes. But one of these factors exactly the source of all spatial characteristics which is of course the main longitudinal axis of the rectangle.

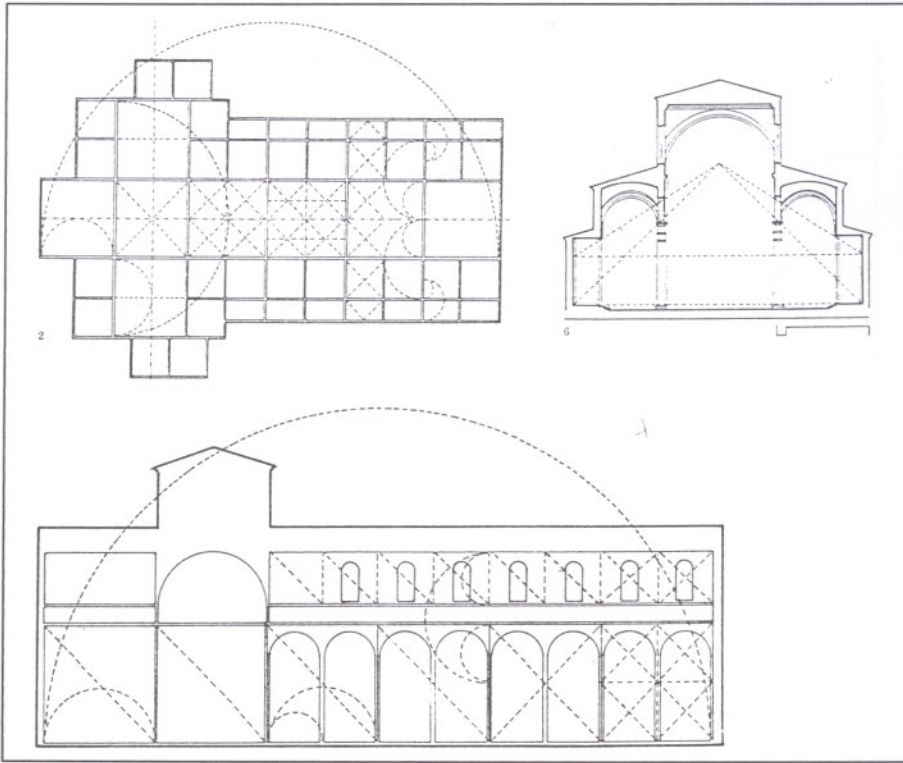


Figure 4. 31 Basilica of San Lorenzo, Filippo Brunelleschi
 (Source: Furnari, 1995)

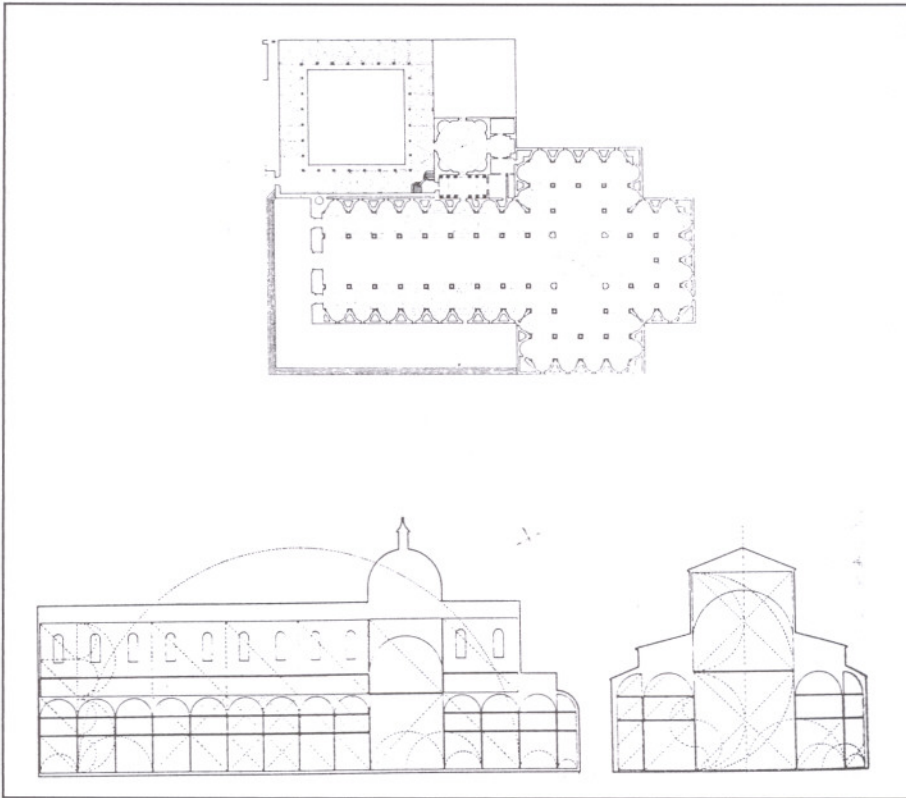


Figure 4. 32 Basilica of Santa Sipito, Filippo Brunelleschi
 (Source: Furnari, 1995)

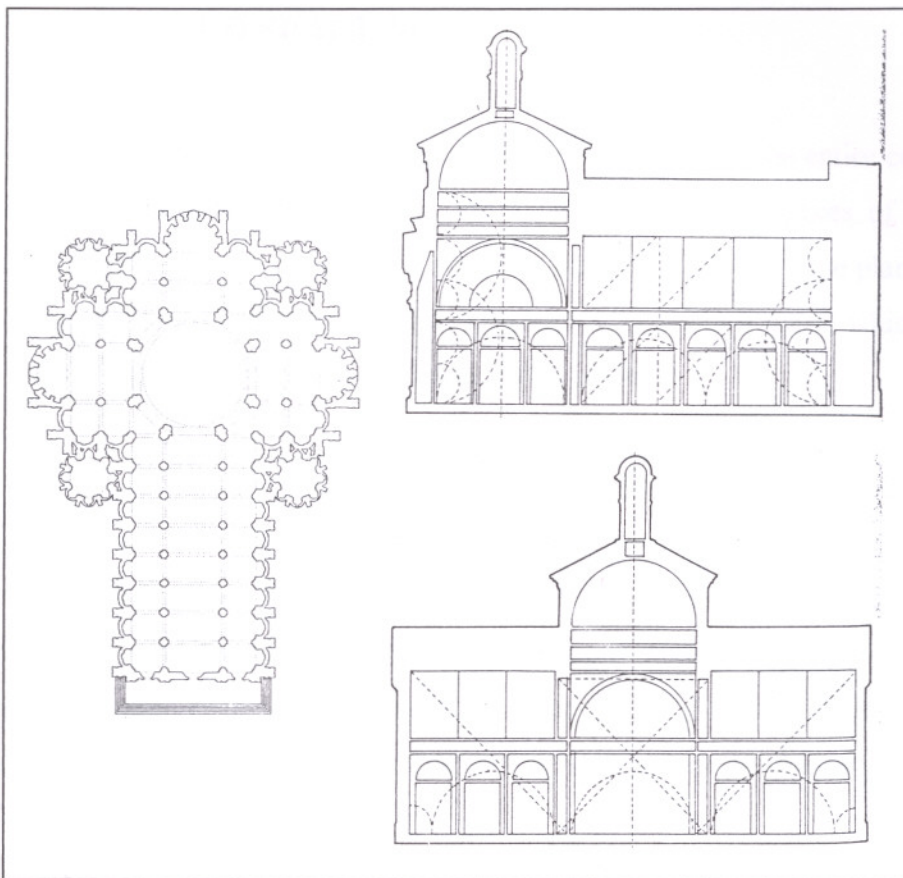


Figure 4. 33 Pavia Cathedral, Donato Bramante. (Source: Furnari, 1995)

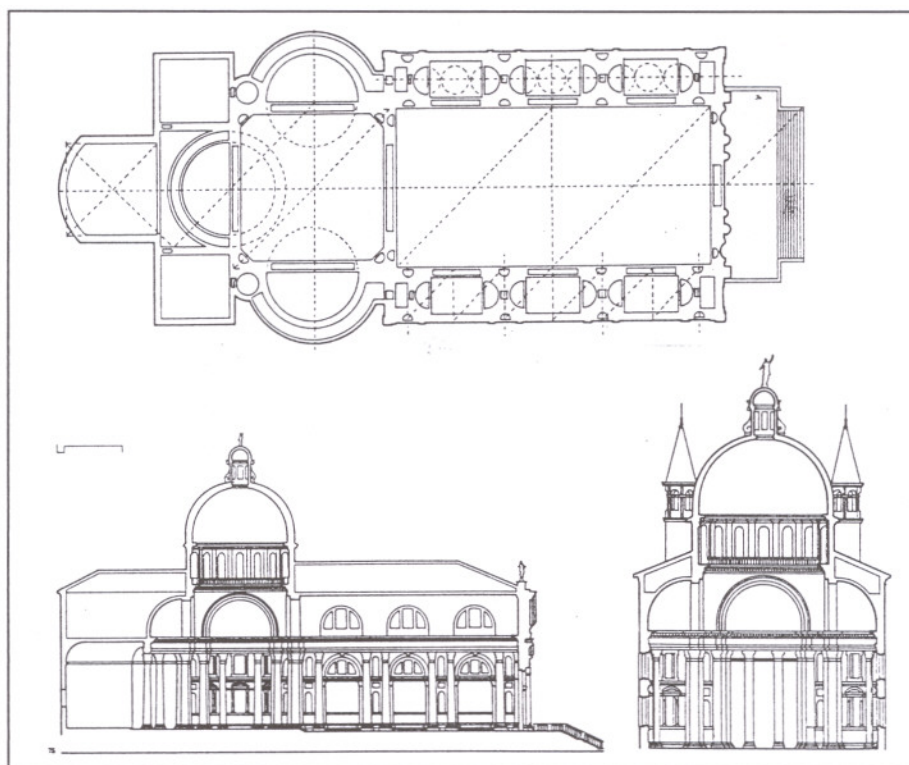


Figure 4. 34 Il Redentore, Andrea Palladio. (Source: Furnari, 1995)

4.6 CENTRALIZED SPACE SCHEMES

A pyramidal scheme of architectural composition centres the entire central- plan structure on the volume of the tribune, from which secondary spaces of decreasing surface area and height are generated. Therefore, the development of the plan scheme is to begin with the selection of a geometrical figure for the tribune space, which becomes the generator of the whole scheme. (Turnari, 1995, p.190)

In this case it is very possible to see the two perpendicular intersected axes of the longitudinal space schemes as a generator of the centralised plans. However, the difference stems from the characteristics of these two axes. Basically, in the centralised space schemes, two intersected axes are equal in length. Geometrically, this equilibrium between these axes, generates a space which needs homogeneity and radial symmetry. Consequently the composition proceed according to a pre-established model of Greek cross or round temple.

We can see two basic models for central- plan churches are applied, in the architectural history.

In the first model, monocentric buildings are initially organised according to a centrality based on the square, and they are also characterised by a limited number of alignment positions for the various volumes. In later organisation since surrounding space of the tribune grew in number as a result of adapting polygonal and circular plans, the axes of symmetry multiplied. Even in same examples they become infinite in number. The main characteristics of this model is its unique central point from which all the unity and homogeneity of space can be perceived easily, as a result eliminating any possible ambiguity of the parts.

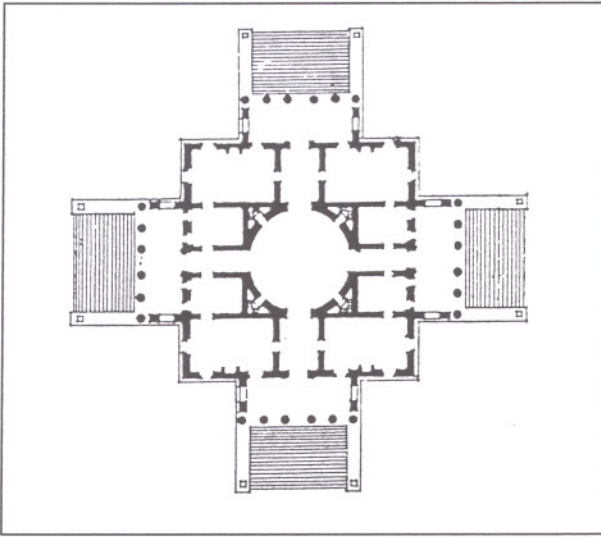


Figure 4. 35 Villa Rotanda (Capra), Palladio Monocentric plan scheme

(Source: Gromort, 1946)

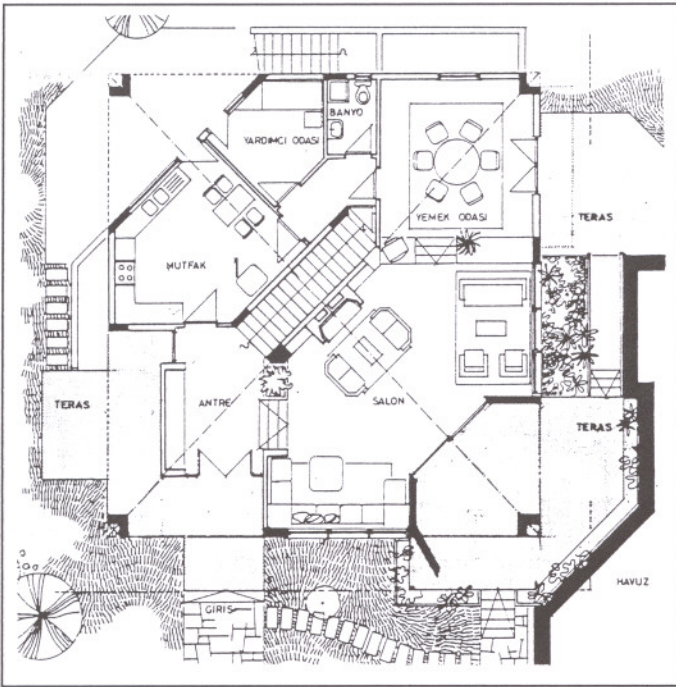


Figure 4. 36 Kare Ev Güngör Kaftancı.(Source:Mimarlık, 1989/6)

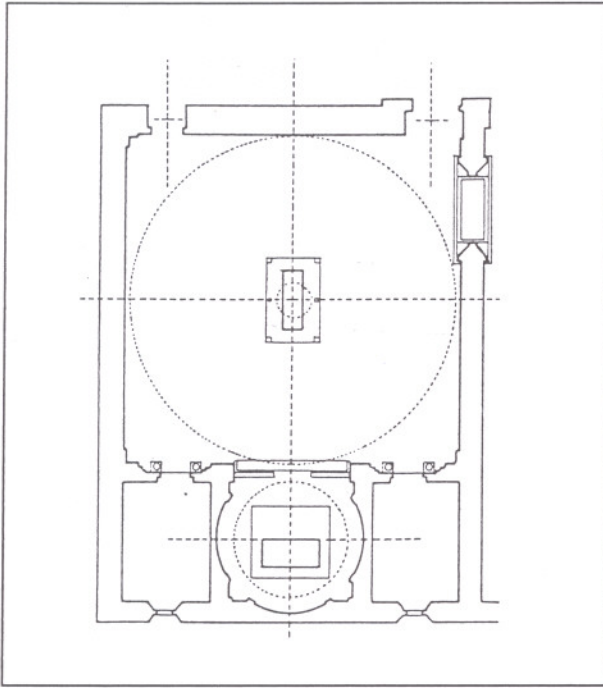


Figure 4. 37 Old Sacristy, Filippo Brunelleschi, Monocentric plan scheme

(Source:Furnari, 1995)

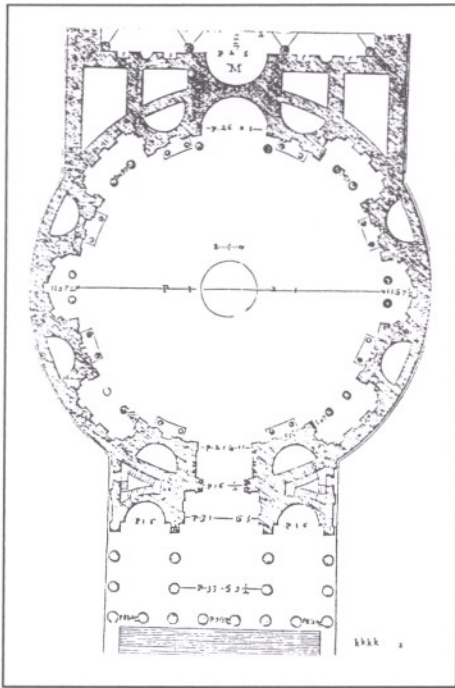


Figure 4. 38 Pantheon, Monocentric plan scheme (Source: Furnari, 1995)

In the second basic model monocentric plan is augmented by the addition of a number of geometrical reference points, and auxiliary spaces are positioned with respect to the corners of the tribune. We may see a superimposition of a principal centrality, which based on two main, orthogonal axis, and a series of minor centres. When it is compared to the ideal organisation of the circular temple, the plan of the polycentric church can be seen as an attempt to resolve the ambiguity between the physical multiplicity and the intellectual unity of perspective space: the multiplication of geometrical centres provides or greater number of places from which to recall the central integrity of the plan. (Furnari, 1995, p. 190)

What is the most important characteristics of the centralised plan schemes is its spatial continuity which enables to user to perceive all the space, even volume easily. These characteristics make this kind of space schemes different from the longitudinal ones and they stem from the replacement of the verticality for horizontality in longitudinal schemes

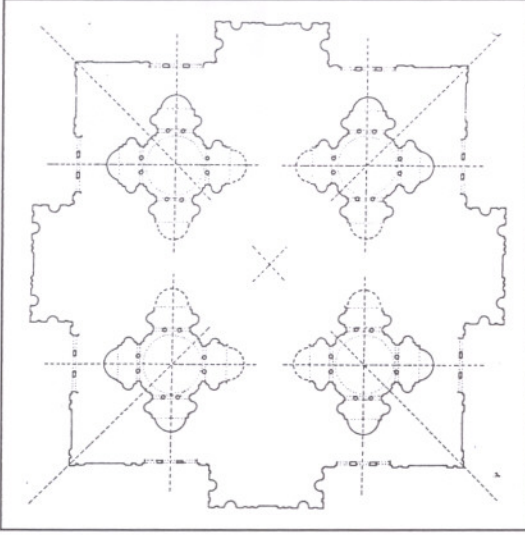


Figure 4. 39 St. Peter, Plan of Bramante's Polycentric plan scheme
(Source:Furnari, 1995)

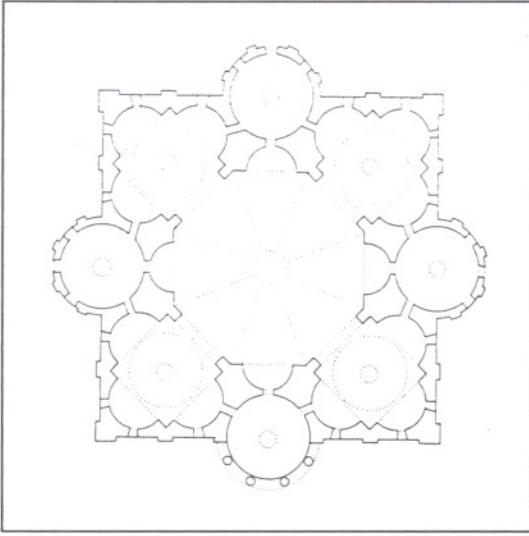


Figure 4. 40 Polycentric plan temple or polygonal base, Leonardo da Vinci
(Source: Furnari, 1995)

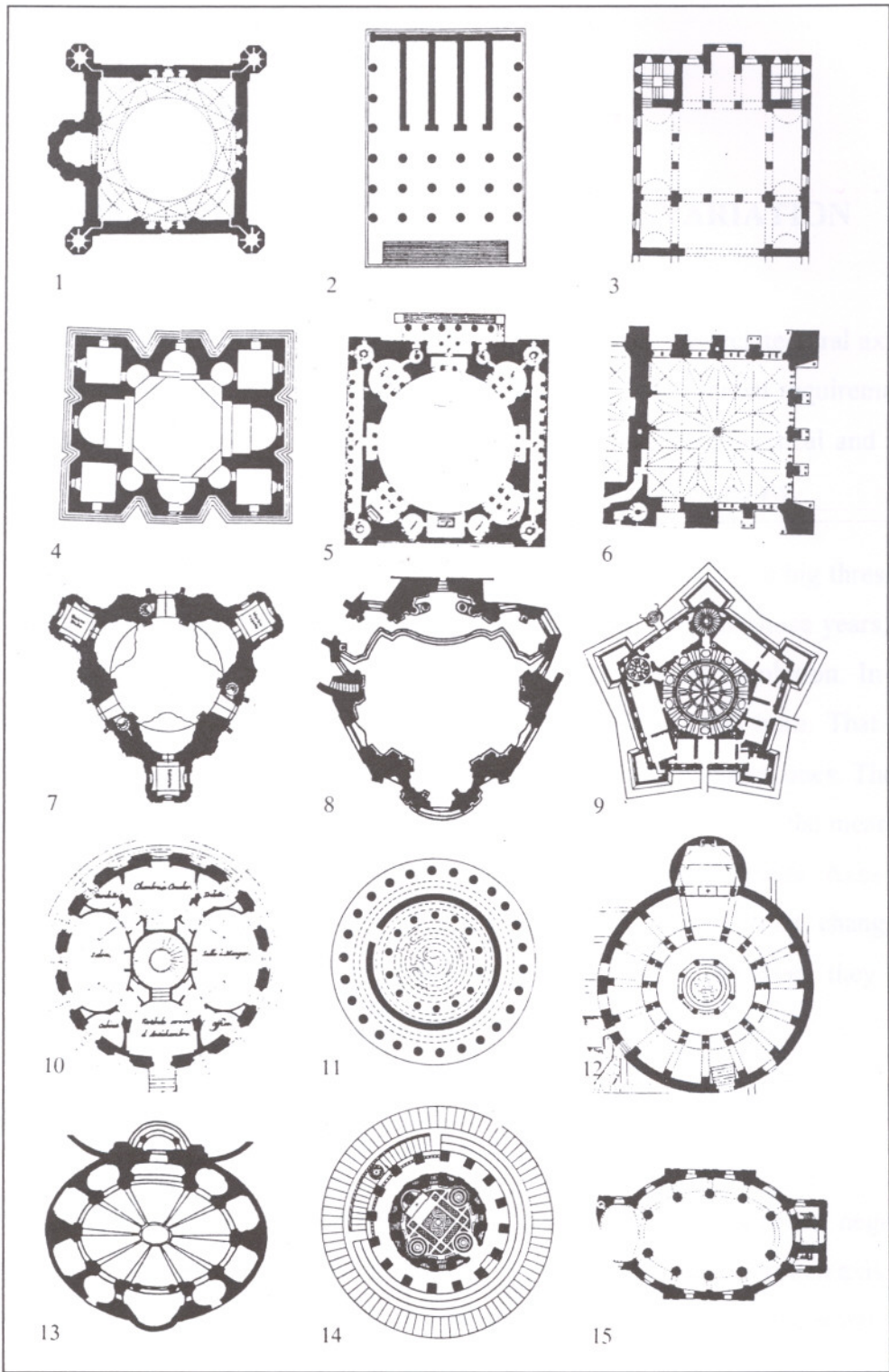


Figure 4.41 Historic examples of central plan schemes (Source: Krier, 1991)

1. Bischapur (India) 2. Falerii Etruscan temple 3. Corvey Westwerk 4. Wagharschat 5. Church in Karlsruhe 6. Marienburg 7. Paura near Lambach 8. Munster 9. Caprarola 10. House in the shape of column 11. Epidauros Tholos 12. Nocera 13. S. Andrea also Quiriri 14. Tempietto 15. Steinhausen

CHAPTER 5

SPATIAL ORGANIZATION WITH AXIAL VARIATION

So far we tried to explain the basic and classical role of the architectural axis in the space organisation process, according to geometrical and also spatial requirements. Almost all organisation of the restricted number of these axes were classical and they were shaped under the effects of religious values and power of the authority.

The end of 1800's and the first years of 1900's have occurred as a big threshold in architecture as it was in all parts of social and economical life. In those years, the world has run into rapid change which comes from the industrial revolution. In this rapid change a word which was named almost all 20th century, was born. That was Modernism. In modern era, many values have been replaced with the new ones. The art of architecture was also effected in this period of replacement. Changes in the meaning, change the characteristic of the 20th century architecture and its elements. Axes and their positional values have inevitably changed according to the current change in meaning of architecture. In this process, while their values were changing, they also became multifunctional generators of the architectural forms

5.1 BROKEN AXIS

The word of broken is usually used to explain the negativity or negative situation. And broken things are usually out of order. But in the case of broken axis, the situation is quite different and the word of broken is not existing to explain a negativity. We can just talk about a geometrical deformation.

The axes are broken deliberately to enhance their characteristic in various ways. Axes are broken to create a spatial diversity. (Figure 5.1) A long linear straight axis has very homogen and continuous character along it. Visually the starting and ending points can be perceived easily. So it makes no differences standing at different points along the

axis. This visual and perceptual homogeneity also generates a spatial similarity. The act of breaking an axis in some points provide us with some opportunities to create a spatial diversity and to achieve the spliment of the differentiated parts along its path. In the case of broken axis the points are very important. Their important stems from both geometrical and spatial requirements. So we can talk about various forms of breaking points according to forms of broken parts of the axis. The plazas can be considered as a spatial equals of the breaking points in urban space scale. (Figure: 5.2)

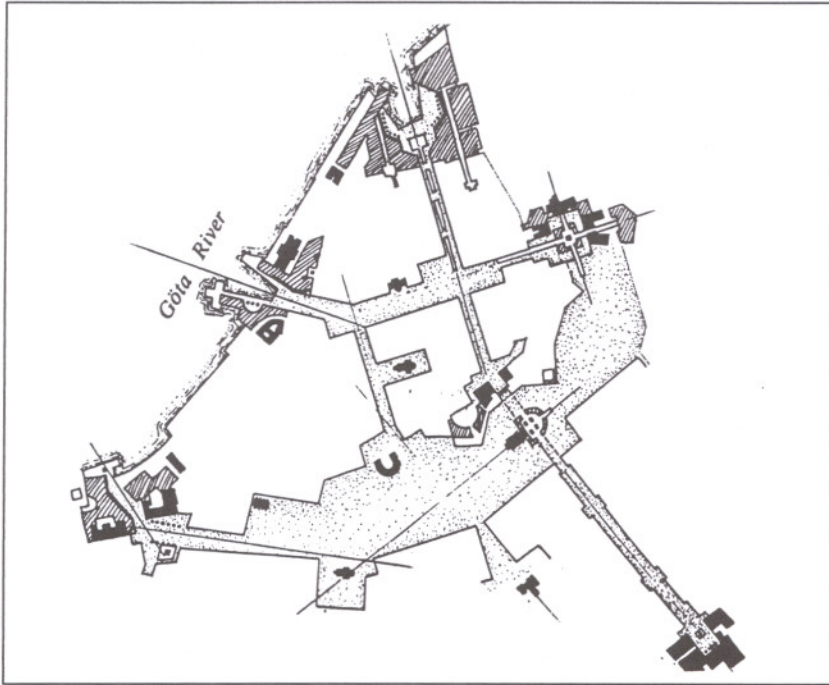


Figure 5. 1 Goteborg, Sweden city plan scheme (Source: Trancik, 1986)

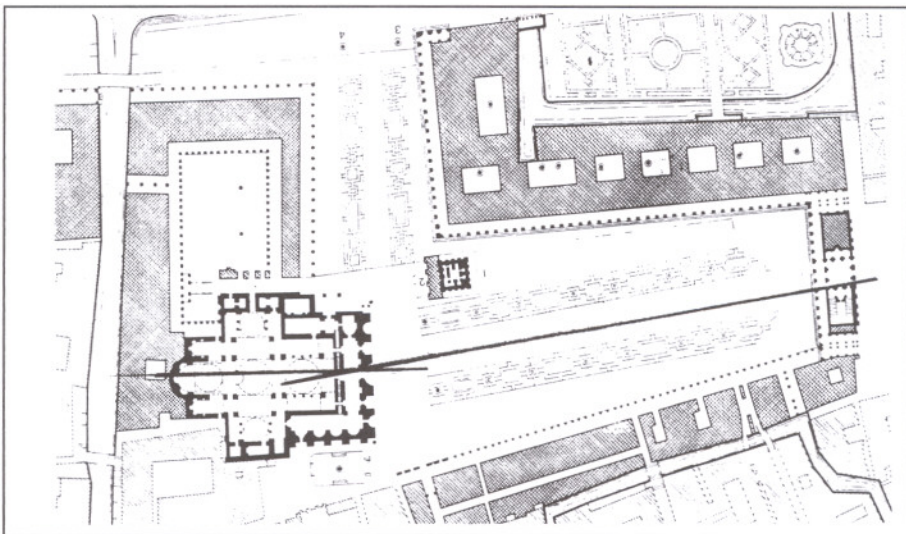


Figure 5. 2 Broken axis of S Marco in Venice (Source: Trancik, 1986)

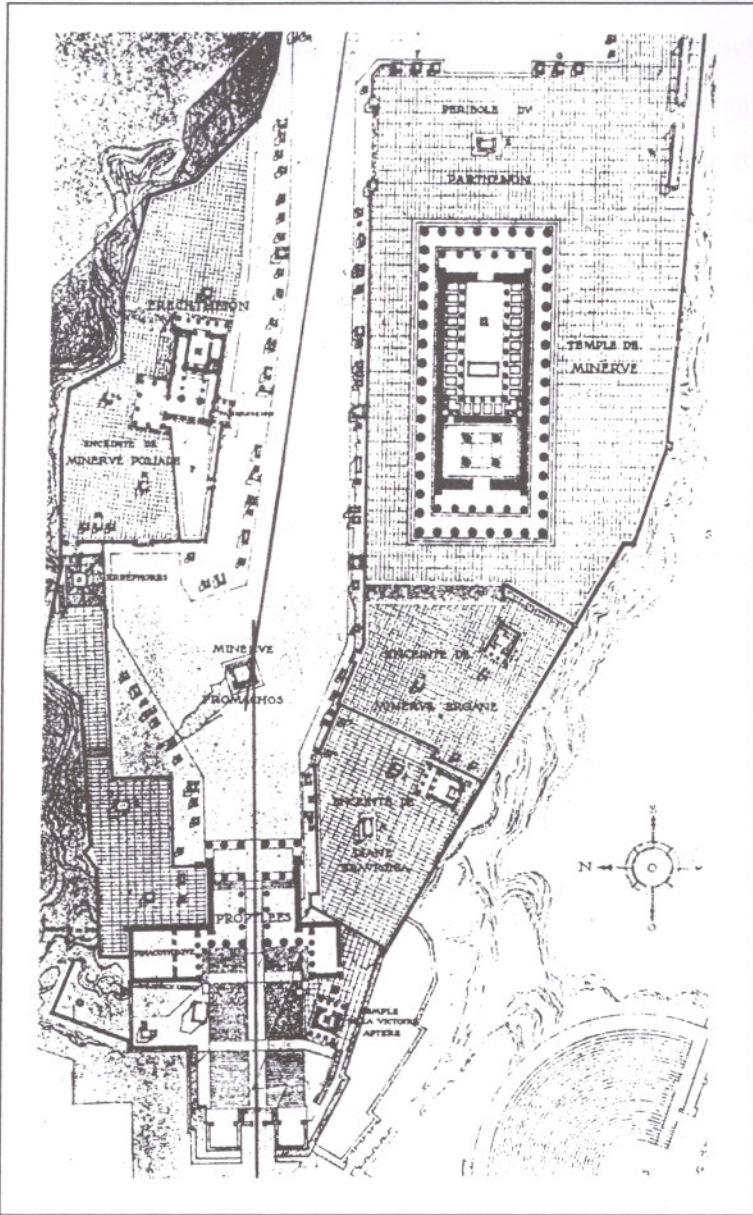


Figure 5. 3 Broken axis of Acropolis, Athens Monumental Statue at the broken point (Source: Gromort, 1946)

We put the single straight line as the simplest and basic way to connect two meaningful points. However, in some cases the straight axis can be broken deliberately to emphasise the importance of the ending points. In this case, the ending point is not perceived directly which increase its sacred and monumental values. In such a organisation the first part of the axis is used for preparing to second one and also final point. We can see such an axial organisation is the Anitkabir complex where Mustafa Kemal Ataturk's monumental mausoleum is located.in this project designed by Emin Onat and Orhan Arda we can see a broken axis. First part of the axis serves to prepare

us to the mausoleum which is at the end of second part, with the Lion statues located at the both side of the axis. At the broken point there is a square which serves to meet for the special ceremony. Second part of the axis begins with this square and ends with the mausoleum. This scheme is quite interesting and unfamiliar for such a monumental complex. It is very normal to expect a long unbroken straight axis which connects the entrance and the mausoleum. But this is a very common way to create a monumentality and its visual and perceptual continuity reveals all the potential of the scheme. Once the user enter the in such a straight linear scheme he or she can perceive all the elements and the final point at the first sight. This reduces all the necessary spiritual secretsof the complex. On the contrary, broken form of the axis gives the spatial and visual diversity to the whole. So, spiritual values are increased with the changing character of the axis

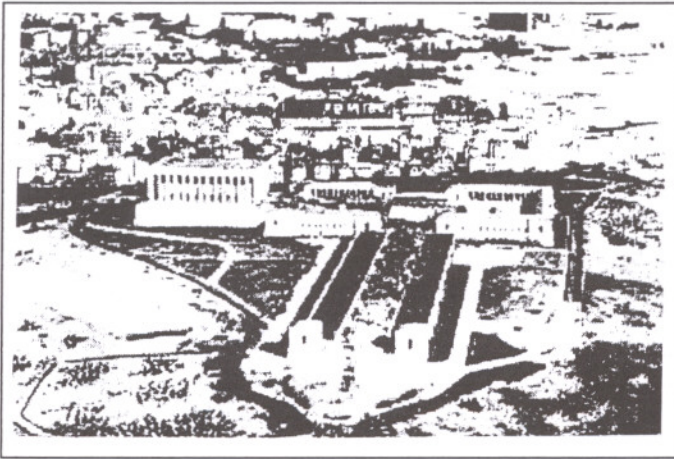


Figure 5. 4 Anitkabir (Ataturk's Mauseleum) Emin Onat and Orhan Arda

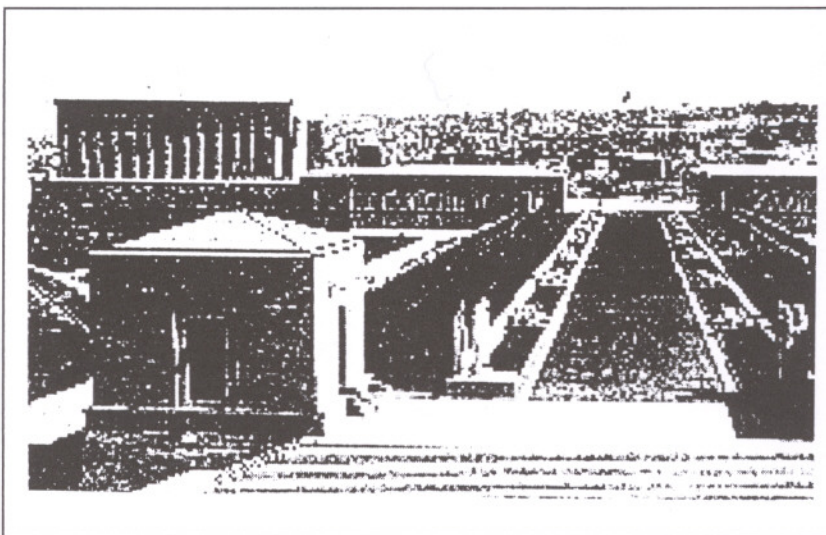


Figure 5. 5 Anitkabir (Ataturk's Mauseleum) Emin Onat and Orhan Arda

The broken axis is also used to connect the two different directions. Especially the affects of site plan and topography free the designers to use a broken axis (Figure 5.8 and 5.9). In the case of meaning, the broken or unbroken forms of the axis aim to reach some goal which is obviously connecting two points (figure 5.6 and 5.7). Difference between these two forms of axis, stems from their movement paths which directly orient the user towards the most important point of the scheme.

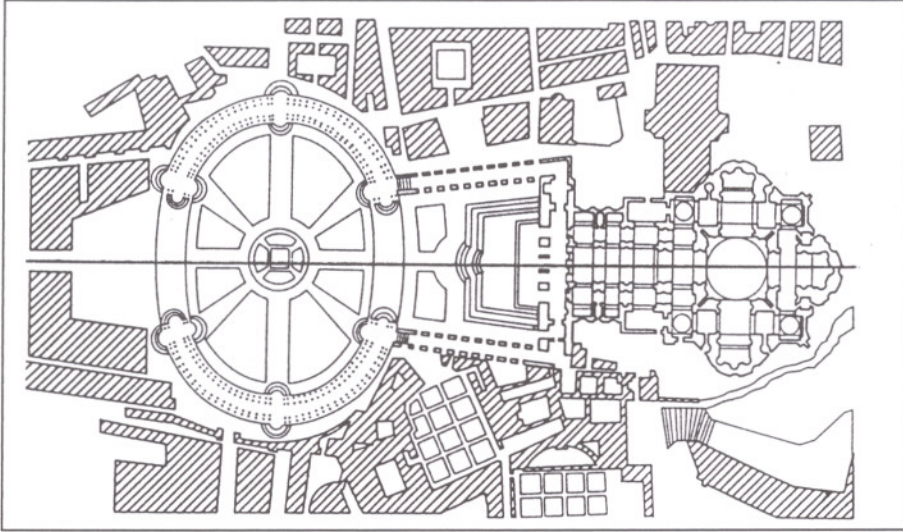


Figure 5. 6 Straight Linear Organisation of St Peter And Its Square
(Source: Weber,1995)

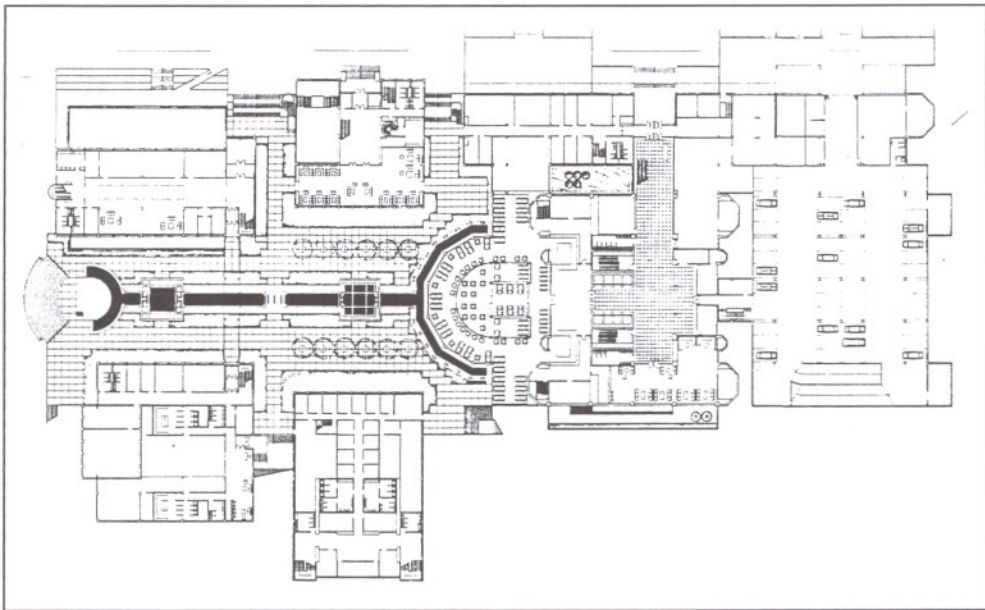


Figure 5. 7 Halk Bankası Headquarter. (Source: Tekeli and Sisa,1994)

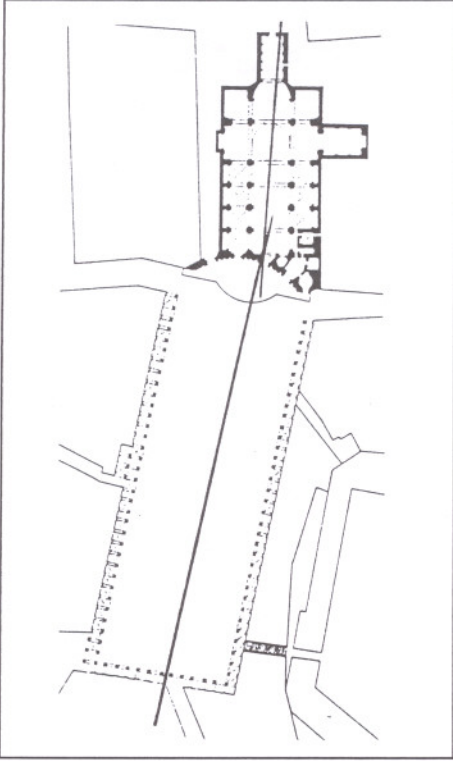


Figure 5. 8 Plaza Vigevano (Source: Von Meiss, 1996)

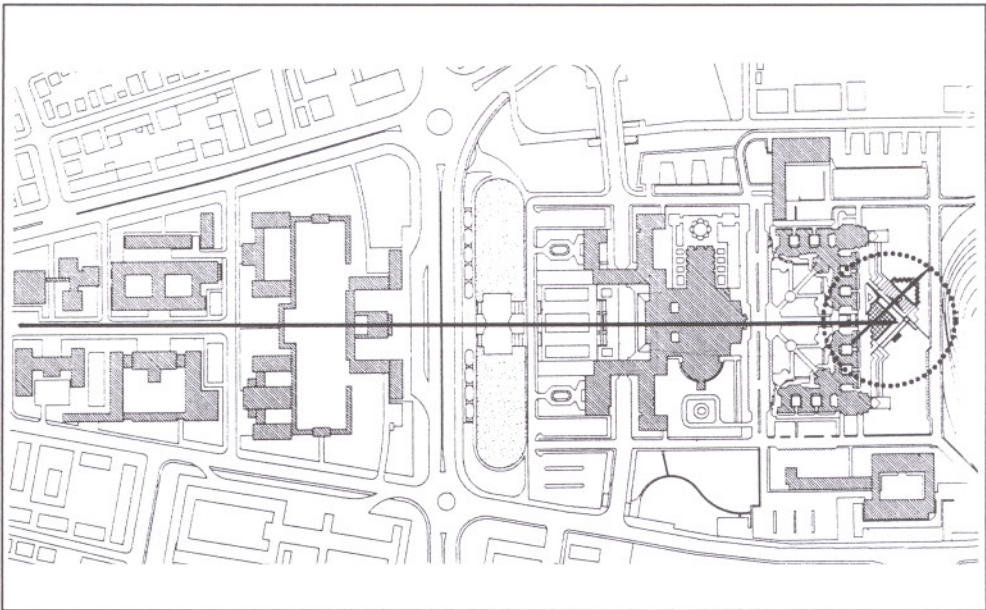


Figure 5. 9 Turkish Senate Mosque Behruz Cinici.

(Source: Egemimarlık, 1996/3)

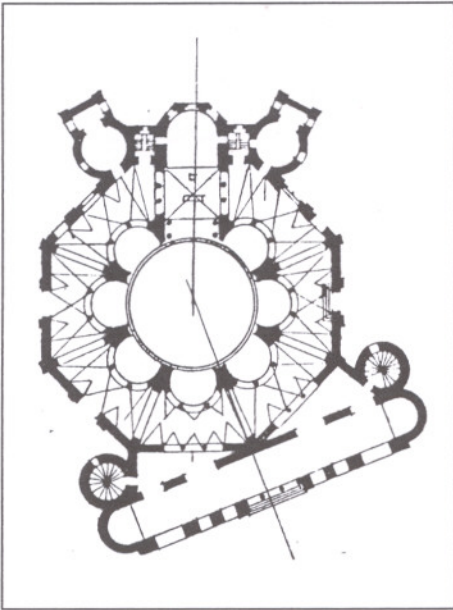


Figure 5. 10 Plan of Saint Vital and its broken axis (Source: Gromort, 1946)

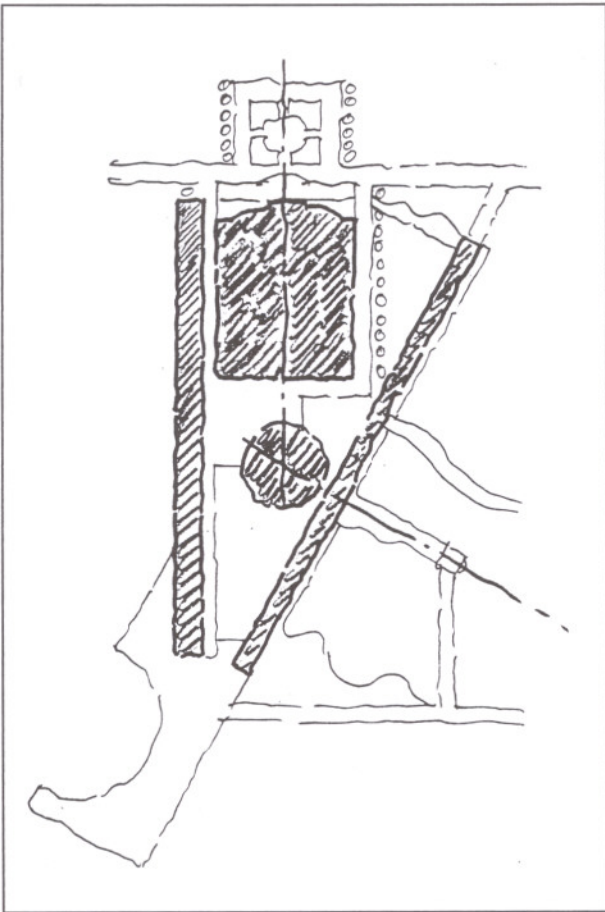


Figure 5. 11 Music Center in Washington, Ralph Johnson
(Source: Johnson 1946)

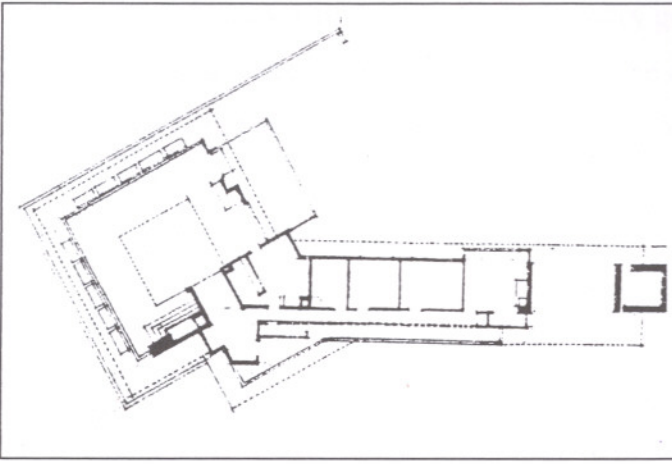


Figure 5. 12 Lowell Walter House F.L. Wright (Source:Ching,1996)

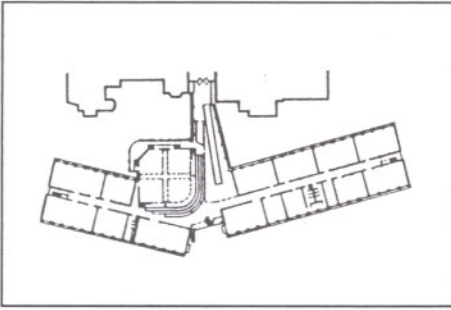


Figure 5. 13 Olivetti Training School. James Stirling

(Source: Clark and Pause,1985)

5.2 TILTED AXIS

Cartesian geometry was the most important generators of the architectural plan scheme and its two perpendicular axes have dominated all the geometrical structures of the two dimensional layouts. We can see the effects of these two perpendicular axes in Roman architecture in which they were called as Cardo and Decumanus in accordance with the North-South and East-West directions. Intersections of the two perpendicular axes was very widespread. It is possible to see such a scheme in all churches. This system was even tried to be applied on the human bodies. In other words, it was believed that the human body as a perfect creator of the world, has been based on Cartesian geometry (Figure: 5.12)

Two perpendicular axes of the Cartesian geometry generates four zones between them. In the Classical architecture these zones were to be organised in accordance the geometrical characters of the main intersected axes. So occurrence of the grid scheme in that four zones was inevitable. Grid schemes have become very popular with their homogeneities. In modern era , in which rationality has become very important, grid schemes were still very widespread because of their functional opportunities.

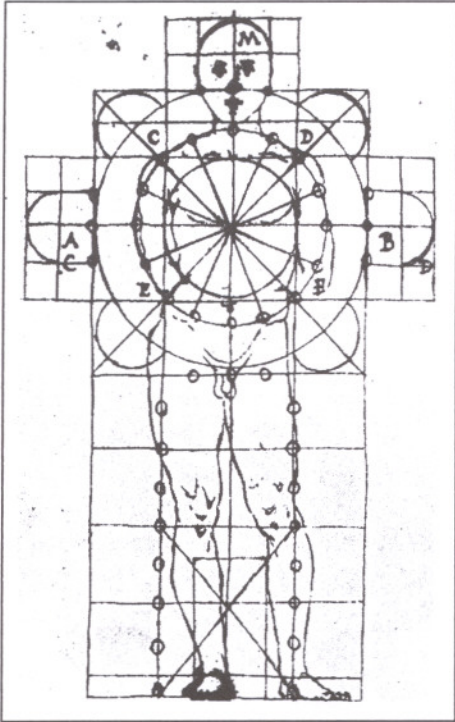


Figure 5. 14 Francesco di Giorgio, Cartesian geometry applied on human body. (Source: Wittkover,1988)



Figure 5. 15 Prien's Grid Scheme 4th Century BC (Source: Ching,1996)

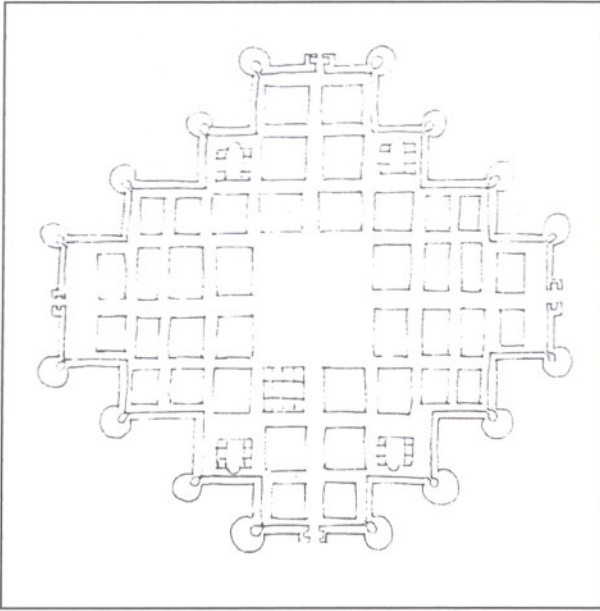


Figure 5. 16 Francesco di Giorgio's Ideal city 1451-1464 (Source: Ching,1996)



Figure 5. 17 Jaipur, India 1728 (Source: Ching,1996)

Multiplication of the two perpendicular axes towards the two perpendicular ways is very simple explanation of the grid schemes. So we can easily talk about the similar even some characteristics of the axes. In such an organisation of the axes, how the differentiations can be emphasised. Using a different angle may be the simplest answer of this question. This answer actually generates the tilted axis. Tilted axis should be considered with its surroundings. So it can be possible to perceive its tilted form in urban space organisation functionally or characteristically different axis is tilted in the homogenous pattern. It is very common way to give different characteristics to an axis.

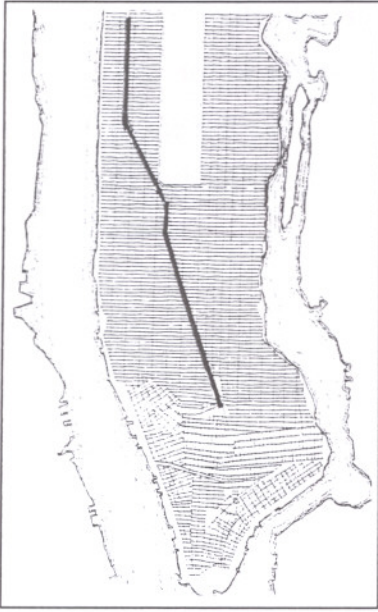


Figure 5. 18 Manhattan and its diagonal axis Broadway (Source: Ching 1996)

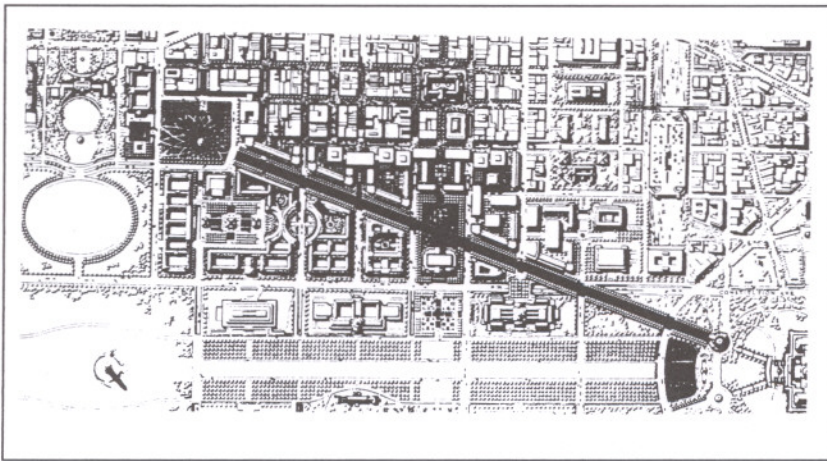


Figure 5. 19 Pennsylvania Avenue (Source: Trancik 1986)

We can see such an act of tilting in the diagonal axis of Manhattan; Broadway and connective axis of Washington, Pennsylvania Avenue. In these two examples necessary axis is tilted in the grid pattern. So it is very easy to understand their characteristically differences.

We can see similar attitude in the Bernard Tschumi's Chartres Master Plan. Tschumi defined a diagonal axis which includes leisure facilities such as indoor sports facilities, meeting halls, and restaurants.

In the building scale, we can use the same logic to emphasise our building or any element in it. The act of tilting the building makes it different in its surroundings (Figure: 5.20). In the same way if we want to emphasise an element in our building we try to use it under different angle apart from the grid system (Figure 5.21).

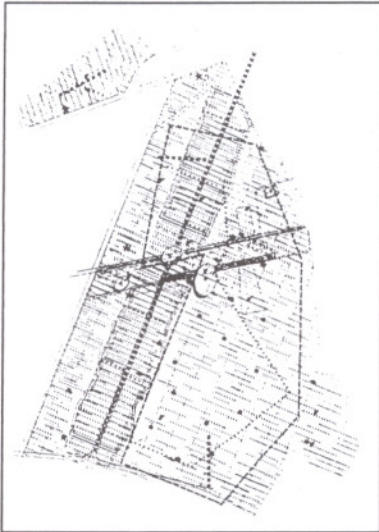


Figure 5. 20 Chartres Master Plan, Bernard Tschumi

(Source: The Architectural Design,1992)

In some cases tilted axis can stem from the site factors. For example a path from the site can go into building under the different angle as an entrance axis.

To sum up, the act of tilting an axis can emphasise its different character, is both urban space and single building scale. But, in this act the surrounding of the axis is important as well as axis itself so the relationship between the tilted axis and its surroundings should be based on valid conceptual criteria



Figure 5. 21 Chartes Master Plan, Bernard Tschumi (Sources: The Architectural Design, 1992)

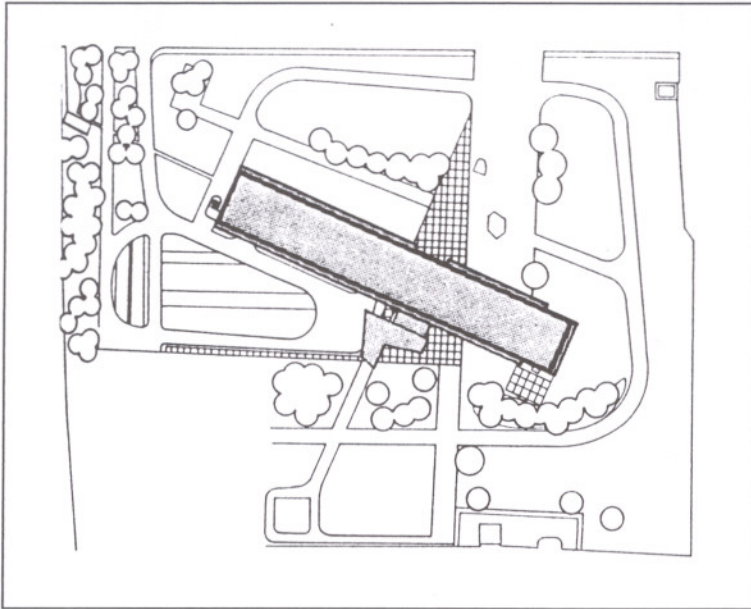


Figure 5. 22 Unité d'Habitation, Marseille, France 1946-52 Le Corbusier used a tilted axis in the whole building (Source: Clark and Pause, 1985)

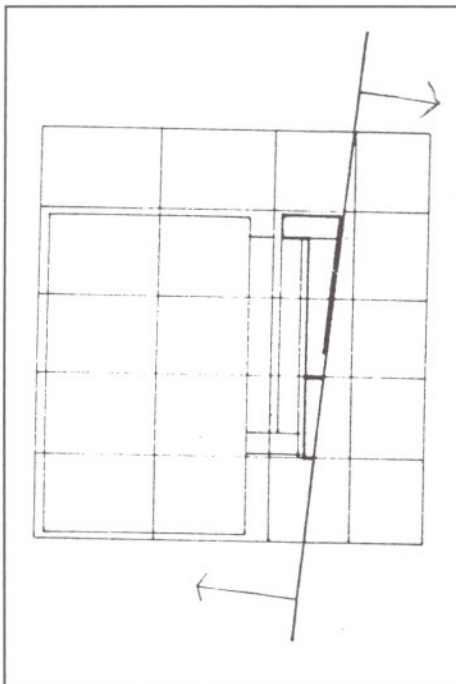


Figure 5. 23 Auditorium of New Harmony Town Richard Meier's 50 AngleTilted Ramp (Source: Baker, 1990)

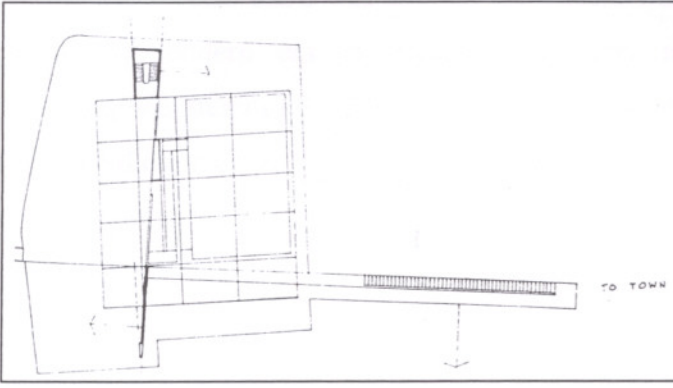


Figure 5. 24 Auditorium of New Harmony Town, Meier conditioned an axis from the site into the building under a different angle (Source: Baker, 1990)

5.3 INTERSECTED AXIS

Up to here, we generally dealt with the basic spatial schemes which includes two intersected axes. These schemes have no so much spatial varieties, because of their restricted number of the axes. Two perpendicular axes can be intersected at one point, so it is not possible to talk about spatial variety and also diversity.

Two axes generated schemes of the Classical Architecture were replaced for the schemes which was consisting of many axes in Modern era. In other words, the idea of pluralism in Modernism increased the number of the generator axis in the spatial schemes

More axes mean more variation, and more intersection points which give the characteristic of the space. In modern era, the ways of intersection of the axis stem from the modern art, especially modern painting. Primarily experiences of the axial intersections and organisation in picture, put the conceptual criteria and characteristics of the new space schemes. Especially Bauhaus and De Stijl groups were very succesful in this case and it is very obvious that their two dimensional organisations in painting were the skeleton of the new spatial layouts (Figure 5.23;5.24;5.25)

This act , especially De Stijl group in painting, enable their members to organise the forms in accordance with the necessity of geometrical balance.

In the same years there was another movement which is also shaped under the requirements of modern era in Russia. This new movement which is called Constructivism, was stemming from the art of painting like De Stijl and Bauhaus ecole. Basically all of these modern movements have developed in parallel with each other and the ways of grouping geometrical forms were the common interest of them. However in accordance with the different interpretation of the modernis, constructivism has tried to find different variations of the modern spatial layouts. In Russia the act of using the axes, under the various different angles is a result of this searches. Combination of the geometrical forms out of axially grid schemes was the main characteristic of Constructivism, which may be regarded as a starting point of today's modern architecture. Breaking of the forms to the pieces has become another way to create a composition. But what the unchanging thing was domination of the primary pure geometrical forms in the composition

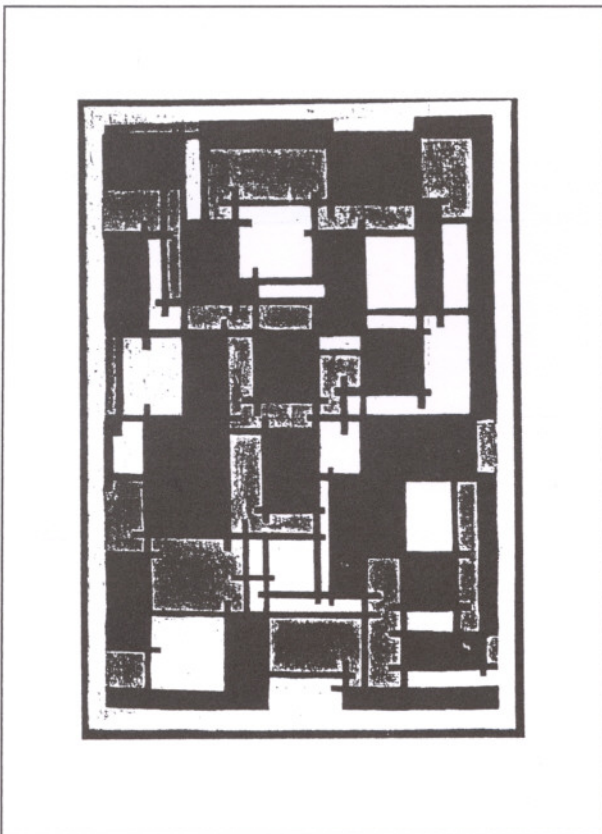


Figure 5. 25 Theo Van Doesburg Composition (Source: Overy, 1991)

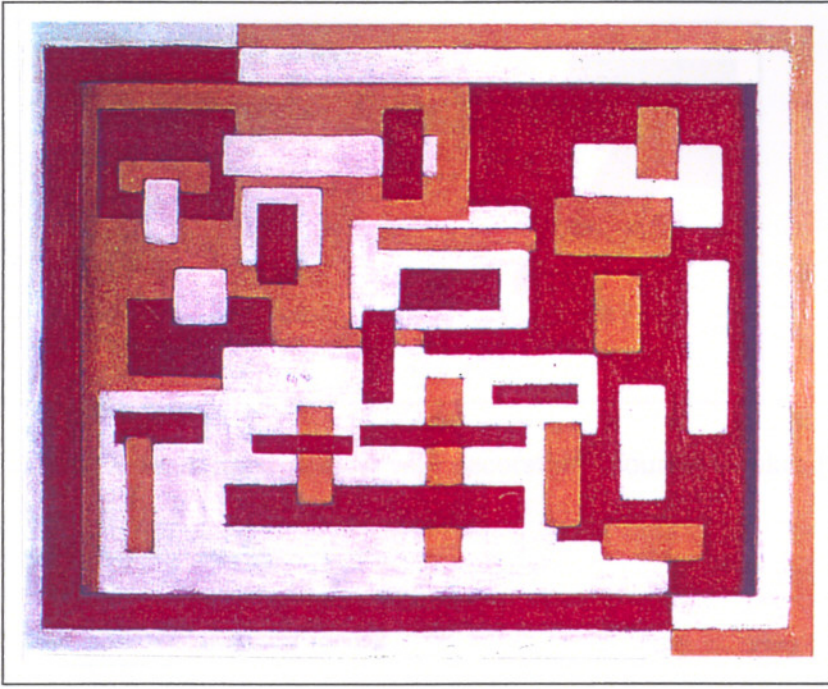


Figure 5. 26 Vilmos Huszar Still Life Composition (Source: Overy, 1991)

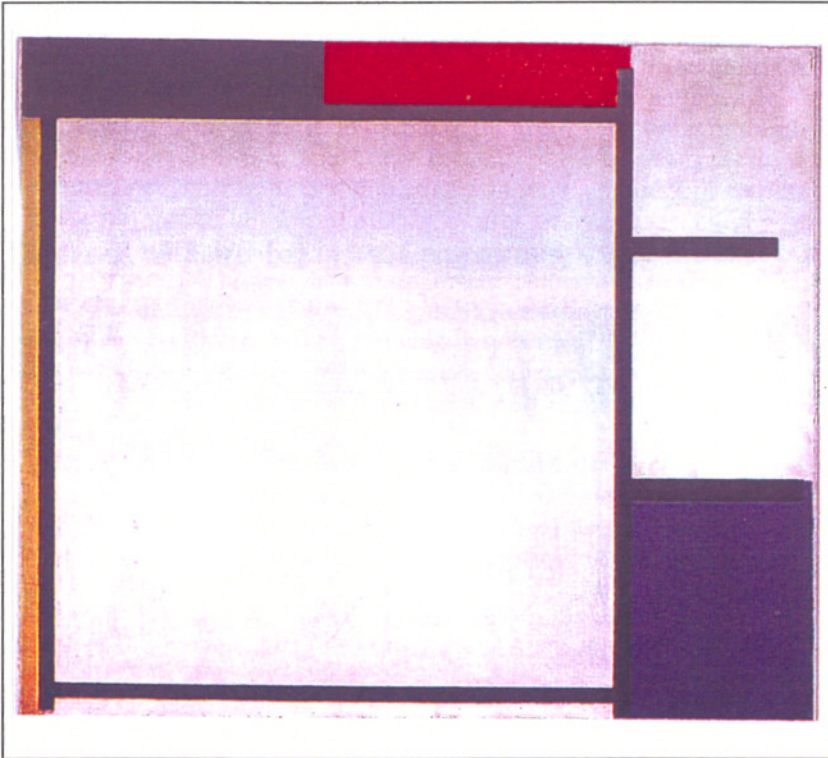


Figure 5. 27 Piet Mondrian Composition in Red (Source: Overy, 1991)



Figure 5. 28 A constructivist wall decoration (Source: Cooke, 1995)

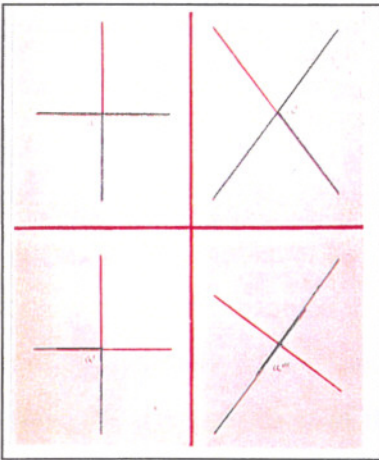


Figure 5. 29 Karel Ioganson, Construction, Using the axes out of grid schemes (Source: Cooke, 1995)



Figure 5. 30 Kasemir Malevich, A cover design. Broken forms into the pieces (Source: Cooke, 1995)

To sum up, increasing numbers of the architectural axis , inevitably brings about the new ways in their organisation process. If we think about the axis, as a representative elements of the geometrical and architectural forms, their organisation process can directly be explained with the variations of axial organisation

5.3.1 THE CONCEPT OF ASYMMETRY AND DISONANCE

The word of asymmetry as opposite of symmetry explains us a situation in which the elements are located unequally. As we mentioned before the word symmetry symbolises the homogeneity, positivity, even in Freudian term homosexuality. The concept of asymmetry tries to break this homogen and passive, regulations. Symmetry also provides us with the need for securit. Symmetrically organised compositions gives us the feeling of calmness. Dissonance generally can be explained with the lack of harmony between the things. It is very obvious that asymmetrical composition are regulated in a more free way because there is no point in organising every thing two times, to create a symmetry. Symmetry is one of the invariable of the classicism. Therefore, asymmetry is invariable of modern language. We should get rid of the obsession of symmetry . we can be involved in today's democratic architecture. Democratic, free, organisation of the asymmetry are still to provide basic geometrical and also architectural requirements, such as balance hierarchy, and order. The concept of dissonance can be regarded as a way to create an asymmetry.

Man experiences the spaces he lives in, asymmetrical. Among the infinitely many directions of three dimensional space along which he theoretically can move , one direction is distinguished by the pull of gravity. The vertical acts as the axis and frame of reference for all other directions.

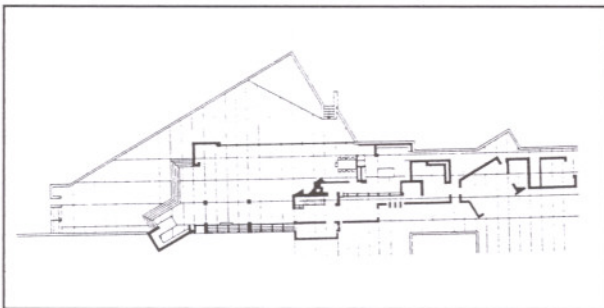


Figure 5. 31 Marcus House, Frank L. Wrihgt. Asymmetrical balance in plan (Source: Von Mace,1996)

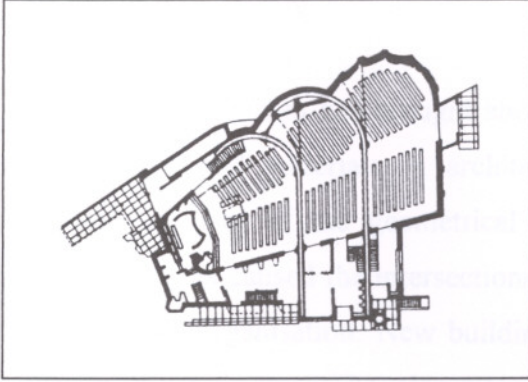


Figure 5. 32 Voukksenniska Church , Alvar Aalto Asymmetric Plan (Sources: Clarck and Pause, 1985)

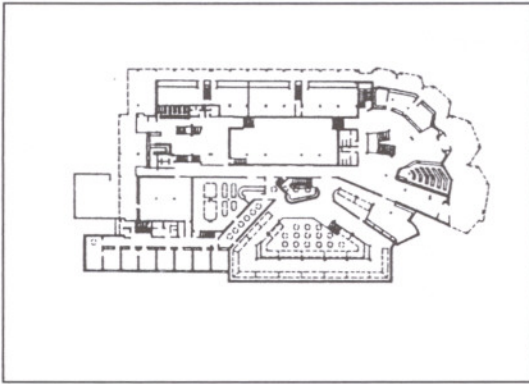


Figure 5. 33 Cultural Centre in Wolfsburg Alvar Aalto Asymmetric Auditorium (Sources: Clarck and Pause, 1985)

5.3.2.INTERSECTED SPACES AND SPATIAL INTERPENETRATION

The age of modernism has brought about not only new concepts, but also new building techniques and materials in architecture. These new techniques directly effected the spatial uses of the geometrical forms and their organisation process. Intersection of the axes caused the intersections of the architectural forms inevitably in the process of space organisation. New building techniques has changed the physical characteristics of the forms. *“The elements of spatial definition and the openings characterise the types of spatial relationships, indeed the degree of which the space remains autonomous or more or less linked to other spaces.”* (Von Meiss 1996,p:109)

The organisations of the architectural forms can be carried out in two different ways on the pre-organised axial layouts; juxtaposition and interpenetration. Spatial juxtaposition stems from the side by side connection of the at least two well defined and closed architectural spaces. That is why spatial juxtaposition insists on autonomy and privacy. In this approach all the autonomous private spaces are connected to each other by some transition spaces. The development of the space in the way of juxtaposition can be achieved with the series by addition or division.

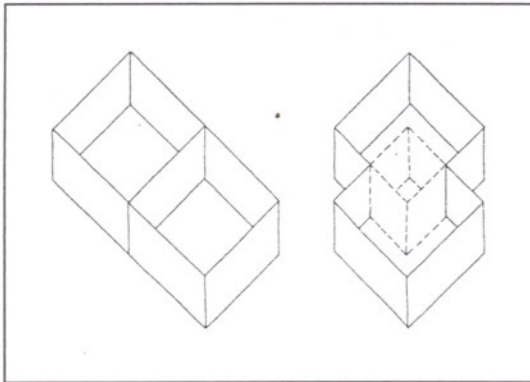


Figure 5. 34 Spatial juxtaposition and interpenetration.(Source: Von Meiss,1996)

Democratic structure of the modern era has effected the architecture as well as social life, and architecture was used to create a new social relationships which based on common use of the world. So, the new spatial schemes the aim of which was creating more spaces open to common use, have occurred in the urban space and architecture.

Spatial interpenetration can be seen as an important result of this process of demarcation and it is based on spatial continuity from one space to the other, and a wall, ceiling, floor is belong to a few spaces at the same time.

“The plane which separates one space from the other is then less substantial and produces an implicit division. The conditions for implicit closure are achieved with a relatively high degree of ambiguity and a minimum of means such as a lintel, a column, the framing of a large glazed opening, the top of a wall, the difference in texture of a surface, or object. The role played by the various means gives rise to different interpenetrations of the space. The theme of spatial continuity evokes a dynamic principle, of passages and stops with planes which guide and lead us to wonder what is to follow by the use of ambiguity between the hidden and the visible, the present and the future.” (Von Meiss, 1996 p:110)

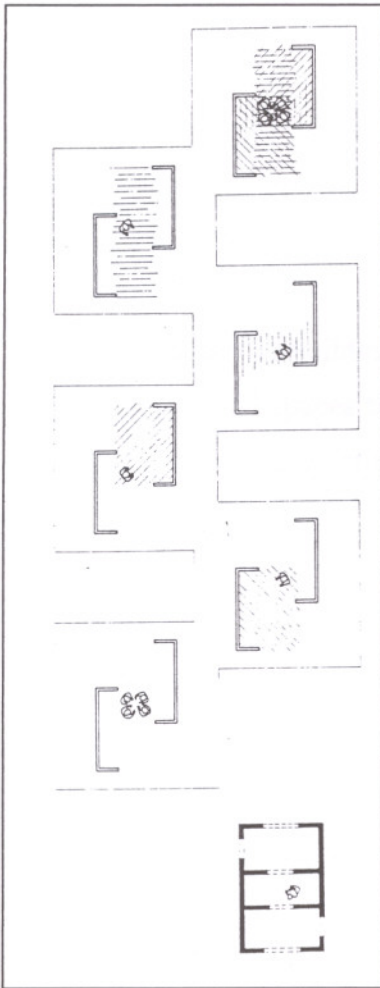


Figure 5. 35 Spatial juxtaposition and interpenetration (Source: Von Meiss,1996)

The intersected organizations of the architectural axes create new space concept which has new perceptual characteristics. So, space of modern era differs from the static symmetrically organized spaces of Classical Architecture.

5.3.3.FLUID SPACES

The organisation of the intersected axes, and its reflections on perceptual spaces caused a new spatial organisation, which tends to create physical, perceptual and visual continuity in modern architecture. In this new space scheme, private and autonomous well defined spaces were replaced with fluid spaces which were interpenetrated both functionally and geometrically.

In the process of geometrical interpenetration again the axes work as a guide lines of the composition. Actually we can say that this role of the axes totally stem from the modern painting. Since the very geometrical forms were used quite often in Modern picture, it was very easy to adaptate the new principles to the architectural schemes. Total and fluid spaces of modern architecture stems from this pictorial expression of architecture (Figure:5.33)

The independency of building components and new building techniques enable the designer to create fluid spaces through which the user of the building can perceive the whole spaces without any interruption, by means of secondary transition zones between the spaces.

The functional continuity of the fluid spaces is also an important necessity as well as perceptual and physical. In other words, the most important characteristics of the fluid spaces is their transition elements between the different functional spaces. In spatial juxtaposition these elements can be a wall or any surface. However, in the concept of fluid spaces, some subspaces are used to provide functional transition instead of surfaces.

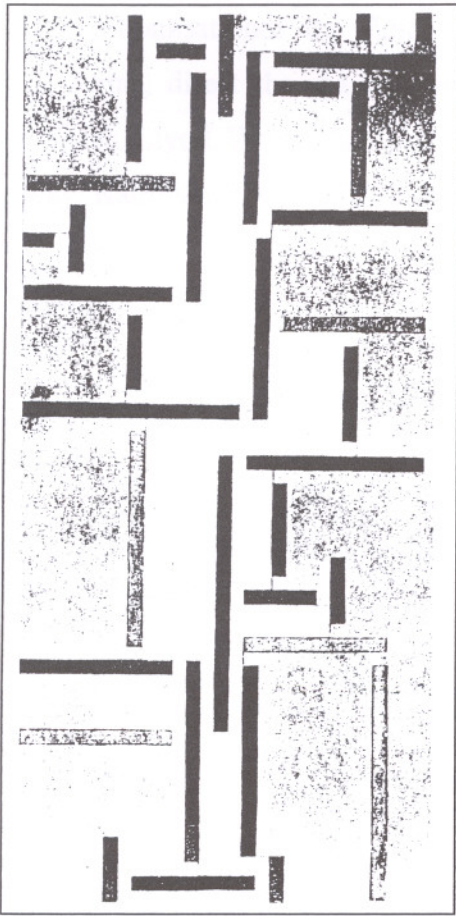


Figure 5. 36 Lizistky, Rhythm of Russian Dance. The most outstanding example for the spatial continuity in Modern Painting (Source:Overy,1991)

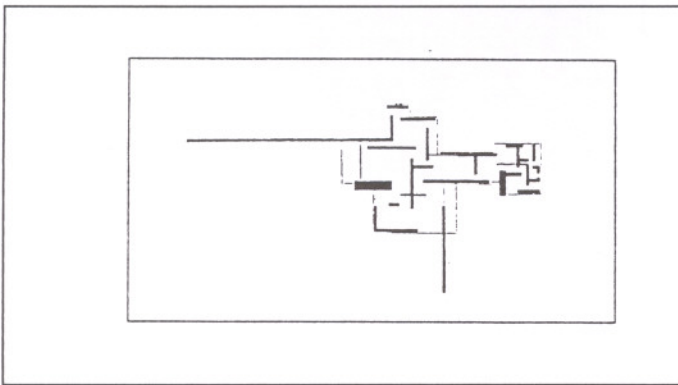


Figure 5. 37 A Stone Home in the Countryside. Mies Van der Rohe 1922. One of the first examples designed in according to concept of fluid spaces. (Source: Colquhoun, 1981)

In the organisation of the fluid spaces the axes, as representatives of the geometrical forms, direct the spatial continuity in accordance with the necessity of geometry. Frank Lloyd Wright has used this method in his projects in a very very effective way. Kaufman House can be given as the most outstanding example of spatial continuity because of its success in vertical movement as well as horizontal. (Figure: 5.38)

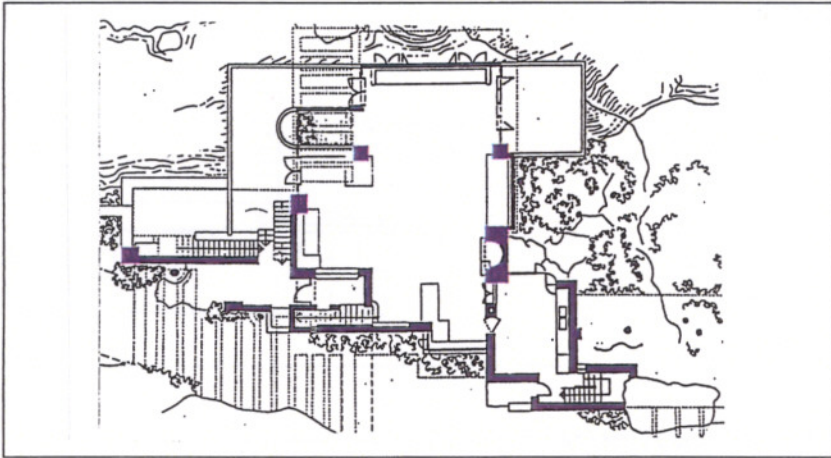


Figure 5. 38 Kaufman House: Frank Lloyd Wright. 1936. Spatial continuity was achieved both horizontally vertically. (Von Meiss, 1996)

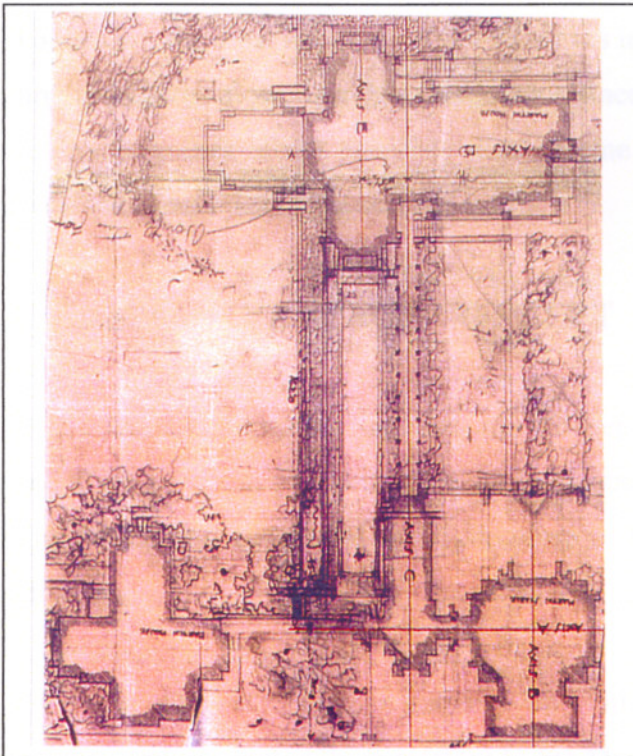


Figure 5. 39 Darwin D. Martin house. Frank Lloyd Wright 1905. Organizations and intersections of the forms were based on a axial scheme (Source: Wright, 1994)

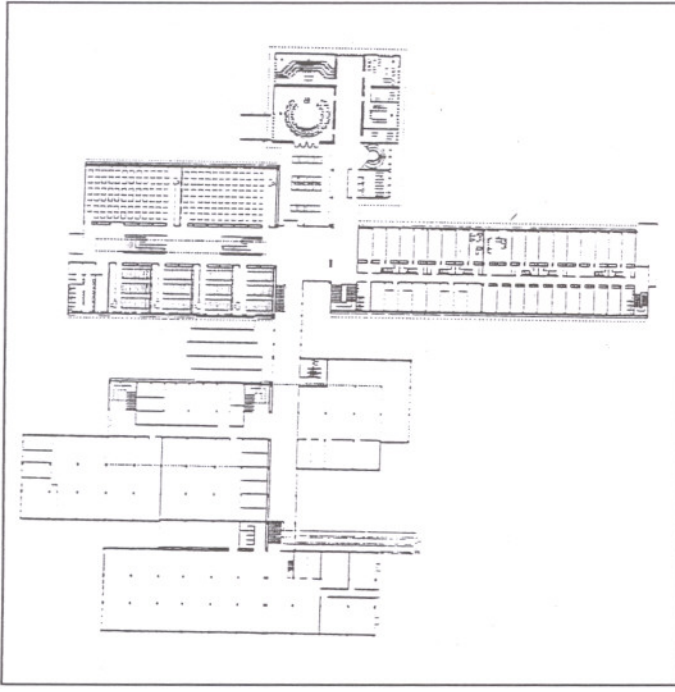


Figure 5. 40 KATU Faculty of Electric Doğan Tekeli-Sami Sisa

(Source: Tekeli and Sisa, 1994)

To sum up, the most important role of the axes in the organisation of fluid spaces is directing the spatial flow. In other words, the concept of fluid spaces is developed along the directing axes of the primarily plan scheme which is shaped in accordance with the various necessities of the site and user.

5.3.4 APERSPECTIVE SPACE CONCEPT

The strong relationships between the concepts of interpenetrated and fluid spaces and their common characteristics brought about a new space concept which reflects the democratic and plural social structure of the twentieth century. That was aperspective space.

The term aperspective space actually was introduced to architecture by Hans Scharoun who used it specifically in relation to his Manheim Auditorium.(Figure: 5.41) However, it is quite possible to see application of the scheme generally in the twentieth century's architecture.

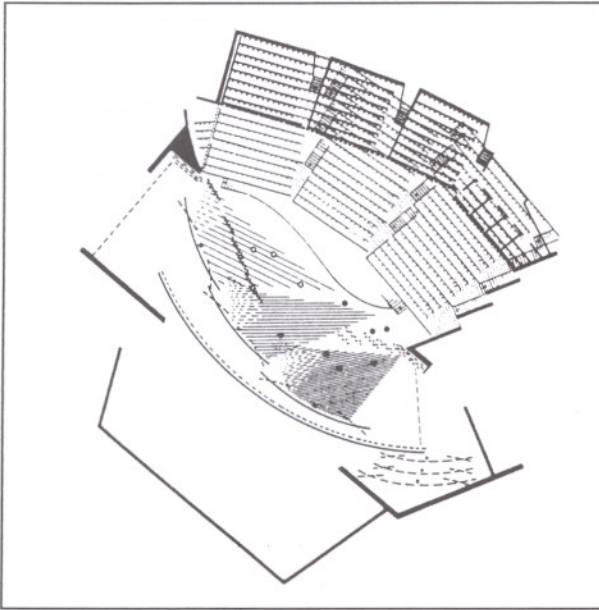


Figure 5. 41 Manheim Auditorium. Hans Scharoun. (Source: Jones,1996)

Single axis oriented linear spatial scheme which was to reveal the power of the authority has created strictly perspective spaces. The axis, along which visual perspective developed was so strong that it has also generated a symmetry and symmetrical organisation of the space emphasised the visual perspective in classical architecture. On the contrary, in modern era, in parallel with the changing values of the society the power of the single axis has been reduced with using another axes in the process of spatial organisation. New democratic structure of society has no more needed perspective homogenous spaces.

Since the spaces was organised for the human beings, their perceptual characteristics can never be denied. Actually the concepts of both perspective and aperspective spaces are based on the perceptual and also mental necessities or peculiarities of the human beings as a unique user of the architectural spaces. Even, Scharoun's use of the term "aperspective" derives directly from the writings of cultural philosopher Jean Gebser, for whom it was a central concept.

The idea of "Tabula Rasa" developed by modernist pioneers has opened a brand new way to design strategies. New aperspective organisation of space was very natural result of this idea.

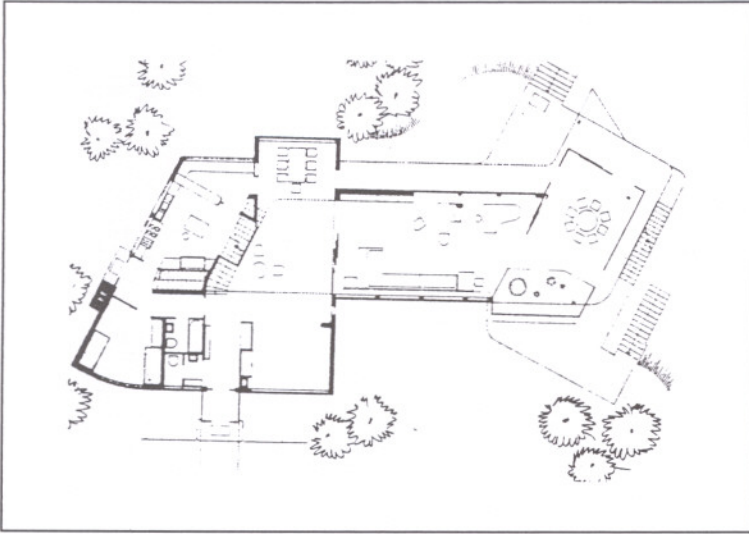


Figure 5. 42 Schiminke house. Hans Scharoun 1932.
A perspective, asymmetric space. (Source: Jones, 1996)



Figure 5. 43 University Library, Eichstätt, Behnisch and Partners. Spatial
aperspectivity created by intersected organisation of the axes (Source: Johnes,
1996)

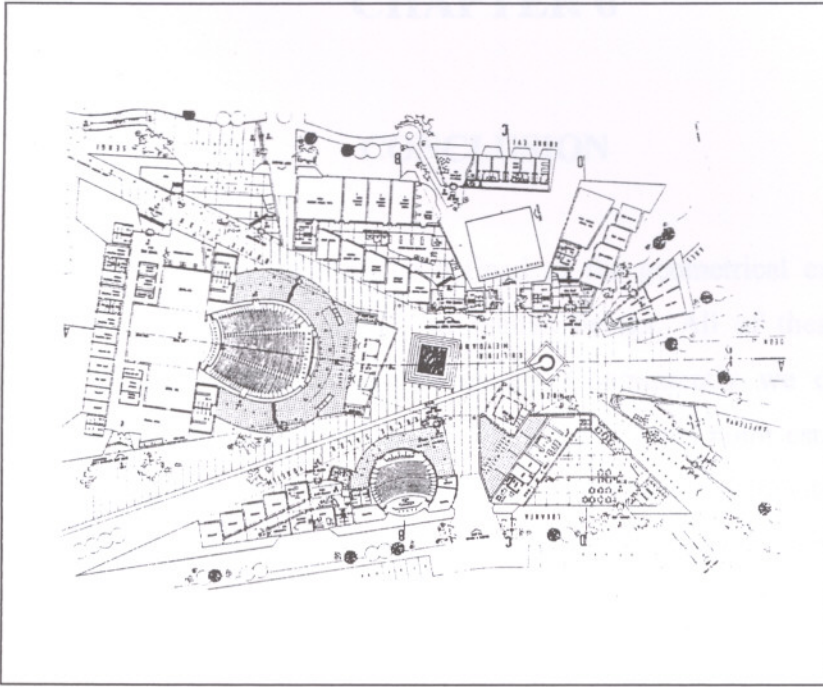


Figure 5. 44 Competition Project for GAP Culture Center, Cem Açikkol
(Source: Mimarlık, 1993/253)

To sum up, aperspective spaces are very natural results of the intersections of architectural axes under the different angles in the design process. We can also define the aperspective space concept as a transformation process of the geometrical organisation of the axes into perceptual and visual characteristics of the space.

CHAPTER 6

CONCLUSION

The art of architecture can be defined as the geometrical expressions of the physical or psychological necessities of human beings. All of these necessities are provided in the geometrically shaped spaces. Consequently we can also put the architecture as an organisation process of the space. In this point establishment of the strong relationships between the geometry and space concept is inevitable. Geometry is the most important tool during the creation of architectural space. In other words, it can be defined as the skeleton system to concretise all the characteristics of space and make it a meaningful whole.

The axis, basically a straight line between the two points, is the main element of geometry and its form. If geometry is regarded as a sentence of architectural language, forms can be defined as its words and the axes its letters. Forms can be drawn by means of the axes and furthermore they can also be represented by them.

Vital importance of the geometry in architecture, makes the axes the generators of the spaces. And organisation process of the space is directly shaped according to the characteristics of the axis. It is possible to see different interpretations of the geometrical axis in different eras in accordance with their social cultural and political atmosphere

In the changing world, interpretation of geometry and its basic element, axis, has also changed. Consequently, spatial organisations and characteristics of space have been effected by this change.

If we examine different building types we can face different spatial schemes in similar or same geometrical forms in different eras according to change of axial interpretations.

Basically, we can talk about two types of axially which derives from the different interpretations of the geometry and architectural axis: that are classical and modern axially

Evolution of the modern axially the intersected space

The characteristics of these spatial organisation systems and their reflections on the process of space organisation, has been viewed as the followings:

- In the classical architecture from ancient Egypt to Renaissance the axially was based on connective characteristics of the axis which derives from its geometrical meanings.
- Axes were used mainly to emphasise both religious and political power in the buildings. Which was the most important characteristics of classical axially.
- Politically one point oriented power, cause classical axially based on single meaningful but multifunctional axis.
- Single axis oriented classical axially has caused symmetry and perspective view, which were two important concepts in determination of the space in classical architecture.
- Classical axially was vertical as well as horizontal, and horizontality was giving the volumetric characteristics of the space.
- Dominant single axis of the classical axially was replaced with the axial plurality in accordance with the democratic pluralist social characteristics of modern era in twentieth century's Modern axially.
- Increase in number of the axes cause a new axially organized layouts on which the modern spaces of twentieth century are organized.

- Modern axially deals with the different variations of the axes according to changing functional and psychological necessities of the era.
- In the spatial organisation of the modern axially the intersected spaces which are defined on the intersection points of the axes give general characteristics of the modern space.
- Modern axially searches for the opportunities of axial intersections under the out of right angle. In other words, it tries to break out the static grid scheme.
- Intersections of different axes under the various angles give asymmetric and visually aperspective characteristics of the modern space.
- Modern axially takes its principles from the art of modern painting and apply them on the architectural layouts.

These characteristics of axially are also valid for the urban space organisation process as well as architecture. The subtle differences in application derive from the difference in scale.

To sum up, the changes in characteristics of *the lines of forces acting on spaces*, changed directly the spatial schemes from *perspective* to *aperspective*.

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