

Architectural Dynamics and A Suitable Public Space

by

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ABSTRACT

This thesis attempts to develop an architectural dynamic design method to build a public activity space to deliberately evoke an appropriate emotion. It is argued that this emotion is evoked by proportional changes between users and the components within the defined spatial framework. These changes contribute to a perceptual force- that of architectural dynamics. It is assumed that the quality of the dynamics can be defined and applied to a certain group of modules within the defined spatial framework. If the dynamics of the proposed space can be predicted and the center round which the modules are organized can be determined, then those modules primarily affecting the dynamics can be inferred, selected and, therefore, organized accordingly. The strategy of this study is to produce the modules, design an architectonic space, conduct a survey, analyze the responses and summarize the findings.

The definition of the quality of the dynamics is based on strictly limiting the primary factors discussed in 2.2.3. The dynamics of a shape is assumed to be an assembly of the dynamics of its visible planes within the defined spatial framework. If it is accepted that the human being's body is the direct source of a reliable criteria to evaluate the space, another assumption is that the dynamics of each plane of each module can be measured by the ratio of the two relevant dimensions to those of the cube which simulates the space occupied by a human body. Consequently, a dynamic value can be assigned and each plane of the modules measured. The implication of this is that if the body is indeed the criteria used, then the majority of people would show a preference to one specific space.

Theoretically, the involvement of personal experience in judging the suitability of a space can be dramatically reduced, thus reinforcing the role of dynamics. Given Le Corbusier's "The Modulor", a form creation system in harmony with the human body, a group of modules can be produced, as discussed in 2.3.5 Quality of Dynamics, and so the dynamics can be practically applied. As the modules are without colour or texture, the sense of weight can be dramatically reduced, as discussed in 2.3. Moreover, the ability to identify the center of a symmetric form comes from man's intuitive perceptive ability and

man's need to be social, as discussed in 2.2.5. Thus, the proposed space built around the center can enhance the involvement of the intrinsic attributes of perception.

The proposed architectonic space is designed in Chapter Three. This is created by making amendments to the defined square-shaped initial layout in order to promote the center (see 2.3.4 and 2.2.5). The convergent dynamics of this proposed space is predicted to be very strong around the level 6-7 (the convergent dynamics is scaled from 0 to 7). This level may represent a suitable space and the dynamics is a collective dynamics, emanating from the four chosen modules (see 2.3.6 and 2.3.7), and composed of the two symmetric axes of the square space of the initial layout, from whose center the dynamics can be perceived. Thus, the dynamics of the proposed four modules can be inferred and selected accordingly. Moreover, if the convergent dynamics is around 6-7, then this implies that the spatial center is very clear. In this way an appropriate architectonic space can be built up possessing very strong convergent dynamics and a very identifiable center.

The survey is carried out in Chapter Four. Eight identical spaces are presented, except for the modules composing the two pairs of symmetrical axes. The subjects comprised non-architectural students, categorized by the gender-age factor, and architectural students. The three independent variables to be tested include the level of the convergent dynamics, clarity of the center and the most preferable space.

In Chapter Five, the responses are statistically analyzed and in Chapter Six it is concluded that there is, in fact, no conclusive evidence that a preferable space is chosen in terms of the level of the convergent dynamics and clarity of the spatial center. Thus, it follows that the human body itself is not a substantially sufficient criterion to be used as a reliable source in order to evaluate a space. The ordinary person did not feel the dynamic fluctuations between the spaces as much as the architectural students. In the non-architectural subjects the fluctuations differed according to their age and gender. This study does, however, suggest that an architectural practitioner could use a design strategy to satisfy his clients depending on whether they are young or old, male or female.

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DEFINITION

Module:	The shapes produced by “The Modulator”
Standard Modules:	A certain number of the modules to be selected from the modules produced by “The Modulator”
Local Coordinates:	The place on the initial layout on which the proposed modules are going to be imposed
Generally Proposed Modules:	The modules imposed on the initial layout constructing the general surroundings of the proposed space
Crucially Proposed Modules:	The modules imposed on the crucial location on this layout primarily affecting the dynamic variable of the proposed space.
Arrangement of Modules in Defined Spatial Framework:	Most of the modules are imposed on the initial layout with their horizontal dominant dimension parallel to the edges of the square-shaped initial layout.
Ground plane:	The bottom surface of the modules on the court space
Frontal plane:	The surface of the modules facing the court space
Side plane:	The surface of the modules vertically perpendicular to its frontal plane

Module A: the module to be imposed on point A in the proposed space.

Module B: the module to be imposed on point B in the proposed space.

Module C: the module to be imposed on point C in the proposed space.

Module D: the module to be imposed on point D in the proposed space.

Module E: the module to be imposed on point E in the proposed space.

Module F: the module to be imposed on point F in the proposed space.

NOTATION

D_T --- the dynamic variable of the theme of the architectonic space to be proposed

D_P --- the dynamic variable of the proposed architectonic space

D_I --- the dynamic variable of the initial layout

D_C --- the dynamic variable of the proposed modules crucially affecting that of the proposed space

D_G --- the dynamic variable of the proposed modules generally constructing the proposed space other than the four crucial modules

D_a --- the dynamic variable of the module to be imposed on point A, which is the collective configuration of the dynamic variables of its frontal plane d_{fa} (the dynamics in the length dimension d_{fal} ; the dynamics in the height dimension d_{fah}), the ground plane d_{ga} (dynamics in the length dimension d_{gal} ; the dynamics in the breadth dimension d_{gab}), and the side plane d_{sa} (dynamics in the breadth dimension d_{sab} ; the dynamics in the height dimension d_{sah})

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1. GENERAL INTRODUCTION

1.1 INTRODUCTORY BACKGROUND

Architecture as a profession seems to have been greatly influenced by art, ignorant of its exclusive interaction between man and man-made space. There are a wide variety of design styles through architectural history, from Classicalism, Modernism, Post-Modernism, Functionalism, Structuralism, Formalism, and so on. Architectural design seems to periodically catch the fashion, to match people's interests. In other words, architects seem to position themselves where human beings, who occupy and use the space, are ignorant of their psychological reaction to the designs. However, architects need to put more of their attention on how to design a building in order to arouse a preferable emotion primarily related to visual perception. A visual condition can contribute a comfortable or uncomfortable psychological effect emanating from the architecture¹. The two drawings (Figure 1.1 a, b) below appear to evoke a strong emotion of visual pleasure.



(a)

¹ The persistent discomfort caused by most of the public settings provided today by man for man urged me to explore the visual conditions that influence the psychological effect of architecture. A more positive impulse came from seeing with my own eyes the remains of the Poseidon Temple on Cape Sounion, high above the Aegean Sea, or Jorn Utzon's opera house on the promontory in Sydney harbor. I felt inspired by the awesome cube of the Palazzo Farnese in Rome and by the new city hall in Boston, by the cupola of the Pantheon and the poetry in cement by Pier Luigi Nervi, also by the crystalline mountains of New York's office buildings lit up at night, the generous expanse of Paris streets, and the labyrinths of Venice. (See: Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 20, 1-3.2)



(b)

Figure 1.1 a, b

There is a belief that there is an echoing relationship between the psychology of emotion and proportional changes of shapes in a defined architectural space and therefore an appreciative emotion can be established relating to the right proportion of a shape to a viewer.

An emotion evoked by a space depends on the surroundings. Perceptually, each shape contributes to the visual dynamics². Thus, there is a link between an emotion evoked from that space and the shapes creating the space. For example, it is assumed that a cube positioned in front of a viewer can change its size freely in three dimensions, and that it stands within a boundary, without color or texture. As the size of this shape changes, the spatial coordinates between the viewer and the target also change. The inter-space establishes a particular ratio of remoteness and connectedness, depends on which affects the architectural complex as a whole. This should not only be considered simply metric distances, but also dynamically, as it can be found that the ratio of

² To be seen as expressive, the shape of an object must be seen as dynamic. (See: Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp.9, 210)

remoteness and connectedness contribute to the forces of attraction and repulsion. In response, this force also corresponds to some degree of emotion, for example, freedom, respect, etc. As the height of the shape increases dramatically, a vertically rising dynamic is evoked and this dynamics may evoke a feeling of emotional freedom. At some stage, a viewer can feel its proportion to be just right. The viewer might say that he/she feels that this shape is appropriate, suitable and he finds comfort with it. This self-evaluated reaction comes from his perception and coordinated spatially according to his physical existence. This idea can be followed through. If an abstract architectonic space can be set up, and the factors involved in influencing the perceptual dynamics of a shape eliminated or limited, the emotion of a space can be primarily related to the three-dimensional changes, the dynamics of the shapes being defined directly in terms of the human body, proportionally. 'The Modulor' can fulfill the practical application of the concept of dynamics, by which a number of modules can be produced. Moreover, if a natural order is determined in which these modules can be organized, such as the intuitive identification of the center of a form, these modules can, accordingly, be organized within a defined framework. Therefore, it is contended that it is possible to design an architectonic space with a reciprocal emotion, by means of the dynamics of its components. The concept of dynamics may, therefore, be adopted as a suggestive design tool in order to design the proposed space.

Additionally, this thesis is an attempt to explain an abstract idea or emotion in a rational and practical way. This can only be done by limiting the factors and narrowly defining the space. Architectural dynamics is used as a bridge between the relationships of each of the shapes, which are systematically and integrally organized in terms of the dynamics, within a defined spatial framework. It is nothing more than a logical design method from a realistic point of view. This is one way to design an architectural space, the other way is historical, which is for these purposes discounted. These seem to be the basic ways of approaching an architectural design³. The creation of the proposed

³ I fell into these thoughts; of which, there were two ways to be delivered; the one historical, by description of the principal works... the other logical, by casting the rules and cautions of this art into some comfortable method: where of I have made choice; not only as the shortest and most elemental, but indeed as the soundest. (Sir Henry Wotton, *The Elements of Architecture*, 1624)

architectonic space within a systematic spatial framework can be seen as a logical design⁴ rather than a realistic exercise.

1.2 PROBLEM STATEMENT

Although the perceptual dynamics of shapes play a significant role in the psychological behavior of man and his surrounding, in terms of architectural design, there are surprisingly few works available on this topic, and the few that there are do not give a systematic explanation of this relationship. One of the major reasons might be that there are so many factors functioning simultaneously, especially those to do with the mind. However, this study attempts to explore the seemingly yet profoundly intangible relationship existing between human emotion and the surroundings.

1.3 RESEARCH OBJECTIVE

The research objective is to establish a dynamic design theory that might assist a designer in designing a relatively suitable built environment in terms of the dynamics of the shapes.

In Chapter Three this theory is applied to an architectural space design in order to examine it. This space is presented to respondents together with a number of other architectonic spaces constructed under similar conditions and this is dealt with in Chapter Four. Whether it is proven or needs some adjustments can only be answered after analyzing the data.

1.4 SCOPE OF STUDY

This study attempts to explore a relatively countable relationship between man and his experience of the environmental space, in an attempt to evoke an appreciative emotion from that space.

⁴ Wilenski (1927), insisted that an architect's "business as artist" was with "the definition, organization and completion of his formal experience by creating a concrete object. (Mitchell, William J (William John), *The Logic of Architecture*, Cambridge, Mass: MIT Press, 1990, P25)

This proposed built environment focuses on a typical public activity space and the development of this space is based on an architectonic space to be defined, and the relevant factors in building up this space need to be explicitly specified (Architectonic Space Defined in Chapter Two).

The factors involved on the human side include the human body, the mind, weight sense, visual perception and coordination and the viewing point. These will be specifically discussed under the Definition of Dynamics in Chapter Two. These factors are used to cast the relevant hypotheses.

1.5 RESEARCH HYPOTHESES

Six hypotheses have been drawn up for the purpose of this dissertation. Each of them is positioned in the relevant part of the context (Figure 1.2).

Hypothesis One:

The dynamics of a shape is an accumulation of the dynamics of its visible planes that assemble this imaginary shape in the defined spatial framework.

Hypothesis Two:

The dynamics of each plane of each module can be calculated and measured by comparing the two relevant dimensions to those of the cube, which simulates the space occupied by a human body, within the defined spatial framework.

Hypothesis Three:

The sense of weight does not function in the modules generally imposed (refer to the relevant definition) in the defined spatial framework but in those with vertically dominant dynamics, crucially affecting the dynamic variable of the proposed space.

Hypothesis Four:

Personal experience and background will not affect the ability to be critical of the emotion evoked from the defined architectonic space.

Hypothesis Five:

There is a center in the proposed architectonic space at which point the dynamic variable of this space can be perceived as the people complete touring this space.

Hypothesis Six:

The dynamic variable of the architectural theme for the proposed architectonic space should demonstrate a relatively stronger concentrated dynamics than the others that are built based on the same available shapes in the same condition. This dynamic variable is seen as the more appropriate dynamic variable.

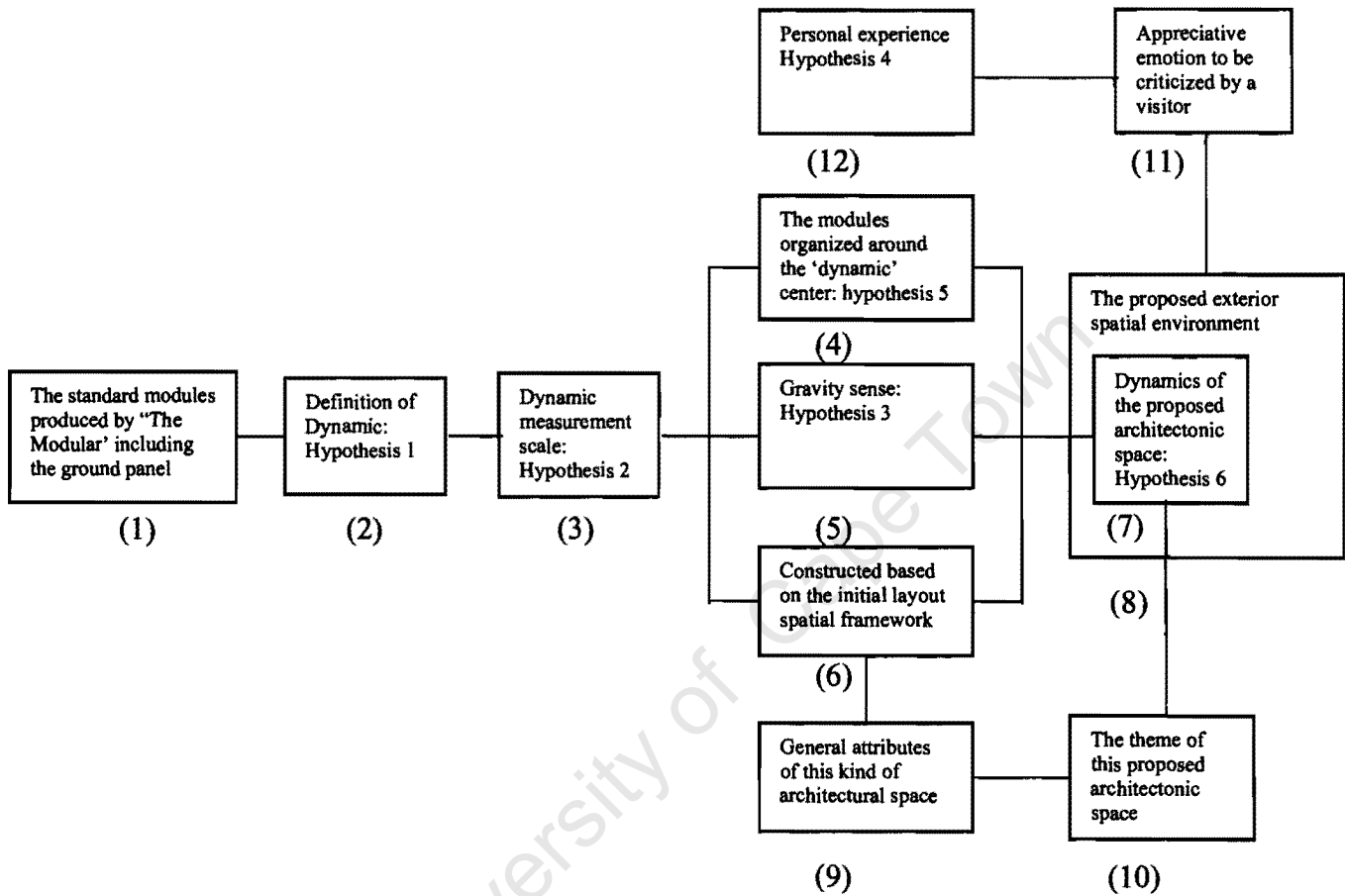


Figure 1. 2

To summarize, it is proposed that an appropriate dynamic variable can be installed in a proposed architectural space. Therefore, a relatively suitable built environment can be built and, consequently, the proposed architectonic space for this study can be established by dynamic means.

1.6 METHODOLOGY

As the objective of this study is to establish a suitably built environment, the complete process involves setting up the design theory, designing the architectonic space in line with this theory, examining the feasibility of the theory in terms of the responses, making any necessary adjustments and forming a conclusion. These five main aspects will be illuminated in the relevant chapters demonstrated in the context structure.

Context Structure

A brief description of the methodological process of this study can be represented graphically, as in the figure below (Figure 1.3) and indicates in which chapter each aspect is discussed. The dashed lines correspond to the relevant chapter and the solid rectangle inside each dashed line indicates the description of each section.

Chapter One, the introduction section, sets up the skeleton for this study. Chapter Two, the dynamic theory section, comprises the hypotheses and definitions of the relevant concepts and this chapter is the primary core of all the chapters. The proposed architectonic space is designed and built up in terms of this theory. The design theory is examined by means of the survey and this is dealt with in Chapter Four. Chapter Five analyzes the data collected. The recommendations and conclusions in terms of the findings are made in Chapter Six.

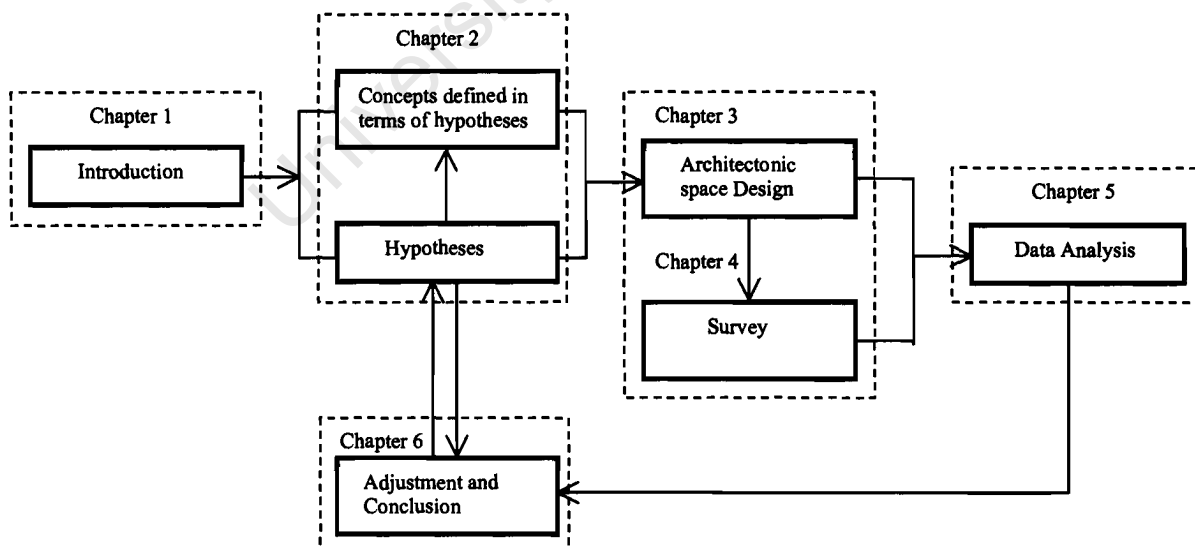


Figure 1.3

Dynamic Theory

It is argued that this emotion is evoked by proportional changes between users and the components within the defined spatial framework. These changes contribute to a perceptual force- that of architectural dynamics. It is assumed the quality of the dynamics can be defined and applied to a certain group of modules. If the dynamics of the proposed space can be predicted, as can be the determination of the center as the spatial order, those modules primarily affecting this dynamics, can be inferred and selected accordingly.

The definition of the quality of the dynamics is based on strictly limiting the primary factors. The dynamics of a shape is assumed to be an assembly of the dynamics of its visible planes within the defined spatial framework. If it is accepted that the human being's body is the direct source of a reliable criteria to evaluate the space, another assumption is that the dynamics of each plane of each module can be measured by the ratio of the two relevant dimensions to those of the cube, simulating the space occupied by a human body. Consequently, a dynamic value can be assigned and each plane of the modules measured.

Given Le Corbusier's "The Modulor", a creative system in harmony with the human body, a group of the modules can be produced from the initial system, and so the dynamics can be practically applied. As the modules are without colour or texture, the sense of weight can be dramatically reduced. Moreover, the ability to identify the center of a symmetric form comes from man's intuitive perceptive ability and man's need to be social. Thus, the modules of the proposed space can be built around the center and this also enhances the involvement of the intrinsic attributes of perception.

The proposed space is built up by making amendments around the spatial center of the square-shaped initial layout. These amendments can be coordinated in promoting the center of it. The convergent dynamics of this proposed space is predicted to be very strong and this level may arouse an appropriate emotion in this proposed space. This dynamics is crucial and represented by the convergent dynamics collectively released by the four chosen modules composing the two symmetric axes of the initial layout and perceivable at its center. In this way the dynamic 'quality' of the proposed four modules can be inferred. The modules can be selected accordingly. Thus, the proposed

architectonic space can be designed in terms of the dynamic quality and evoke an appropriate emotion.

Since the establishment of this type of architectonic space is based on conditional generalization, this design method might be seen as a reference to guiding those architectural designs supposed to have similar functions and emotional goals.

Architectonic Space Design

This proposed architectural space is built up according to the concept of architectural dynamics. The design is the practical application of the dynamic theory.

The establishment of this architectonic space is divided into seven steps and is specifically illuminated in Chapter Three. They are briefly introduced here:

Step 1. Programs Study and Initial Layout

Step 2. Theme Synthesized and Dynamics of Theme Formalized

Step 3. Module Generation, Standard Modules Selected and Dynamic Assignment

Step 4. Dynamic Framework and Coordination of Proposed Modules

Step 5. Dynamic Inference

Step 6. Proposed Module Determined

Step 7. Architectonic Space Presented

Survey

The survey is covered in Chapter Four. The objective of this part of the study is to test whether the emotion evoked by the architectonic space designed in Chapter Three is relatively more appropriate than those of others. This means that this proposed space has to be presented and compared with a number of analogous architectonic spaces. The questionnaire is provided with 'closing' questions in order to collect the data. The 'quota sampling' method is used to draw a representative sample. The respondents include thirty non-architectural people and ten architectural students from the local architectural school.

Data Analysis

This section is covered in Chapter Five and entails the statistical calculation process.

Data analysis is carried out to see whether the hypotheses are accountable or not.

Conclusion

Chapter Six concludes this research. Any adjustments and recommendations form part of this conclusion.

1.7 SUMMARY

This chapter has outlined the general skeleton of this research, section by section, including the introductory background, problem statement, research objective, scope of the study, and the research scope, research hypotheses and methodology.

In order to proceed, a three-dimensional model will be set up using a number of modules produced by “The Modulator”. These modules will be organized according to the dynamics concept. An experiment is set up to justify the design. Findings will be determined from the results of the analysis and recommendations made.

2. ARCHITECTURAL DYNAMICS AND ITS APPLICATION

2.1 INTRODUCTION

The objective of this chapter is to attempt to define the “quality” and scale of the architectural dynamics and present how it can be applied to the architectural spatial design. The factors involved in defining the dynamics are divided into two main parts discussed in separate sections: Architectural Dynamics and Architectonic Space Defined, respectively. The Dynamic Three-Dimensional Framework and Architectural Factor attempt to apply the method of architectural dynamics to the spatial design.

2.2 ARCHITECTURAL DYNAMICS

2.2.1 INTRODUCTION

Within the defined architectonic space (to be defined in 2.3), emotions evoked by a space can be primarily related to how the mind evaluates the perceptual surroundings, reflecting and coordinating the spatial coordination of the person in this space.

A number of hypotheses will be made in terms of the relevant factors, such as the coordination of viewing points, visual perception, the mind and weight sense and the human body. A number of modules can be produced by “The Modulor” in terms of the basic spatial volume occupied by the human body, being the reference cube, with which the modules keep a proportional relationship. The “quality” of the dynamics of the modules can be defined, and then measured in terms of this reference cubic space. There is a center, either a form or a space, intuitively perceived by a person, round which the modules may have to be organized in terms of their dynamic “quality”.

2.2.2 DYNAMICS OF SPACE AND RESULTING EMOTION

Perceptual dynamics conveys its host which is the “shape”. It can be said that a shape is the vehicle carrying the dynamics. To be seen as expressive, the shape of an object must be seen as dynamic.

Since matter creates space, there must be a dynamic presence in an architectural space as well. The dynamics should be clearly presented, without causing any ambiguity, since, psychologically, the appearance of the frame of a building needs to be as simple

as possible in people's minds⁵. No matter what kind of space it is, a space has to be created by something that gives clear character to the space, according to its relevant arrangement. This is perceived as people experience the space and perform their activities. The character of a space is clearly determined by its surroundings. Surroundings appear in a decisive situation and space in a passive one. Naturally, designers hope the character of their design will evoke an emotion that the users feel comfortable with.

A space, however, is not just empty, as it has a certain quality⁶. This quality is evident from the shapes that create this space. A visitor perceives the space and this space evokes a certain emotion of comfort, discomfort or indifference. The figure below demonstrates this quality within the spaces⁷ (Figure 2.1). If it is assumed that these

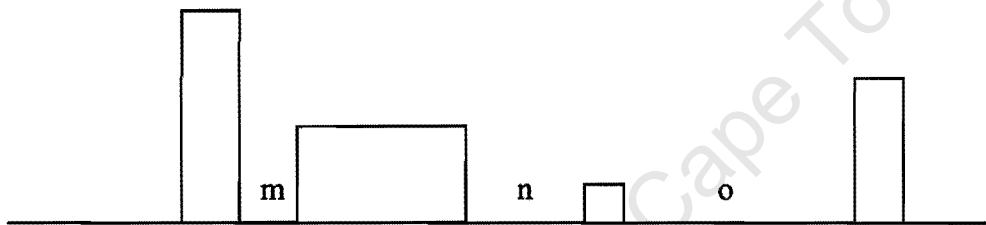


Figure 2. 1

⁵ In spite of what spontaneous perception indicates, space is in no way given by itself. It is created by a particular constellation of natural and man-made objects, to which the architect contributes. In the mind of the creator, user, or beholder, every architectural constellation establishes its own spatial framework. This framework derives from the simplest structural skeleton compatible with the physical and psychological situation. Under elementary conditions the structure established by the architectural layout as a whole may rule uncontested. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 18-22, 13).

⁶ A good way to demonstrate that interspaces are not empty is referring to what may be called their density. If one makes small models of our two buildings and moves them back and forth, closer together and farther apart, one observes that the interspaced looks looser and thinner as the distance between the buildings increases. Conversely, the interspaced becomes denser as the distance diminishes. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 17-22, 18)

⁷ Interspaced *n* will look smaller and denser when compared with *o*; it will look larger and looser when compared with *m* (figure 2.1) (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 29-31, 18).

shapes keep on shifting in this way until it is felt to be the right position at that moment, then this space can be said to be relatively more suitable than any other. There is a particular ratio of remoteness and connectedness users feel is “just right”⁸. Although this spatial “quality” is vague in that it cannot be measured, it can be represented by the “quality” of the shapes constructing this space.

The subject of this study is concerned with the exterior court space holding public activities and attempts to explore whether this particular ratio exists or not. An emotion might be evoked by the dynamics of its surrounding. A positive emotion will be aroused from the proposed space if the expectation of the public coincides with the intuitively expected⁹ emotion.

The psychological properties of verticality and horizontality are the basis of building symbolism¹⁰. This means that the dynamics of the surrounding is generated through the process of visual perception while the surrounding is interpreted in symbolic images in three dimensions. The condition of a person’s own existence means his body physically and temporarily occupies a space, which is a fundamental criteria source referred to as a spatial framework. This space can be viewed as a small cube. There may be a proportional relationship between the three dimensions, the symbolic images of his surrounding and this cubic space. If there are a number of modules, the proportional relationships of these modules and this cubic space can be established, enabling the dynamic “quality” of the modules to be calculated.

⁸ The inter-space, then, establishes a particular ratio of remoteness and connectedness, which affects the architectural complex as a whole. When we considered remoteness and connectedness are not simply metric distances but dynamically, we find that they depend on the forces of attraction and mutual repulsion: they want to be moved apart. At a somewhat greater distance the interval may look just right or the objects may seem to attract each other. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 36, 18-4, 19)

⁹ When the environment appears and behaves as expected, i.e. ... this generally produces a positive emotional response in the perceiver (assuming of course that the expectation was for a pleasurable, comfortable environment). (Lam. William M. C., *Perception and Lighting as Formgivers for Architecture*, McGraw-Hill. C, New York, 1977 pp 39-45, 34)

¹⁰ The psychological properties of verticality and horizontality would hardly be worth our attention if their dynamics did not greatly contribute to making buildings into symbolic images, in which man sees fundamental conditions of his own existence. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 13-16, 64).

A proposed architectonic space can be set up in terms of the dynamics. Firstly, all primary factors involved in affecting the dynamics are confined or eliminated except for the proportional ratio factor between the person and his target basically contributing to the dynamics. Secondly, the identification of the center comes from the intrinsic intuitive visual perceptual attributes of the mind. This identification is further reinforced by the ordering of the modules for a proposed space. An emotion can thus result from the three-dimensional dynamics. Thus, an emotion can be the response of the human body relating to the other modules within the defined spatial framework. Consequently, a desirable emotion, evoked by the proposed architectonic space, can be promoted by establishing the appropriate dynamics of its components.

This study attempts to design an architectonic space which will evoke an appropriate emotion by utilising the dynamics of the shapes. It is felt that this can only be achieved if a very specific architectonic space is defined. In 2.3 Architectonic Space Defined, factors, for example, how such a space is generated (Figure 2.2), the initial layout of the prototype, the source of the production of all the shapes/modules and the relationships of the dynamic variables of the contents, are described. The primary factors involved in these dynamics are also specifically discussed. In this attempt to define and rationalize the concept of dynamics, there are a number of factors involved in influencing perceptual dynamics, and these need to be strictly defined. These factors are noted and discussed later, and include how the proposed space is generated, shapes, space, order, the dynamic variable, co-ordination and viewing points, visual perception, sense of weight, the human mind and the human body.

As the concept of the “quality” of dynamics is defined, the process below indicates how the dynamics can be utilized. The dynamics will be applied in conjunction with the definition of a center of the proposed space. The center around which the modules are organised is discussed later in this chapter. This center is made prominent by the force of the dynamic connection of the “local” modules (Figure 2.2). The four local coordinates are determined by promoting the center and these coordinates are the points on the initial layout on which the proposed modules are crucially affecting that of the proposed space (see 2.3.6 and 2.5.5).

If the dynamics of that space can be clearly specified, the dynamic variables crucially affecting that of the proposed space can be inferred, since they can be assigned to the group of standard modules in terms of the definition of the dynamic “quality”. These dynamic variables can be compared in terms of the defined dynamic scale, which is defined in accordance with the human body, as noted in hypothesis four and discussed in the Scale of Dynamics. The two dynamic variables have to accommodate each other and this is the basis for selecting the properly proposed modules. Thus, the proposed modules imposed on the architectonic spatial framework can be selected from the standard modules.

In summary, an emotion emanating from an architectonic space might be evoked by systematically organizing the modules in terms of the “quality” of their dynamics within the defined three-dimensional framework. An appropriate emotion for the proposed architectonic space might be evoked by the dynamic variables of the modules crucially affecting that of these proposed spaces, which, if the “quality” of the dynamic variables is properly assumed, can be organized in a certain order within a defined spatial framework.

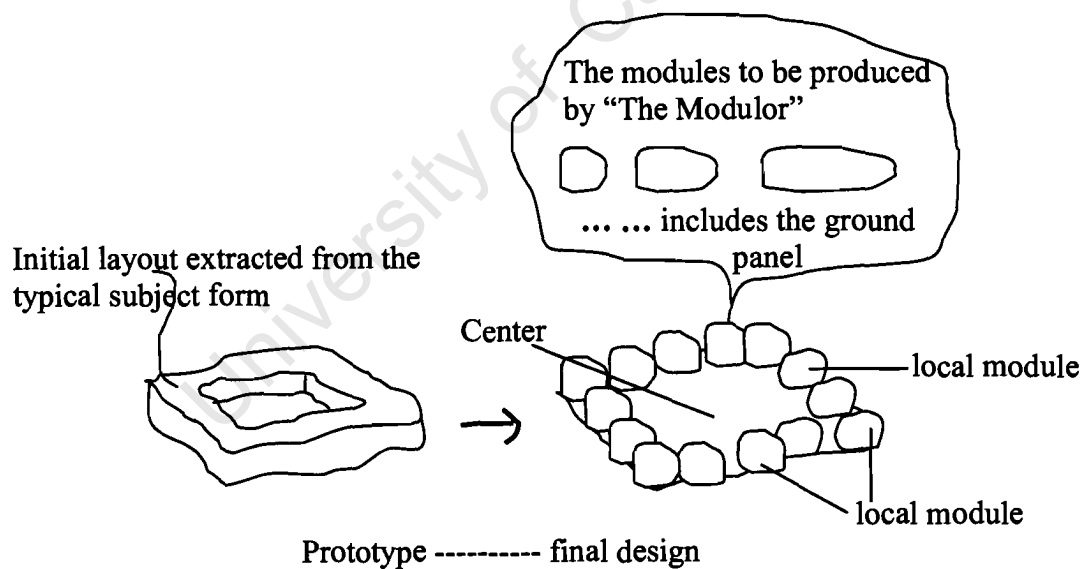


Figure 2. 2

2.2.3 “QUALITY” OF DYNAMICS

The dynamics of a shape can not be defined unless an architectonic spatial framework is defined, within which the scope of all the primary factors affecting the dynamics of this shape have to be systematically set up¹¹. Only then can it be defined.

FACTORS INFLUENCING DYNAMIC PERFORMANCE

The relevant factors can be demonstrated by presenting simple graphics showing the person and the central area of the public space where a viewer is standing (Figure 2.3). It is assumed that there is a viewer wondering within a finite boundary and standing in front of a shape that could be shifted freely horizontally, either forwards/backwards or right/left. The shape, intrinsic visual attributes and the mind form the basis of any perceptual dynamics. A spatial frame has to be defined in order to pursue the rationality of dynamics. The spatial coordination between the person and his ultimate position in the space affects perceptual dynamics, and this coordination is determined by the position of the shape and/or the location from which he is looking at this shape. Personal experience and background will be dealt with later. All these aspects contribute to the perceptual dynamics and the resultant emotion.

The basic factors involved in a person experiencing and appreciating a space have to be summarized in order to define the “quality” of the perceptual dynamics. Human existence, experience, perception and knowledge are the fundamental factors in satisfying

¹¹ Clearly, there are no fixed bounds in either space or time for any object. But relativity should not deter us from attempting to describe architectural objects with some precision. On the contrary, given a defined a framework, the interaction between the object and its context has objectively establishable effects. This framework must include not only the conditions outwardly presented to the perceiving mind but also those prevailing in the viewer himself: his mental preparation, his intensions and goals, his way of looking at things, and so on. For a valid analysis one has to make explicit both the frame work that is being considered and those potential influences which are being bracketed out. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 10, 68)

one's needs in a certain space¹². This helps infer the necessary factors. In order to realize one's own existence, a human being needs a physical space and to be conscious of one's body. The spatial layout has to be presented in a certain way in order to compare the contents, as well as the type of shapes that construct the space. Thus, an architectonic space has to be defined and the human body plays the role of a hub transferring spatial coordination into a kind of emotion. The proportional relationships between a visitor and his targets are obviously essential. Theoretically, the architectonic space can be defined letting this spatial proportional relationships play the primary role in establishing the proposed space. A group of buildings can set up this mutual relationship with the human body through human-sized buildings. This point appears to influence the general layout of the proposed built environment. The human-sized block has to be frequently presented and this can keep a proportional continuity between a visitor and his surroundings. The continuity can help human beings mutually interact with the buildings¹³. This is another of the important factors. Moreover, as a visitor is experiencing the space, the relative position between him and his targets keeps on changing consistently. This spatial coordination between him and his targets is, no doubt, an important factor. Furthermore, as the space is experienced, his visual perception and his mind process a very complicated process involving perceiving visual information and outputting the relevant emotion. Furthermore, the sense of weight is an intuitive consciousness of which there is no doubt. Thus, the primary factors are the architectural space defined, the coordination and viewing points, visual perception, human mind, weight sense and the human body.

¹² Thus the threefold contact of our human existence with the spatial datum of nature---physical experience of space, sensory perception of form and intellectual appraisal of size---give rise to the development of an architectonic space comprising inside and outside, of an architectonic form comprising line, plane and volume. Space, form and size then reflect in the house the three levels of human existence, and experience, perception and knowledge in their turn find in them the support they need. (Dom H. Van Der Laan, *Architectonic Space*, Copyright 1983 by E. J. Brill, Leiden, The Netherlands, pp. 17, 19).

¹³ If human beings are to interact with a building functionally, they must be united with it by mutual continuity. Huge though a building may be as a whole, it can make contact with the visitor by providing a range of sizes, some small enough to be directly relatable to the human body. These human-sized architectural elements serves as connecting links between the organic inhabitant and inorganic habitation. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 20, 133)

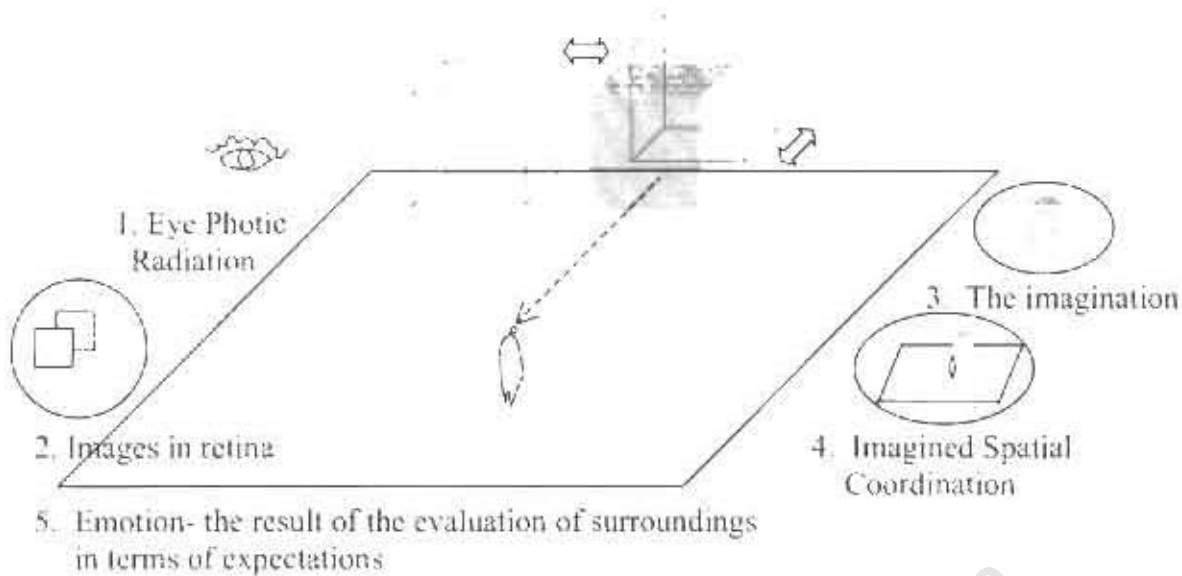


Figure 2. 3

Architectonic Space defined

The dynamics of a shape cannot be defined unless the architectonic space is defined. All necessary factors involved in perceptual dynamics will be within the scope of the space to be defined. The architectonic space is specifically discussed in 2.3 Architectonic Space Defined.

Coordination and Viewing Points

The perception of the space is generally, which means it is assumed that a visitor looks at the contents integrally rather than looking at each individual shape of the contents constructing the proposed space. Coordination here refers to the spatial coordinates between the person supposedly wondering around the central area of the space and his targets.

Three-dimensional changes of a shape are made in terms of their relative coordinates, by moving either the shape or the person in that space. As the person wonders in a space, the changes in his viewing point, as well as the changes of the visual movement of the shape into different positions, both contribute to the proportional perceptual changes. In order to define the degree of the dynamics, this spatial coordination has to be consistent. In an attempt to eliminate any perceptual dynamic influences from various viewing

positions, an ideal state needs to be envisioned. This ideal state is really a person going through the space, with every shape having an equal chance to be looked at, and the person eventually standing in a central area to look around the space. As an example, one can simply imagine a colourless and texture-less cube in front of a person (Figure 2.4). Both are within a finite boundary and the relative coordination between the person and the central point remain consistent. By this it is meant that the distance between the geometric center of this cube and the point representing a person remains constant. The changes of spatial coordination affected by his body movement can be eliminated in order to focus primarily on the spatial coordination affected by the proportional changes of the shapes, constructing the space. Thus, it must be assumed that the changes in the perception of shapes are consistently influenced by locomotive (changing) viewing positions in terms of the spatial coordinates between the person and the surroundings.

Before comparing the dynamic “quality” of the shapes, the local coordinate for these shapes has to be determined. If it is assumed that this cube changes its shape three-dimensionally, then the horizontal dimension perpendicular to the pre-determined coordinate, a locomotive area for a viewer, will not be changed around the central area of the boundary (Figure 2.4). As the coordination of the viewer around the central area can, therefore, be made with relative certainty, so can the accountability of the dynamics of a shape in terms of its proportional size. The three shapes “m”, “n” and “o” in the figure above are made by changing the volume of the initial cube in three dimensions. The increasing dynamic force indicated in “m” lessens the downward sense of gravity. The relatively solid sense of volume “n” can be perceived. The horizontal pressure force is felt in “o”. Thus, the local coordinates on the initial layout have to be pre-determined before the shapes supposedly imposed on this position can be compared proportionally.

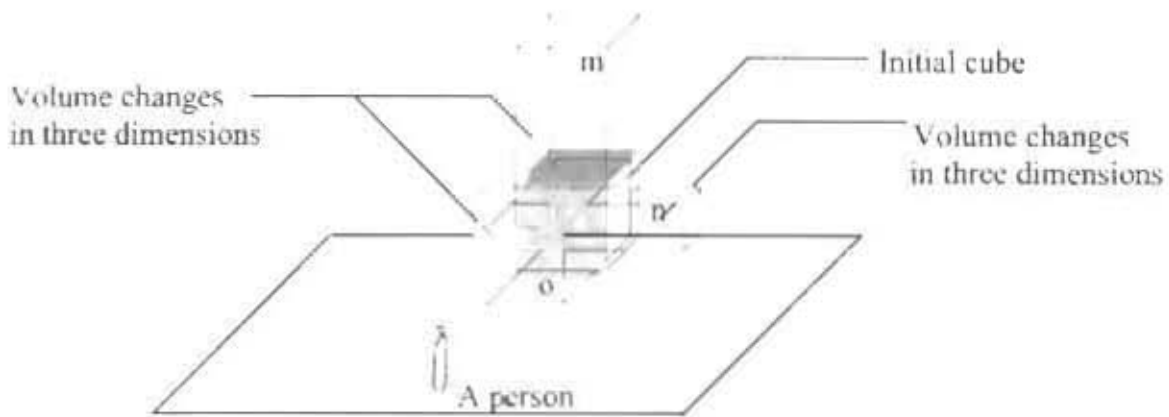


Figure 2.4

Visual Perception

Perceptually, the dynamic quality conveys a shape. This quality animates the subject and creates a certain impression. It animates every shape, such as a column¹⁴.

It becomes necessary to look at the reality of how the process of visual perception works. Physically, because of light, anything can be seen in the world. A shape is converted to an energetic quality, a photic radiation¹⁵ that is processed through visual perception. The visual perceptual process is, however, far more complicated, and any detailed discussion is outside the scope of this dissertation. When a direct stimulus is received by the receptor, called the retina, which is a two-dimensional surface, a copied image of a physical shape is imprinted. In order to proceed to the next section, Dynamic "Quality", a closer look at the specific management of photic radiation in visual

¹⁴ The dynamics animating a column, however, does not issue entirely from its extremities. The weight center established by the column itself is something made explicit by a swelling. Examples are the so-called bud-and-bell columns, imitating bundles of papyrus reeds, in Egyptian architecture. The swelling is greatest well below the column's center and thereby emphasizes upward movement. The same is true for the entasis of classical columns, which departs farthest from the straight line about one-third of the way from the base. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 11, 51)

¹⁵ Photic Radiation: to begin with, we shall abandon the term light as the name of the energy that effectively stimulates the eye. (S. Howard Bartley, *Introduction to Perception*, Memphis State University, Harper & Row, Publisher, New York, 1980, pp. 148)

perception needs to be made. This is a simplified description of how a pattern of light converts to electrical charges¹⁶.

Basically there are three stages in the visual perception process: the attributive stage, expectation stage and the affective stage. In the attributive stage, the raw data from the eye are interpreted, classified and given meaning by association. The expectation stage allows us to create extensions of the visible world in our minds: it is expected that a red sign inside a building which manifests the visual pattern 'EXIT' indicates a means of escape in time of danger, and the affective stage is concerned with how each stimulus affects our emotional or evaluative response to stimuli. It is the intention of the researcher to look at this in an abstract manner and not to deal with the process in any depth. Actually, the visual perception of a shape is the imaginary physical shape. According to biological evidence, an image pictured in a retina has a two-dimensional effect and a shape has a three-dimensional one. The third dimension is projected through one's imagination¹⁷. Thus, a shape may be seen as an imagined whole, grouping in people's minds.

A shape can theoretically be seen as an assembly of a number of planes¹⁸ into an imaginary whole. Perceptually, any change of a shape has to be seen dynamically. Consequently, the dynamics of a shape can be assumed to be an assembly of the dynamics of its visible planes. The dynamics is the result of a visual mechanism as the

¹⁶ Let us trace a somewhat idealized and simplified form what happens to a visual stimulus as it is received by the eye and converted into a perception. A pattern of light passes through the lens of the eye, which focuses the image on the nerve cells that make up the retina. In and of itself, the pattern of light and dark and color has no inherent meaning despite the fact that it could be quantified, measured, and described---so much light of such and such wavelength here, a darker area of such and such a size there, etc. The cells of the retina convert the pattern into raw sensory data---a complex matrix of electrical charges of various strengths---and send them coursing along the pathway of the optic nervous system to the brain. (Lam. William M. C., *Perception and Lighting as Formgivers for Architecture*, McGraw-Hill. C, New York, 1977, pp. 33, 31 -3, 32).

¹⁷ The third dimension in space gave the conventional theory trouble. The third dimension was not conceived as representable on the retina, since the retina is only a two-dimensional manifold. (S. Howard Bartley, *Introduction to Perception*, Memphis State University, Harper & Row, Publisher, New York, 1980, pp. 11-14, 281)

¹⁸ The first major realization to be made regarding the texture-gradient concept is that the concept implies that all surfaces function as components of a macrotexture of the visual field as a whole. Many surfaces are themselves physically differentiated in some way and are thus seen as textured. (S. Howard Bartley, *Introduction to Perception*, Memphis State University, Harper & Row, Publisher, New York, 1980, pp. 22-27, 283)

visual perceptual system manages oncoming visual information and there might be some intrinsically legitimate principles in the process of this management. This could have common attributes of human beings.

In summary, the impression that the dynamics of a shape gives can be synthesized and assembled by means of its planes. This leads to the postulation of the first hypothesis that the dynamics of a shape is an assembly of the dynamics of its visible planes in configuration with a synthesized dynamic impression.

Human Mind

If asked to give opinions on an architectural space, people would probably respond very differently but if the target/architectural space is restricted to a certain kind of space, then the diverse opinions may become more contained (Figure 2.5). The involvement of the factor of personal experience may be dramatically reduced by strictly defining the subject and the other related factors¹⁹. Using this analogy, the space studied hopefully limits the responses in terms of experience.

In this proposed architectonic space, the factors involved in influencing visual dynamics are strictly defined or eliminated and only the three-dimensional changes of the verticality or horizontality of the shapes contribute to perceptual dynamics. Human beings perceive everything physical in the world as due to the intrinsic attributes of visual perception, such as shape and size constancy. Through the visual perceptual process, there are eternal physical transfers to psychological properties of verticality and horizontality. There could be some common intrinsic attributes to help them become recognizable information. Moreover, if the fourth hypothesis is correct, the human body

¹⁹ In trying to clarify these relationships for myself, I have been greatly helped by a simple diagram (Fig 2.5), in which T indicates the target viewed while A, B, C, D are different observers. If we restrict our analysis to the cultural and individual conditions prevailing in the observers, we proceed without any knowledge of the perceptual object they are receiving; and we are left with the absurd and distressing conclusion that since they all see different things, there can be no shared experience and no communication. If on the other hand, we restrict our analysis to the target T, we ignore the substantial modifications introduced by the point of view of any individual or collective observer. In this equally one-sided way we can get at the common core, but we cannot tell what happens to it in a particular instance.” (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977. pp. 21-38, 5)

may indeed be a reliable reference from which analyse surroundings, from this restrictive point of view, in order for people to react in a similar way.

In raising the fourth hypothesis it is assumed that one's personal experience will not have much effect on analysing the appreciative emotion but that it comes rather from the intrinsic attributes involved in the defined architectonic space.

It is assumed that the internal visual mechanism is basically the same for every person and that this forms the basis for establishing an impression of an architectural space. It is further assumed that personal experience will not interfere much with dynamics.

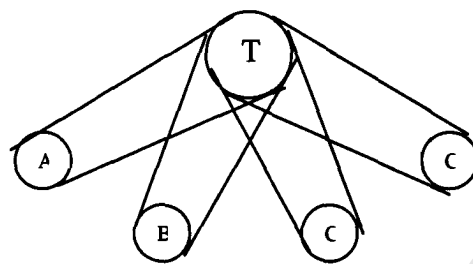


Figure 2.5

Weight Sense

Downward gravity weight sense is an intrinsic property of a perceived shape. In this study, all shapes are rectangular, defined within the spatial framework and without texture or colour. Thus, the changes in the sense of weight of these shapes only come from varying the three-dimensional sizes of the shapes. What the impact of the sense of gravity is on the dynamics of the shapes is postulated in the third hypothesis and synthesized in the section under Dynamic Type below.

Human Body

The human body can help a person understand a building²⁰ as his body is a direct and

²⁰ We have carried heavy loads and have known pressure and counterpressure. We have collapsed on the ground when we no longer had the energy to oppose the downward pull of our own body's weight. That is why we are able to appreciate the proud happiness of a column and to understand the tendency of all matter to spread shapelessly on the ground. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 6, 212).

reliable reference for appreciating a built environment and it serves as an interpreter of the emotion as expressed by a shape²¹.

Furthermore, from the architectural point of view, a physical human body can be seen as a cube measuring $2260 \times 2260 \times 2260 \text{mm}^3$ and this measurement is seen as the fundamental unit reference for the other modules. "The Modulor", referring to this unit, can produce a number of the modules. There are three reasons for the specific size of this unit. Firstly, the height of an average person, with the arm raised, is 2260mm according to 'The Modulor'²². Secondly, the size of the initial square is determined from the module production panel²³ (or see Figure 3.1 c). The $2260 \times 2260 \times 2260 \text{mm}^3$ cube can, thus, be produced and used as a fundamental reference²⁴ to the other proposed modules.

The process of creating images in one's memory is similar to that of a laser scanner²⁵. Analogously, it is imagined that there is a spatial framework, which is a huge cubic space with internal planes scaled at $2260 \times 2260 \text{m}^2$ (see 2.4.2). The image of the planes of the shapes imposed on this framework appearing in such a visual field can proportionally be compared with each other. The relationship between the human body and the other modules can be interpreted as a proportional ratio of the relevant

²¹ Wolfflin bases his theory of perceptual expression on the assertion that "the organization of our own bodies is the form that determines our apprehension of all physical bodies." He further proposes that the "fundamental elements of architecture, namely, matter and form, gravitational weight and force, depend on experiences we have had within ourselves. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977 pp. 6, 212).

²² These three measures (113-183-226) define the occupation of space by a man six feet in height. (1) footnote: 113 the solar plexus; 182 the top of the head (relationship \varnothing of 113); 226 the tip of the fingers of the upraised arm. (Le Corbusier, *The Modulor*, Faber and Faber Limited, 3 Queen Square London, 1954, pp. 4-5, 65)

²³ Figure 33 & Figure 34 (Le Corbusier, *The Modulor*, Faber and Faber Limited, 3 Queen Square London, 1954, p. 85-86)

²⁴ The series RO begins at zero and stops at 1.828m. (72inches): the series BL starts at zero and stops at 2.26m (89inches). They culminate in a unit by volume---a cube with sides measuring 2.26m. -- which, it seems to me, is well worth taking into consideration in matters pertaining to building. (Le Corbusier, *The Modulor*, Faber and Faber Limited, 3 Queen Square London, 1954, pp. 18-22, 84)

²⁵ A laser scanner, as used for the input of images to a computer, provides a clear model of this. The scanner treats the visual field as an array of small, square cells (pixels) and scans it to produce a corresponding array of numerically encoded intensity levels. (Mitchell, William J (William John), *The Logic of Architecture*, Cambridge, Mass: MIT Press, 1990, pp. 27-31, 2)

dimensions, by referring to $2260 \times 2260 \times 2260 \text{mm}^3$.

In a design process, the proposed shapes are organized in terms of a certain order and the local coordinates can be determined within the defined spatial framework. In the second hypothesis, the dynamic “quality” of a shape can be calculated between a proposed coordinated shape and the reference cube, by comparing the ratio of the two dimensions of the relevant parallel planes. (The relevant planes of one of the proposed modules and the reference cube are always parallel to each other).

The human body is also the dynamic perceptual center, since it is the carrier of perceptual and intellectual facilities that are used in experiencing the spatial environment. Different types of architectural spaces have a particular arrangement of space according to the activity performed. The center of an architectural space should be where public activities are most experienced. Thus, the area of the major activities experienced in the space should coincide with the central area of the form of the proposed space intuitively expected by people.

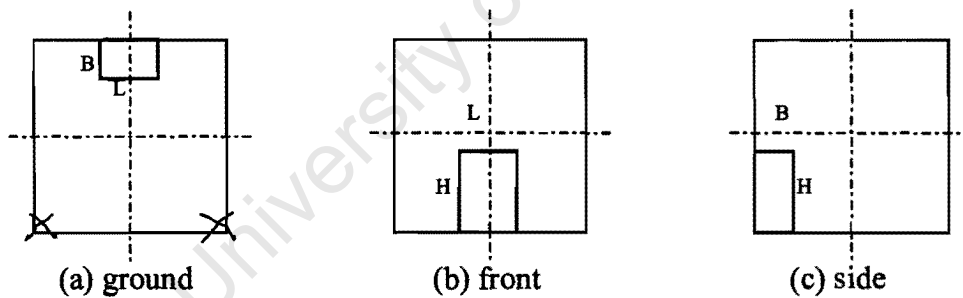
Definition of “Quality”

The three-dimensional changes are the primary factors that cause a shape to change. Three-dimensional changes of a shape can represent the dynamics of the shape. Geometrically, a ratio of two dimensions of each of the planes can express the three-dimensional changes of this shape. The formation of a surface can be seen as a continued movement of a line from one edge to the other in either dimension, disregarding its direction of movement. Surfaces of a shape can be represented by measuring their edges²⁶. Geometrically, it does not matter what direction the movement of the line takes. However, perceptually the ratio of two dimensions of a plane gives a visual orientation tendency: dynamics. Two dimensions of a plane can be thought to represent the two dynamic tendencies compromised in a single plane.

²⁶ Volume is not bounded by line directly, but only by way of surface; we know the size of a volume by the size of its bounding surface, which in turn borrow their size from the measure of their bounding edges. Thus here we meet not with a dyad, as with space and form, but with a triad: line-plane-volume. Through the union of these three elements in the squared form of the mass the conflict inherent in measure is over come. (Dom H. Van Der Laan, *Architectonic Space*, Copyright 1983 by E. J. Brill, Leiden, The Netherlands, pp. 32, 18-4, 19).

The “quality” of the dynamics of the modules can be defined within the scope of the study and the defined spatial framework. This definition is based on the first and second hypotheses that, from the architectural point of view, the dynamics of one of the shapes is an assembly of those of its planes (ground, front, and side planes) and that the dynamic “quality” of a shape between a proposed coordinated shape and the reference cube can be calculated by comparing the ratio of the two dimensions of the relevant parallel planes. The definition of the dynamic “quality” can therefore be summarized and the surfaces of a shape can be represented by measuring the edges and it can be collectively represented by those of the planes. Practically, the dynamic ‘quality’ of planes is more directly perceivable and applicable than that of their host. However, the dynamics of the modules can only be accountable through that of its planes.

A simple example shows how the dynamics of a module is represented by the planes (Figure 2.6). The dynamics of the front elevation can be calculated. It can be expressed as the ratio of Length (L) / Length (the reference cube) and Height (H) / H (the reference cube) in two dimensions respectively. Those of the other planes, that is, the ground and side planes, can be expressed as a similar ratio. The dynamics of the modules becomes the imagery of its accumulated planes.



Figures 2.6 a, b, c

The motivation for doing this is that the dynamic “quality” of the modules can be compared and selected in response to that of the proposed space assumed (the number of the modules, the local coordinates and the order are determined).

If the coordinate on which the proposed module is going to be imposed is pre-determined and the dynamics of the interspace predicted in terms of the architectural

theme, as well as the group of the modules, the proposed modules can be selected accordingly.

An extension based on the second hypothesis can be made. The stronger the dynamic “quality” in one prevailing dimension of a plane, the longer the dimension is, disregarding the actual dynamic tendency. This point will be applied in inference to the dynamic variables.

DYNAMIC TYPES

Dynamics can be divided into two types. The first one is the dimension of dynamics, which is the focus of this study and is influenced by the proportional changes of a shape itself and orientated in three dimensions. The other is linked to the sense of gravity, which is a perceived intuitive sense. It is also affected by the three-dimensional changes of a shape. However, the height of a shape is its major influential factor.

Dimensional Dynamics

Any changes of a shape contribute to this kind of dynamics appearing in three dimensions and is greatly influenced by the changes. As in the first and second hypotheses, this form of dynamics can be rationalized in terms of its proportional changes within the defined spatial framework.

Weight Sense

There is always an intuitive vertical downward sense of gravity or weight sense of a shape and this is primarily related to the height of a shape. Downward gravity weight sense is an intrinsic property of a shape and it is always downward due to its attraction to the center of the earth.

The dynamic impression of a shape is a synthesis of the dynamic performance of the two types. Dimensional dynamics is the focus of this study. However, the impact of gravity has to be considered since changes of a form can shift the reallocation of its

weight center and this shifting stimulates the dynamics of a shape²⁷. This indicates that proportional changes of a shape can result in a different impression of that shape.

The intensity of weight sense and the weight center can be changed dramatically by the factor of height. Height is always an important element influencing the weight sense. If this factor consistently plays a very big role, then vertical dynamics is more dominant. A change in an object's height changes its visual weight. The weight relationship between different parts of a building depends on its height, and therefore the compositional place and function of any element of an architectural design has to take the factor of height into account, especially those shapes whose vertical dynamics is dominant.

However, the impact of gravity can be eliminated from some of the proposed modules. Firstly, for the purposes of this study, the modules are texture-less and colourless and the impact of this sense of gravity is incorporated in the third hypothesis. Secondly, the number of architectonic spaces presented are very similar and built on the same base except for the modules proposed at certain local coordinates. These proposed modules do not differ much in size and the impact of weight sense on most of these proposed modules can be ignored.

The third hypothesis contends that the sense of weight does not function in the modules generally imposed (refer to the relevant definition) in the defined spatial framework but in those with vertically dominant dynamics, crucially affecting the dynamic variable of the proposed space.

DYNAMIC PROPERTY

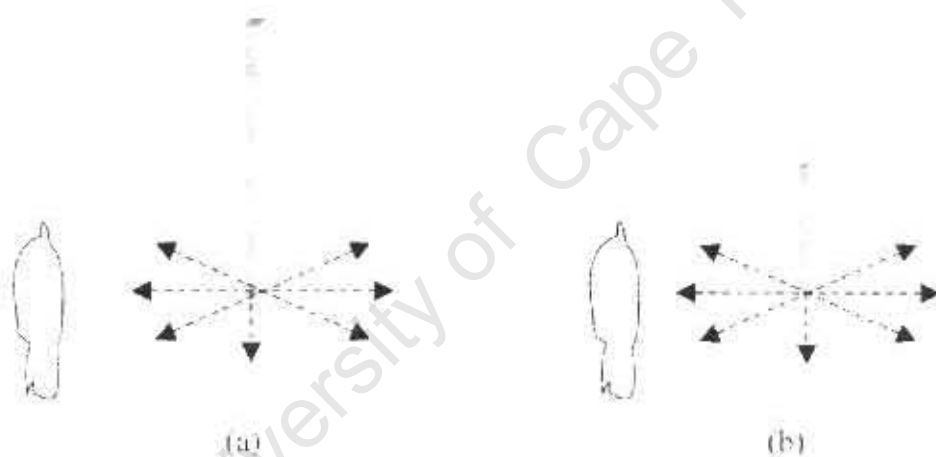
The properties fundamentally describe the character of the dynamics. Orientation is one

²⁷ The weight center established by the column itself is sometimes made explicit by a swelling. Examples are the so-called bud-and-cell columns, imitating bundles of papyrus reeds, in Egyptian architecture. The swelling is greatest well below the column's center and thereby emphasizes upward movement. (Rudolf Arnheim *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977 pp. 12-16, 51)

of the properties of dynamics since dynamics has intrinsic attributes of orientation tendency²⁸ and a building can be characterized by this tendency²⁹.

The sense of horizontal and vertical dimension is a psychological property of our visual perception. This can be proved by means of an experiment. A laser scanner, as used for the input of images to a computer, provides a clear model of this. The scanner treats the visual fields as an array of small, square cells (pixels) previously mentioned. Thus, the other property of dynamics is its three-dimensional orientation. It therefore follows that the three-dimensional orientation is the basic property of the dynamics.

The dynamics always accompanies the degree of force perceived by a person. The example demonstrates this. The increasing power of the column in Figure 2.7 (a) is stronger than that of the column in Figure 2.7 (b). Thus, another property of the dynamics is the degree of force. This is in line with the definition of the dynamic quality previously discussed and which can then be calculated.



Figures 2.7 a, b

²⁸ Dynamics has generic qualities, such as straightness or flexibility, expansion or contraction, openness, or closeness. These dynamic qualities are perceived not only as particularly visual characteristics of a particular object, but as properties of a very general nature. They are experienced as ways of being and behaving, to which we may find analogies, for example, in our own mind. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 26-31, 253).

²⁹ Gaston Bachelard describes this in another way: "Our image of a building is characterized by two qualities: we perceive of it as vertical and as centralized (figure 2. 7). Gaston Bachelard. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 10-11, 36).

Verticality

Vertically dominant perception means that a shape has a sense of upward orientation. The dynamic tendency of a shape is the overall impression of its planes. This orientation tendency is determined by the dominance of one of the two dimensions of the plane. The world is three-dimensional, as is the proportional changes to the modules. For example, in Figure 2.7, the ratio of the two dimensions between the height and width of each of the planes of (a) is much bigger than that of (b). The vertical dimension is in line with that of the height of the shapes and the vertical upward dynamics of the column in (a) is stronger than that of the column in (b).

Verticality defines the other dimensions and acts as a reference for all other directions in space. In verticality vision takes the upright position. The vertical orientation is primarily related to the height of a building and is divided into two orientations: upward and downward.

A proportionally high building can ease the gravity of its weight and evoke an emotion related to this symbolism. A typical example of this is the great symbolism of the upright figure used powerfully in religion³⁰.

Horizontality

The horizontal is the realm of activity. Most activities are performances parallel to the surface of the earth. Almost all the space that provides activities is horizontal, except the effort spent in vertical movement. The surface of the earth is horizontal, the ground is horizontal, and so is the floor. A feeling of safety is felt if activities are performed in a horizontal space, because of the familiarity of this orientation. It is not possible to relax while stepping up or down, as it is necessary to keep one's eyes open to watch the movement, in an effort to keep a balance. Thus, horizontality is an enjoyable orientation presenting the emotion or feeling of the presence of nature, of stability and the involvement with physical experience emanates as the primary subject of the design.

³⁰ William Golding's novel, "The Spire", tells the story of a medieval churchman who adds a spiral tower to his cathedral as a perilous monument to his devotion and ambition. "Golding's story shows, first of all, the dimension of verticality still intact, visually as well as ideally. Only because the tower alone reaches beyond its environment into virgin space can it serve as the architectural fulfillment of a climactic aspiration. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 20-32, 64).

Any horizontal changes in a space result in a relevant dynamic change corresponding to emotional changes as well. A change of distance between two persons can evoke emotions, thus a change in distance brings about a change in emotion as the personal and social attitudes can be affected by spatial location³¹. The change in the horizontal position between a person and his target also represents emotional change. This depends on the architectural arrangements. If there are a few shapes in front of a person that are different in size, in the shorter distance that person would feel the dynamic pressure of the biggest one to be stronger than the smaller ones in the longer distance.

Degree of Force

Dynamics conveys a kind of degree, either extremely strong, strong, or weak. It can be expressed as a “quality” of the dynamics, but the so-called degree is less precise. In the hypotheses, it is postulated that the degree/quality of the dynamic force of a shape is represented by those of its planes, and its orientation follows the synthesized orientation tendency of its planes. Although the degree of the dynamic force of one of the planes can be collectively represented by the ratio of its two dimensions and the dimensions of the fundamental reference, the character of the dynamics of a plane always follows that in the prevailing dimension.

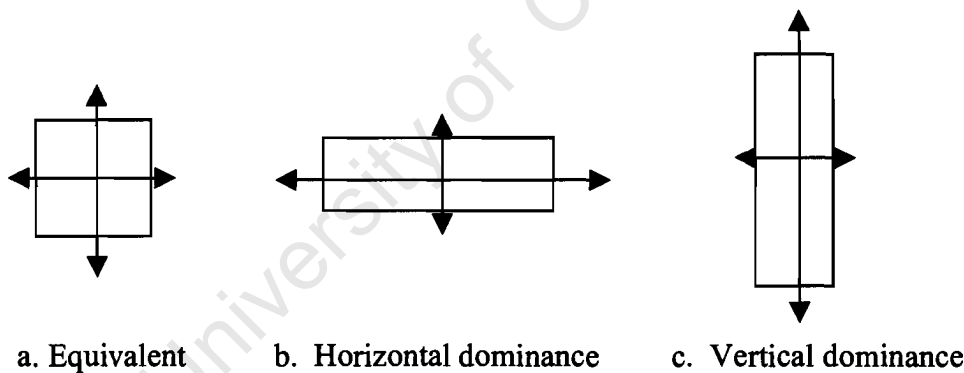
EXPRESSION

Dynamics of a shape is a kind of psychological effect and, therefore, also discussed possessing three-dimensional properties. This is in line with the psychological properties. The psychological properties of verticality and horizontality greatly contribute to making buildings into symbolic images in which man sees fundamental

³¹ In recent years, especially through the work of Edward T. Hall, attention has been drawn to the psychological and social connotations of spatial distances between people in daily intercourse. How close together or far apart people are expected to be when they meet depends on their personal relationship and more generally on the social conventions of the particular cultural settings. These “proxemic” norms influence also the choice of preferred distances between buildings. What looks oppressively close to one kind of observer may be welcome as cozily protective by another. These personal and social attitudes overlay and modify the specifically perceptual factors I am discussing here. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977 pp. 4, 19-8, 20).

conditions of his own existence. Since the dynamics represented resorts to three dimensions and each of the two dimensions of a plane synthesizes all the lines along the same dimension, a plane can be thought of being comprised of lines. Thus the symbolic three-dimension may represent the emotion that is supposedly to appear. The dynamic orientation can be expressed in symbols (Figures 2.8 a, b, c) and this may help a designer to analyze a design in terms of the dynamics. The spontaneously perceivable analogy between the visual characters, the behavior of an object and the corresponding mental or spiritual character and behavior relies on very generic attributes, such as height or depth, openness or enclosure, outgoingness or withdrawal.

Every form has its own either horizontal or vertical orientation. With the input of the horizontal and vertical dimensions to a receptor, the visual perceptual system can be sorted into an array of physical stimuli and the output can be a corresponding array of symbols, stored in the memory and recording qualitative and quantitative attributes. The array of the dimensional symbols stored is the internal basis for triggering the relevant emotion.



Figures 2.8 a, b, c

Form a: no dominant orientation;

Form b: horizontality is the dominant orientation;

Form c: verticality is the dominant orientation.

2.2.4 SCALE

There are two scales to be discussed. One is for the modules and the other for the proposed space. Their relationship will be discussed in 2.3.6 Dynamic Variable. The general concept needs to be discussed first, before the specific ones.

Scale is the assigning of numbers to objects according to a rule.

OBJECT

For the specific purpose of this section, the objects for the dynamics “quality” scale refer to a group of modules produced by “The Modulor”. The objects of the dynamic scale of the space are the number of these architectonic spaces.

RULE

The fundamental unit of reference, the cube, as a rule, simulates a human body. As in the definition, the dynamic “quality” is assigned in terms of this reference unit. A linear scale in conjunction with the level of the dynamics of the proposed space will be constructed.

ASSIGNING OF NUMBER

What is a measurement? An example could easily be drawn to explain this concept. However, the researcher is more interested in the accuracy of reflection of a measure rather than the concept itself. Any measurement has a relative degree of accuracy in terms of the relevant matter to be measured. This diagram can be representative of any measurement³² (Figure 2.9).

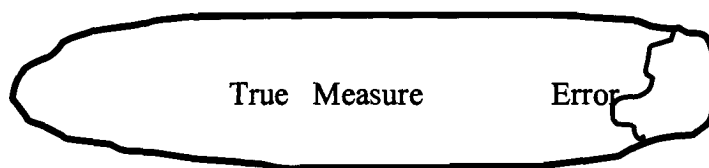


Figure 2.9

³² any measure could be represented as shown in the figure below. (A. N. Oppenheim, Questionnaire Design, Interviewing and Attitude Measurement, New Edition, Pinter Publishers, London and New York, 1966, 1992, p. 15).

The overall shape represents the reading or observation; the true measure is that part of the reading which is required - it is an indicator of an attribute of something or someone, for example, length, musical ability, blood pressure; error is that part of the measurement that is not required. The wavy line between the two parts indicates that there is rarely any certainty about the exact size or location of the components. The diagram is an abstraction; it shows that the measurement is known to be “impure” or “contaminated” but by how much or in what way is not always known.

Since the linear scale is one of the most recognizable scales, it is used in this research making it approachable and user-friendly. The linear-scaling model is used as the structure of the measurement scale. This supposedly meets the basic requirements³³. The establishment of the measurement scale for this survey is associated with these requirements and in this way it is hoped that such a measurement scale can be set up to rank concentrated emotion.

In association with the objective of this study, an overall shape is required to create a measurement for the dynamics of the modules and the architectonic spaces. For example, the true measurement is the reading of the levels of the convergent dynamics of the spaces that act as an indicator of an attribute of the architectonic space. Error is that part of the measurement that is not, in fact, required, and this error could result from many different causes. The relevant architectural theories are used to construct a number of architectonic spaces each of which supposedly evokes a level of convergent dynamics. As the perspectives of each of the architectonic spaces were presented to the respondents and studied by them, the researcher required to know what they thought about the level of the proposed convergent dynamics, and if the respondents thought one emotion was more preferable. After looking through all the architectural perspective presentations the respondents ranked the convergent dynamic levels by means of the measurement scale. Moreover, the objective of the study is narrowly defined to evoke an appropriate convergent dynamics. Hence, the necessity of setting up a measurement scale for ranking

³³ 1. uni-dimensionality or homogeneity, 2. reliability,, 3.validity, 4. linearity, equal or equal-appearing intervals, 5. reproducibility. (A. N. Oppenheim, Questionnaire Design, Interviewing and Attitude Measurement, New Edition, Pinter Publishers, London and New York, 1966, 1992, pp. 28, 187---27, 188).

these dynamics so that the rational relationship between the concentrated emotion and dynamics can be identified.

Dynamic “Quality” Scale

In terms of the definition of the ‘quality’ of the dynamics, the assigned number for the dynamics of the modules is basically the ratio between the reference cube and the practical module. Thus, the scale of the dynamic variables of the modules can be seen as the proportional ratio of the relevant planes to that of the fundamental unit, being that of the cube measuring $2260 \times 2260 \times 2260 \text{mm}^3$. This scale measures the dynamic measurement between the modules so that the dynamics of the modules can be compared.

The “rule” or fundamental unit is the cube of $2260 \times 2260 \times 2260 \text{mm}^3$. There are two reasons for this. This study focuses on the relationship between emotion and proportional changes of the shapes. The human body is a reliable reference to intuitively analyse surroundings. Wolfflin bases his theory of perceptual expression on the assertion that the organization of our own bodies is the form that determines our apprehension of all physical bodies. Secondly, this cube measurement of $2260 \times 2260 \times 2260 \text{mm}^3$ should be the smallest volume within the proposed space and it is considered to be the fundamental unit³⁴. This helps set up an entire spatial network³⁵. Wolfflin then went on to discuss the ratio governing the dimensions of the human body and to propose that the dimensions of a building are derived from the basic module by using a system of ratios related to that of the body. This supports the fact that the human body can be viewed as a cube and it relates to the measurement.

How is this done? Consider Figure 2.10. The four shapes of the two-dimensional panel of the boundary are produced by “The Modulator”. In this example, shapes B and D are two cubes using the fundamental units of $2260 \times 2260 \times 2260 \text{mm}^3$ respectively. There

³⁴ This fundamental unit should be the smallest reference in this system. To take points as the primitives of a design world is to initiate an exploration of formal possibilities in a very low-low, atomistic way --- much like considering the physical world purely at the atomic-- much like considering the physical world purely at the atomic and molecule level, painting in a pointillist style like that of Seurat, or examining a building in brick-by brick fashion. (Mitchell, William J (William John), *The Logic of Architecture*, Cambridge, Mass: MIT Press, 1990, pp. 6-11, 39).

³⁵ The Greek, Vitruvius, suggested “a correspondence among the members of an entire work, and of the whole to a certain part selected as standard.” (Mitchell, William J (William John), *The Logic of Architecture*, Cambridge, Mass: MIT Press, 1990, pp. 25, 27 and figure 2.1, 2.2).

is a figure imitating a person in front of the modules. The planes facing this viewer are the front planes. “H, l, and b” represent the height, length and breadth, respectively. The coordinates of these modules can be pre-determined in terms of the proposed theme of this architectural space. The ratio of $L_a : 2260\text{mm}$ to the $H_a : 2260\text{mm}$ of the front plane represents the dynamic variable of the front planes of module A in two dimensions, respectively. Similarly, the dynamic variables of the other two planes, the ground and side planes, can be calculated.

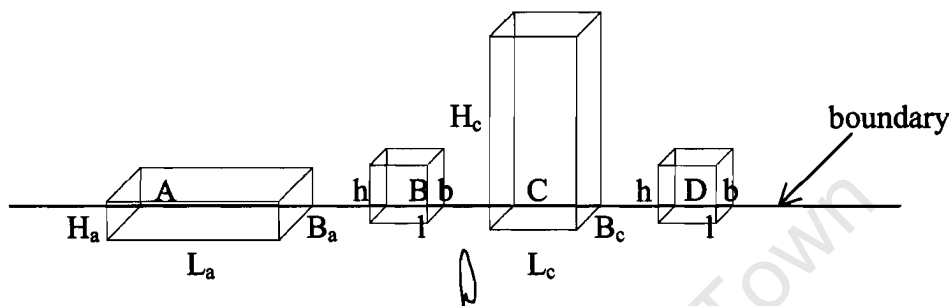


Figure 2.10

The dynamic “quality” is defined in terms of the proportional ratio of the relevant dimensions between the cube $2260 \times 2260 \times 2260 \text{ mm}^3$ and the modules. The scale of the dynamic measurement is an extension of the second hypothesis. The dynamic “quality” is naturally comparable in terms of its definition. If the local coordinates are determined within the defined spatial framework, each of a certain number of the modules can be compared with each other. One implication of this is that if the fundamental unit cube acts as a reference, it should be frequently present in the construction of the proposed space³⁶. This will be applied to the practical design in Chapter Three.

Comprehensibly, if there are a number of modules, their dimensional dynamic “quality” can be calculated and represented by means of numerical quantity. These

³⁶ The fundamental unit will appear in the proposed architectural space in a relatively large numbers. This will reinforce the dynamic relationships of all the other modules. When the architect discovers proportional sets that have become meaningful to users and reconstitutes them in new environmental contexts, a link is formed between the experiential resources of the users and his environment. (Herb Greene, *Mind & Image*, The University Press of Kentucky, Copyright ©1976, Kentucky, pp. 2-17, 139).

quantities can be ordered, say from the biggest to the smallest, and from the strongest to the weakest. How many levels there are depends on the number of modules to be compared.

Convergent Dynamic Variable Scale

This scale looks at the dynamic measurement from a broader point of view, normally a group of modules in a space rather than one single module. It is set up by a group of modules peripherally allocated on the square-formed ground. This is specifically presented in 2.3.7 Convergent Dynamic Variable Scale.

2.2.5 CENTER - DYNAMIC ORDER

The existence of natural law in the universe cannot be denied and almost everything in the world has its exclusive order of visual properties organized in terms of the presentation of its features. This applies to architecture, too. A building should be designed systematically³⁷ in a certain order. Order plays a fundamental role in architectural design as does form and space. It is the basis of organizing components of a design framework³⁸. It must, therefore, be understood as indispensable to the functioning of any organized system, whether its function is physical or mental. Just as neither an engine nor an orchestra nor a sports team can perform without the integrated cooperation of all its parts, nor can a work of art or architecture fulfill its function and transmit its message unless it presents an ordered pattern. It is a universal law that there is a center round which relevant matters are organized and the center of a form, especially a symmetrical one, can be intuitively identified. Therefore, along with the objective of this

³⁷ Almost any architectural setting is a highly complex constellation of such spatial systems, some subordinated, some coordinated, some bordering upon each other, some crossing or surrounding others. At its comprehensive level the setting may be the shape of an entire city, composed of distinguishable boroughs, each of which is made up of isolable parts, with these (Rudolf Arnheim *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 4, 15)

³⁸ Order is possible at any level of complexity: in status as simple as those on Easter Island or as intricate as those by Bernini, in a farmhouse and in a Borromini church. But if there is no order, there is no way of telling what the work is trying to say. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 10-21, 162)

study, the center is seen as the fundamental order in this study round which the proposed modules are organized.

Center of Space

Almost everything has a center. The sun system cluster has a center as has the earth. Prominent matter usually performs at the center³⁹. However, not only can a dominant mass be perceived as a center but it also can be a point of a space which can be physically invisible. A center of a form or a space can be perceived by using intellectual intuition. Therefore the center of a form, especially a symmetrical form, can be identified without any indication there⁴⁰. For a circle, the center is indicated geometrically as the point where the diameters cross. But distances, connections and locations are invisible; they are made visible only through objects. They can give a center perceptual or intuitive definition by inference and construction, but they cannot make it directly visible. It takes dots, or lines, or other suitable shapes to do that. No matter what an object is, the center of a plane can be intuitively induced⁴¹. The induction of a center of a square can be made

³⁹ Cosmically we find that matter organizes around centers, which are often marked by a dominant mass. (Rudolf Arnheim, *The Power of The Center*, University of California Press, Berkeley and Los Angeles, California, 1982, pp 4-5, vii)

⁴⁰ In geometry, I said, a center may be determined without being made explicitly visible. The same is true for configurations organized and held together by intuitive judgment. The center of a circle can be visually present without being marked explicitly by, say, a black dot. The black dot would give the center 'retinal presence'. This means that it is represented in the physiological pattern of retinal stimulation created by a corresponding pattern in the physical world. A black dot in the center of a circle drawn in ink on a piece of paper will be registered in the retinal projection of any healthy eye that focuses on that paper. Such a registration, in turn, is the physiological precondition for the dot being perceived as a part of the line figure. This is what is meant when the black dot is said to be 'really there', as distinguished from the center introduced into the visual image indirectly, by induction. Induction is the perceptual process that enables features to appear in a visual image without their having retinal presence. (Rudolf Arnheim, *The Power of The Center*, University of California Press, Berkeley and Los Angeles, California, 1982, pp. 21-34, 3)

⁴¹ As long as one is dealing with a pattern in a two-dimensional plane, the center around which the whole pattern can readily be determined by intuitive inspection. This is true for drawing and painting. It is also true for architecture as long as we are looking, for example, at the centerpiece of the façade of a building or at an obelisk marking the center of a square. (Rudolf Arnheim, *The Power of The Center*, University of California Press, Berkeley and Los Angeles, California, 1982, pp. 1-3, 7 and Figure5).

just as well and this is also an intuitive judgment. Some intrinsic attributes of visual perception help recognize what a physical shape really is, such as its shape and size consistency. Moreover, this intrinsic ability of the human being can also be applied in architectural space. The prototype of the initial layout of the proposed architectonic space is basically a square-formed layout. Some of the attributes of perception such as the shape and size consistency help people recognize this form as it is. The center of this layout can be configured in this squared architectural space. The identification of the center of this layout is, therefore, an intuitive judgment.

Matter is naturally clustered around a center. The identification of the center is dependent on the matter that defines it. If shapes define a spatial center, the identification depends on how strongly they are connected through the central area of the space. A strong dynamic connection can be perceived between two prominent centers⁴². A more identifiable center or an induction of a point can be established by two pairs of blocks strongly connected.

The fifth hypothesis, that there is a center in the proposed architectonic space at which point the convergent dynamic variable can be perceived, is raised. In order to enhance the identifiability of the center, a strong dynamic connection of the blocks or strong convergent dynamics defining this center has to be set up.

Organized Around Center

A good architectural design itself is a visual balance. A well-set visual pattern with a higher-level center can be subdivided into a group of lower level centers⁴³. As discussed, a center can be either a physical matter or invisible yet perceivable when referring to the other physical matters. The overall balance is created by the imbalance of the local

⁴² Around the balancing center to represent it horizontally. Every visual configuration, however complex, possesses such an overall balancing center. A strong dynamic connection tends to develop between any two centers. (Rudolf Arnheim, *The Power of The Center*, University of California Press, Berkeley and Los Angeles, California, 1982, pp. 21, 5)

⁴³ Any reasonably complex visual pattern is a hierarchy of structural levels. At each level the centers of the higher level subdivide into groups of a lower order. (Rudolf Arnheim, *The Power of The Center*, University of California Press, Berkeley and Los Angeles, California, 1982, pp. 5-7, 6)

center⁴⁴ and a strong dynamic connection is set up between the two local centers⁴⁵. Within the defined spatial framework, a strong dynamic connection between two local centers should be at the nearest distance to the center of the prototype, the strongest connection across this space being linked by the two points in opposite sections, but in the middle of the two edges of the square space. Theoretically, two pairs of dynamic connections can perceptually coordinate the center of this space. Thus, in promoting the center of the proposed space, the local coordinates, which are composed of the symmetric axes of the initial layout, can be determined

An observer is the dynamic perceptual center and a balancing center is normally close to eye level if he/she appears in a small cubic space⁴⁶. Spatial orientation tendency from the shapes can be comprehended through the human body⁴⁷. Moreover, the ideal touring route for this proposed space is defined. Thus, the predicted dynamics for the proposed architectonic space can be perceived at the central area of the proposed space.

Scale of Identification of Center

The scale represents the probable range of clarity of the center. The measurement will be used to measure the level of clarity of the center in the survey and will be presented in the questionnaire.

⁴⁴ The overall balance of a visual pattern can be, and often is, obtained by the interplay of directed tensions created by the imbalance of local centers. These local centers enrich the structure of the whole, making it alive. (Rudolf Arnheim, *The Power of The Center*, University of California Press, Berkeley and Los Angeles, California, 1982, pp. 35-41, 6)

⁴⁵ A strong dynamic connection tends to develop between any two centers. It is owing to such induced connection that we may see two dots as a line or three as a triangle. In this sense, the lines we draw with a pen to actually connect the dots are redundant. (Rudolf Arnheim, *The Power of The Center*, University of California Press, Berkeley and Los Angeles, California, 1982, pp. 20-23, 5)

⁴⁶ Since he himself is a center with its own field of forces, he may have to move around a while to compensate for the effect of particular locations and perspectives. Even the final result is likely to be influenced, legitimately, by the viewer's presence as one of the centers that constitute the architectural experience. Whereas the center of a small cube may coincide with its geometrical middle, the balancing center of an architectural interior may be located closer to eye level. (Rudolf Arnheim, *The Power of The Center*, University of California Press, Berkeley and Los Angeles, California, 1982, pp 23, 7-1, 8).

⁴⁷ Spatial orientation is truly understandable only if one considers an additional dynamic center, namely the observer. (Rudolf Arnheim, *The Power of The Center*, University of California Press, Berkeley and Los Angeles, California, 1982, pp. 35-36,).

There is a similar discussion in 2.2.4. The linear ranking scale represents the levels of clarity of the center. The scale is divided into three classes ranging from very clear, quite clear, to the least clear and is numerically labeled in the same order from 3, 2 to 1 (Figure 2.11).

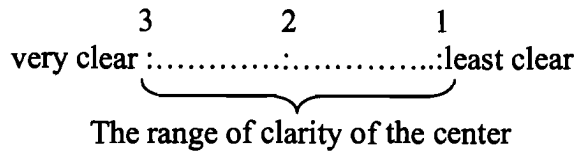


Figure 2.11

2.2.6 SUMMARY

The dynamics of the contents of a space is greatly associated with its emotion. The “quality” and the scale of the dynamics of the shapes are both defined, based on various hypotheses. The center of the space is identified as the place around which the shapes should be organized. Consequently, the dynamics of the shapes can be organized accordingly in term of their dynamic “quality”. A designated emotion of proposed space can be aroused by organizing the proposed shapes accordingly in terms of their dynamic “quality”.

2.3 ARCHITECTONIC SPACE DEFINED

2.3.1 INTRODUCTION

The definition of the architectonic space forms the basis for studying the dynamics of the space. The definition entails the scope and function of the space, the ways of establishing the proposed space, the modules produced, the relationships of the dynamic variable and the dynamic assumption made for the proposed space.

2.3.2 SCOPE

The type of built environment used for this study focuses on an exterior public space, and the prototype of the initial layout can be extracted from its typical spatial arrangement. All the shapes used in designing the proposed architectonic space are the standard modules produced by “The Modulor” of Le Corbusier, a generally recognized

harmonious construction system. These modules, as well as the square panel on which the modules will be laid, are produced by “The Modulor” and they are rectangular, texture-less and colorless.

In terms of the aim of this study, the built environment is assumed to be seen as a whole, rather than isolated singular subjects. In other words, an ideal route for a visitor, except those with visual perceptual problems, such as the blind, can be set up in such a way that the visitor, in touring the space, looks at each of the shapes within the space equally and completes touring it from the entrance to the exit. The implication of this is that the locomotion of the human body, in this instance, can be ignored or discounted as being an influence on visual perception.

2.3.3 FUNCTION AND FORM

This is an exterior public activity space so that the function itself does not make the form⁴⁸. However, dynamically, this form may be extracted for the typical type of layout⁴⁹. An initial layout of a prototype of this kind can be extracted from the general layout and is the basis for the progressive development of the final design product.

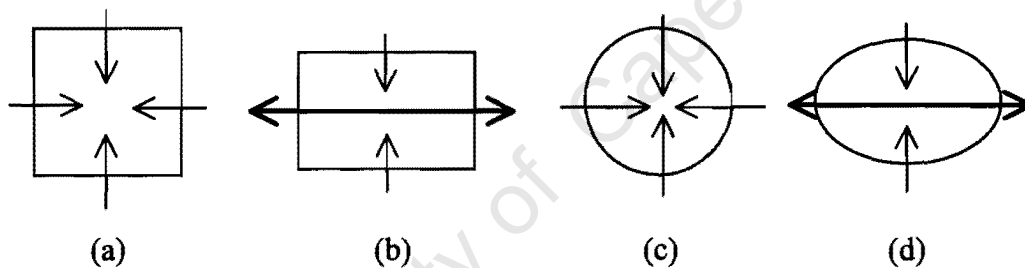
The horizontal ground provides the spatial activity. Since the shape and size of the intrinsic attributes of visual perception remain constant, a person should be able to recognize any shape, even if it is horizontal. The dynamics is derived from comparisons, both physically and psychologically. A building environment is always within a finite boundary. Different forms transfer a variety of perceptual forces to a visitor. It is assumed that different forms will transfer a variety of perceptual dynamics.

From the design point of view, architecture is concerned with rectangular forms.

⁴⁸ Clearly, expression is not identical with a building's physical properties: a building may be soundly built yet look flimsy and precarious. Nor is expression identical with what the viewer, rightly or wrongly, believes the physical structure of a building to be. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 21-25, 254)

⁴⁹ Expression, on the other hand, relies on what I have described as the dynamics of visual form. Dynamics is a property supplied by the mind spontaneously and universally to any form that is perceivable, i.e., organized in such a way that its structure can be grasped by the perceiving nervous system. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 21-25, 254)

From the dynamic point of view, since the edges of a square are equivalent to each other, the dynamics of a square-formed ground has no particular prevailing tendency over another. Theoretically, this dynamics does not interfere with the amendments to be made. Thus, this is the base on which the modules are built and it does not interfere with the dynamics of the amendments to be investigated. Moreover, a square shape coincides with the intrinsic acquisition of a center that is drawn as one of the entities of the architectural theme. In fact, the center of a square form can be better coordinated than any other form (Figure 2.12), if the rectangular forms are considered to be more frequently used in architectural design, as in this study. Furthermore, the square used as the base for designing this architectonic space is produced by “The Modulor”, as previously mentioned, because this square-formed ground is known to be in a harmonious interrelationship with the human body. This has generalized significance in terms of the aim, that is, to promote a harmonious environment. The size of this square can be determined in accordance with that of a practically proposed project.



Figures 2.12 a, b, c, d

2.3.4 WAY OF ESTABLISHING SPACE

This section (Figure 2.13) illustrates how the proposed architectonic space is reached. The method of design can be seen as being from the general (initial layout) to the specific (by making amendments). The form of the initial layout can be extracted from the defined type of space and the amendments made in terms of the proposed subject. The amendments seek to break the initial layout and impose the relevant modules. The amendments are made to the initial layout progressively in order to finalize the design. This method uses the perceptual dynamic changes between the initial and the final design advantageously by using an exterior court space and this meets the requirements of the spatial form that are intuitively expected by the public. This is basically to open the

initial layout and this should deliberately coincide with the theme of the architectural space⁵⁰. Figure 2.25 shows the process of the production of the proposed space.

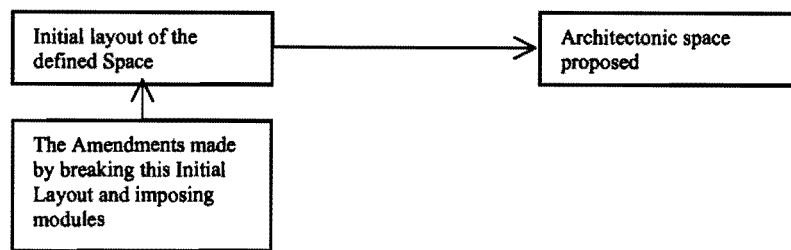


Figure 2.13

Initial Layout

The form of the initial layout can be depicted from the typical layout of this kind of space and people's experience⁵¹. The square ground can be produced by "The Modulor". Furthermore, the sectional size of this form is $2260 \times 2260 \text{mm}^2$. Thus, the squared peripherally allocated form on the squared form ground that is produced by "The Modulor" can be viewed as the initial layout (Figure 2.14).

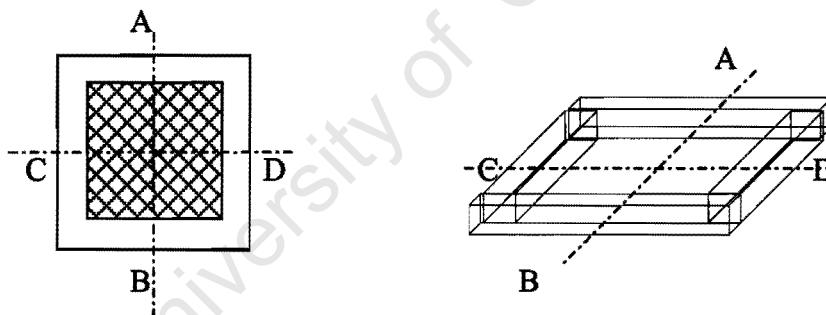


Figure 2.14

⁵⁰ The perceptual character of openings is strongly influenced by a difference between types of buildings, to which I referred earlier. A building is thought of either as a closed container, into which holes are punched as needed, or it is set of units---boxes, boards, and posts---added to ... (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 10, 226)

⁵¹ An understanding of the archetype becomes critical when a designer appropriates a visual model from the past for use in the present. An archetype or ideal type that is used must elicit meanings consistent with the patterning of associations established in previous experience. (Herb Greene, *Mind & Image*, The University Press of Kentucky, Copyright ©1976, Lexington, Kentucky, pp. 1-11, 150)

Amendment

Amendments are the proposed modules to be imposed on the relevant local coordinates on the initial layout and these are made at certain points (refer to Figure 2.2).

These amendments include the two types of the proposed modules, generally proposed modules and crucially proposed modules (see Definitions). These will be specifically discussed in the section on Architectural Geometric Factors further on in this chapter.

Architectonic Space Proposed

The architectonic space is reached by making amendments to the initial layout.

2.3.5 MODULE PRODUCED

A number of standard modules are produced by the “The Modulator”, being the basic architectonic datum⁵² in order to design the architectonic space. Before carrying on, there is an issue that has to be clarified. There might be a little confusion about the relationship between the initial layout of the defined architectonic space and the contents mentioned here. Actually, there is no such contradiction. The initial layout is the prototype that has no more significance than a frame on which a number of progressive amendments are based.

Not all the produced modules are used, but the chosen modules are referred to as the standard modules. Firstly, the size of the modules produced by “The Modular” change progressively in three dimensions. The dimensional sizes of some of them are too close to be easily discriminated by means of perception. The objective of the study is to investigate the relationships between the three-dimensional changes of the shapes and the relevant emotion. However, some of these relationships are not so strong. Consequently, the modules used in this context need to show relatively big differences in terms of their three-dimensional sizes. This should help the respondents to distinguish them. Thus, only modules with great differences in their three dimensions qualify as eligible modules

⁵² There are three basic architectonic datum for architectural space: bar-form, slab, and architectonic space. (Dom H. Van Der Laan, *Architectonic Space*, Copyright 1983 by E. J. Brill, Leiden, The Netherlands, pp. 1, 9-12, 10)

for the contents used in the architectonic space design. Only after the modules have been produced can the standard modules be determined.

How does “The Modulator” generate the modules for an architectonic space? Three steps were used to generate these modules. Firstly, the possible range of the proposed architectural project needs to be determined. This means that the range has to be previously manipulated in response to the “The Modulator”. This range can be found in the table called “A Demonstration: Values and Exercises” in Appendix 1. The numerical value of the bottom line is 2260mm as defined by this system. The range of the supposed architectonic space is 25000mm, the numerical range for this space being from 2260mm to 25069mm when referring to the table (only the Blue Series: BL was used). Secondly, the panel of production of modules needs to be displayed (refer to Figures 3.1 a, b, c, and d). Thirdly, in terms of the fourth hypothesis, in order to determine the coordinates of these modules within the spatial framework, the dynamics of each modular plane is made proportional according to the ratio of the sizes of the relevant dimension of the planes to the cube. The cubic volume, $2260 \times 2260 \times 2260 \text{mm}^3$, imitates the spatial volume of the human body from which an appreciative impression is evoked which directly relates to his body. It follows that the two dimensional panel of “The Modulator” could be given a third dimension of 2260mm to the plane of $2260 \times 2260 \text{mm}^2$. Thus, the modules can be produced in three-dimensions. The size of the reference cube within this system, the minimum size, should be the smallest one at the lower left corner of the marked square panel. In order to generate volume, a third dimension had to be given to this panel. Spontaneously, the height of 2260mm can be assigned to the cube. Consequently, in terms of the size of the volume in the table of “The Modulator”, every volume in this panel can be assigned a specific value. Thus a three-dimensional image is generated.

Now the modules for an architectonic space have been made. A dynamic value is assigned to every module. This whole process is practically presented in 3.2.

The contents are classified into three sections: the squared-formed panel, the fundamental unit and the standard modules. A square-formed panel is a two dimensional plane on which the defined architectonic space is based. While producing the modules, the form is produced by coordinating the size according to the table of “The Modulator”. This size can be specifically determined by monitoring the size as indicated in the table

and the proposed architectural project. The fundamental unit acts as the fundamental reference for the proportional comparison in three dimensions within the spatial framework. In the discussion on the Dynamic Scale in Chapter One, the cube of $2260 \times 2260 \times 2260 \text{mm}^3$ was concluded to be the fundamental unit for reference of the comparison of the shapes (modules) within this system. Standard Modules are the modules that will be chosen from the initial modules produced by “The Modulor” from which amendments on the defined initial layout can be made. This is detailed in Chapter Three (see Step 3, 3.2 Design Process).

2.3.6 RELATIONSHIPS OF DYNAMIC VARIABLES

The relationships of the dynamic variables involved throughout the design process will be discussed. These act in an abstract and overall manner and will not be discussed and analyzed individually as the interaction of each item would be neglected.

As previously discussed, perceptually a shape has to be seen dynamically as well as a group of shapes. Making amendments to the initial layout produces the proposed space and the dynamics must come along with the amendment (Figure 2.25). The types of the dynamic variables are roughly classified in terms of the different amendments. They are generally categorized into two parts: the generally proposed modules and the crucially proposed modules. The generally proposed modules can be seen in Figure 2.25 (d) constructing the basic layout of the proposed space and the crucially proposed modules are indicated in Figure 2.25 (e) comprising the two symmetric axes. Thus, there are two main dynamic variables evoked by the amendments made to these two types of proposed modules. The initial layout presents the third kind of dynamic variable. The final goal is to set up the proposed space and this space, constructed by all the imposed modules, presents the fourth dynamic variable. The development of any design is based on the precise extraction of the theme of the design and the dynamic sentiment can be extracted from the architectural theme. Thus, there are, in total, five types of dynamic variables including the architectural theme, the proposed space, the initial layout, the generally proposed modules and crucially proposed modules. These different sections are indicated in Figure 2.15 (also Figure 2.25). Their dynamic relationships are illustrated in the form

of a figure as indicated below (Figure 2.16) and the relationships of their dynamic variables will be discussed.

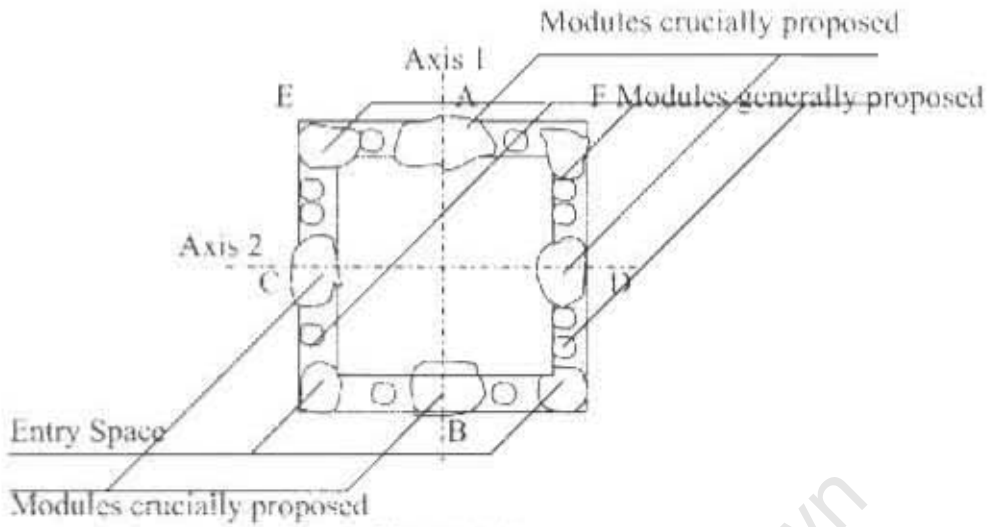


Figure 2.15

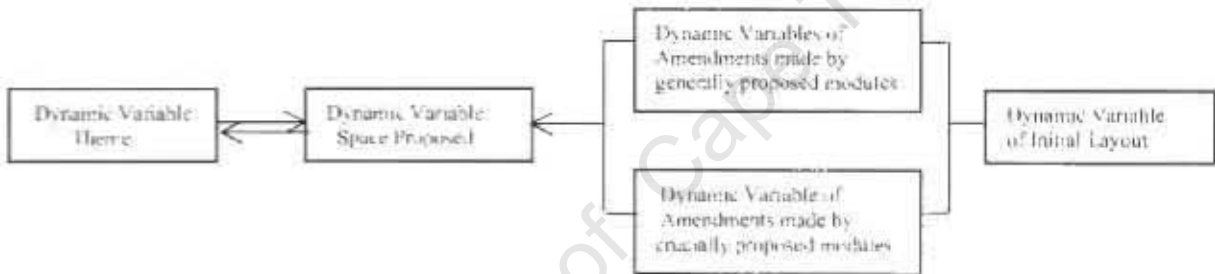
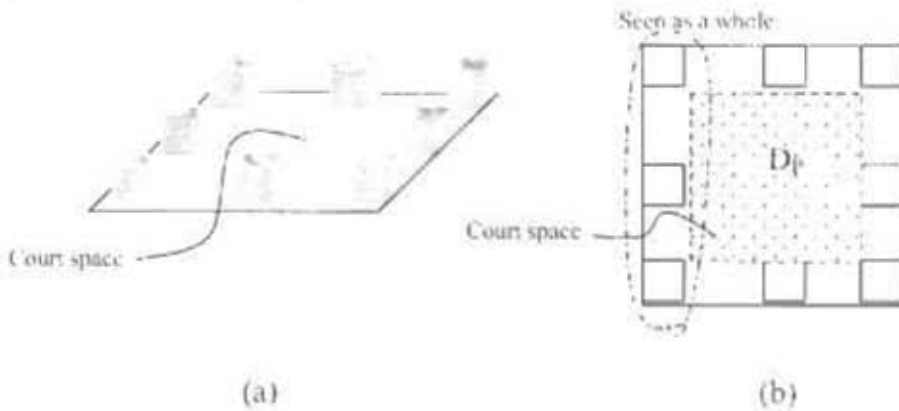
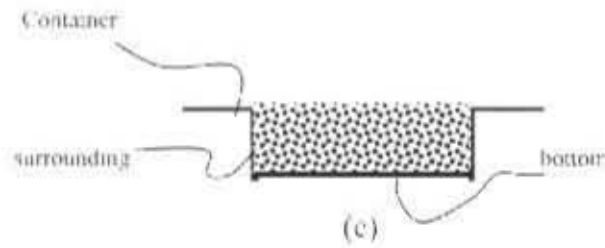


Figure 2.16

Variable of Space Proposed (D_F)

The emphasis of the dynamic variable of this proposed space is on the central court space (Figures 2.17 a, b). The juxtaposed space must be kept as narrow as possible (sec 2.5.3). It is possible to view this space as a bowl or container (Figure 2.17 c).





Figures 2.17 a, b, c

Just like the figure of the container above, the dynamic quality of the entire space is presumably affected by the dynamics coming from below and peripherally surrounding the container. The bottom is a horizontal plane. Perceptually, the horizontal plane is an activity realm. Any proportional expansion primarily affects the orientation of activities. This is directly related to the size of each edge of the bottom plane. These activities are presented as the horizontal dynamic force.

The relationship of the dynamic variable of this proposed space and the architectural theme is expressed as follows:

$$D_T \approx D_P = D_G + D_C$$

It can be explained that the dynamic variable of the theme may approximate that of the proposed space. The dynamic variable of the proposed space (D_P) can be theoretically accumulated by the dynamic variables from both the generally proposed modules (D_G) and the modules crucially affecting the proposed space (D_C). The notations refer to the definition.

Variable of Architectural Theme (D_T)

The dynamics of the theme is supposedly extracted from the proposed space. The dynamic variable of the theme of the proposed space is interpreted by means of the dynamics. This variable is assumed to approximate that of the proposed space.

Architectural Theme Semantics

The architectural theme is germinated from the natural law of human nature. This

germination may trigger an intrinsic reaction acting as a bridge between the requirements of a building and its design⁵³.

People tend to think of matter in terms of a spatial image and any thought is organised in the mind in terms of spatial imagery⁵⁴ (Figure 2.18). This can be “filed” in people’s minds according to the similarity to the typical layout of the space store in the brain.

A building or other construction that defines a type of space seems to be associated with a certain type of behavior (Figures 2.19 a, b). A general type of proposed space presents itself as a typical form that can be represented as a defined initial layout. The identification of a center is subconscious. In terms of the fifth hypothesis, it is assumed that there is a center people can intuitively perceive. Moreover, human beings are social creatures and their involvement in social activities is not only intuitive but a desirable part of normal life. Furthermore, the construction of the space aims to trigger and increase the involvement of the role of intrinsic attributes of visual perception and expectation. The theme of the proposed space is all about how to let people identify the center clearly.

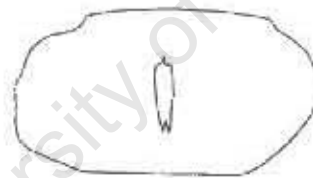
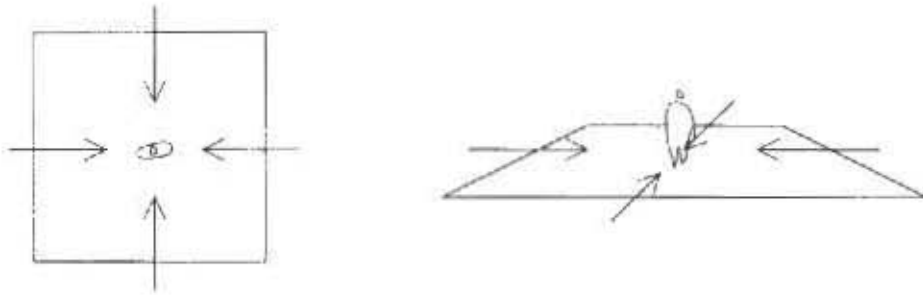


Figure 2.18

⁵³ The germinal theme is crucial to all human inventions. Whether it is a work of art, a piece of machinery, a scientific theory, or a business organization, they all sprout out from a central idea and grow around it. In the case of architecture, however, the central theme also serves as the bridge between the program for a building and its design. The relation between these two fundamental components has been something of a puzzle in architectural theory. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 18-22, 270).

⁵⁴ When the human mind organizes a body of thought, it does so almost inevitably in terms of spatial imagery. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 16-17, 272).



Figures 2.19 a, b

Dynamic Interpretation of the Architectural Theme

The space referred to in this study is a typical public exterior activity space well experienced by people. This typically simple squared layout subconsciously serves the visitors a general picture of what the function of the space is⁵⁵. As previously discussed, the spatial center can be intuitively identified. Therefore, it can be inferred as a highly abstract theme of the proposed space, that a well proposed architectonic space depends on how clearly the spatial center is identified.

From hypothesis five and the properties of the dynamics, it can be implied that the clearer a spatial center is defined, the stronger the convergent dynamics of its surroundings are. This is due to the properties of the dynamics having an orientation tendency and a degree of force. Consequently, the dynamic variable of the architectural theme should be able to be interpreted into the appearance of relatively strong convergent dynamics. This dynamic variable is seen to evoke a relatively more appropriate emotion.

Variable of Initial Layout (D_1) and Generally Proposed Modules (D_{1c})

This dynamic variable (D_1) is evoked by the initial layout (Figure 2.25 a). The squared ground on which this form is peripherally located keeps a harmonious spatial relationship with the human body, as has already been discussed. Thus, the dynamic variable of this initial layout is considered to be a consistent dynamic variable without interfering with

⁵⁵The interpretive mechanism of the mind's eye operates according to the basic principle that similar causes will cause similar effects; we can survive and function only because the world usually behaves and appears as we expect it to. (Lam, William M. C., *Perception and Lighting as Formgivers for Architecture*, McGraw-Hill, C. New York, 1977, pp. 22-24.)

the dynamic variables of the other imposed modules. The nature of this layout is assumed to remain unaltered, although the proposed modules will be imposed on it and will eventually replace the frame. The dynamic variable (D_{T_1}) (Figure 2.25 d) is 'aroused' by the generally proposed modules basically constructing the proposed space, other than the four crucially proposed modules (refer to Definitions). The layout constructed by the generally proposed modules is manipulated keeping as fewer changes as possible on the initial layout perceptually and this will be discussed in 2.5.3. Consequently, the dynamics of the initial layout (D_I) approximates that of the generally proposed modules ($D_I \approx D_{G_1}$). Thus, the dynamic variable of the generally proposed modules can be seen as a consistency. Thus, the dynamic variable of the proposed space (D_0) can be approximately represented by those of the crucially proposed modules comprising the two axes (D_C).

Variable of Crucially Proposed Modules (D_C)

As discussed, this variable comes from two divisions of the modules, one laid for the overall layout (D_{G_1}) and the other (D_{G_2}) for the crucial modules specifically composed of the symmetric axes of this space. The crucial modules are at the local coordinates indicated at points A, B, C and D in Figure 2.25(e). The relationships of the dynamic variables are indicated in Figure 2.20. The dynamic variable of the crucially proposed modules is collectively represented by that of each of the four individuals and it is expressed as $D_C = D_a + D_b + D_c + D_d$.

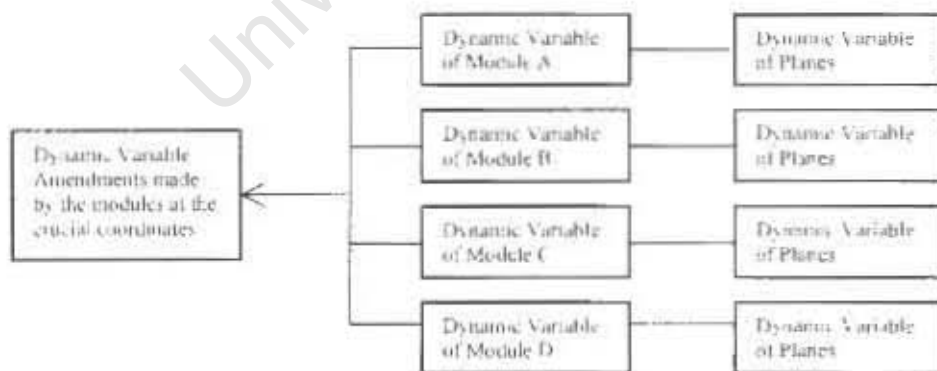


Figure 2.20

Therefore, an abstract equivalent mode might assume that the dynamics of the proposed space is represented abstractly expressed as:

$$D_T \approx D_a + D_b + D_c - D_d$$

In terms of the sixth hypothesis, the dynamic variable of the proposed space is crucially influenced by those of the proposed modules to the local coordinates composed of the two symmetric axes of this initial layout. The equation above can be explained by virtue of the fact that the dynamic variables of the proposed space can be collectively represented by those of the modules at the four crucial local coordinates comprising the two symmetric axes.

2.3.7 CONVERGENT DYNAMIC VARIABLE SCALE

The basic concept of the scale has already been discussed in 2.2.4. This scale measures the convergent dynamics of the proposed space.

It should be noted that the length of the straight dotted line, as well as the space between the two marks, have no meaning; it is purely for ranking the levels of convergent dynamics and this is presented as a straight dotted line. The scale is open-ended. This dynamic measurement scale has a linear ranking scale representing the levels of a convergent emotion. The scale is divided into seven classes of the central emotion ranging from extremely strong to quite strong to neither strong nor weak (or not applicable), to quite weak, extremely weak and down to nothing and is numerically labeled in the same order from 6, 5, 4, 3, 2, 1 and 0. The "0" level is for people who might not feel a convergent emotion at all (Figure 2.21). The space over the rank '6' represents the strongest convergent emotion and '1' is the weakest one, with '2, 3, 4, 5, growing from weaker to stronger. The bracket on the scale represents the probable range of convergent dynamics.

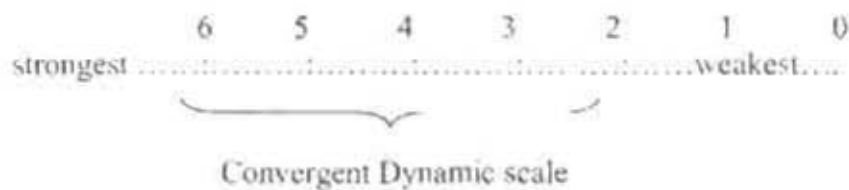


Figure 2.21

From the arguments in Chapters Two and Three, and in accordance with some intuitive and basic architectural concepts, a link between a public exterior activity space and a convergent dynamics can be established. This dynamic scale has no other function than ranking the levels of the convergent dynamics. The measurement scale itself is open, the numbers merely represent the ranking level, and the value between the bigger and smaller numbers does not represent any mathematical meaning. For example, the numerical value difference is not comparable. It could be said that $6-2=4 > 5-3=2$ in this scale. Those values just simply represent the level of convergent dynamics and have no related value implication.

2.3.8 DYNAMIC ASSUMPTION

The assumption about the dynamic variable is based on the architectural theme of the proposed architectonic space. In terms of the dynamic scale presented, it can be assumed that the dynamics of the proposed space (D_p) presents very strong convergent dynamics at about the 6-7 level, which is collectively represented by those (D_c) of the four crucial modules. This is the sixth hypothesis.

2.3.9 SUMMARY

The "quality" and scale of the dynamics of the modules within the defined spatial framework are themselves defined, as well as the center of the space around which the modules are going to be organized. From the architectural space point of view, the elements related to designing the space are limited, especially the relationships of the dynamic variables of the relevant subjects that are set up. The specific level of convergent dynamics of the proposed space is assumed to be in line with the architectural theme and it can be represented by those of a certain number of the modules to be imposed on the initial layout. The implication seems to be that the appropriate space can be designed in terms of the level of the convergent dynamics and the clarity of the center. Within this spatial framework, the proposed space can be constructed by very strong convergent dynamics; thus, the clarity of the center could be very distinguishable.

2.4 DYNAMIC THREE-DIMENSIONAL FRAMEWORK

2.4.1 INTRODUCTION

Although the dynamics and other related concepts have been defined, there is a need for the specific spatial framework to practically bridge and perform the concept of dynamics and the defined architectonic space.

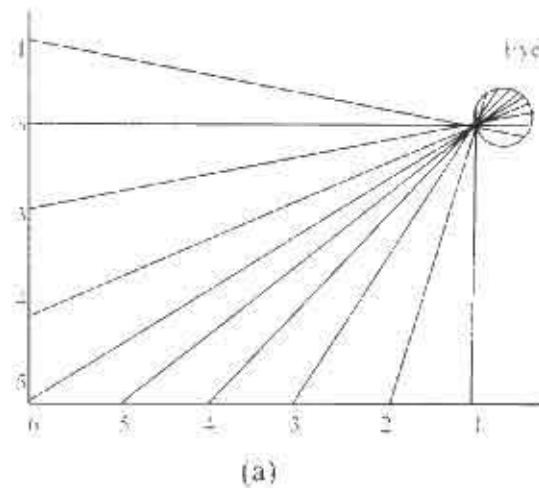
An imagined spatial framework is going to be erected. The establishment of this spatial framework is still based on the legitimate theory of "The Modulor" relating to the hypotheses. This space can bring together the initially defined architectonic space and specifically modify the dynamics of a shape in association with the defined architectural theme. This spatial framework is to further modify the previously defined architectonic space, called the initial layout. A comparison of the modules at the particular coordinates can be directly perceived on the internal surface of this framework.

This space is a huge cubic space with six internal surfaces, using any surface material, as the material is not important for this study. The previously defined initial layout should lie in this space and only then can the amendments be made to it. This is the basis of comparison of the suitability of the modules to be imposed at the relevant positions. Moreover, in terms of the previous discussion on the concept of the dynamics of a shape and the relevant hypotheses, each of the internal surfaces of this cubic space are marked by the $2260 \times 2260 \text{mm}^2$ grid. Consequently, each plane can be measured in terms of this scale and the subsequent amendments compared.

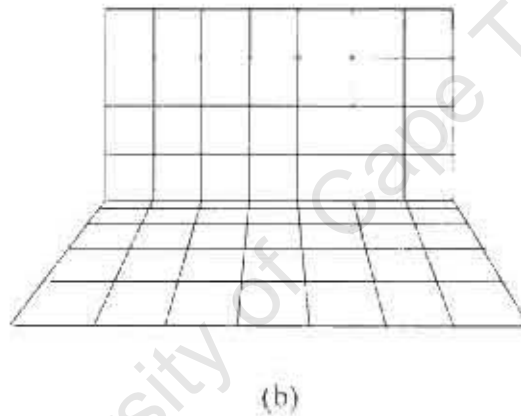
2.4.2 THREE-DIMENSIONAL FRAMEWORK

The three-dimensional framework functions so that the defined initial layout of the architectural space can be practically laid in this space, and the particular modules determined from the number of the modules can perceivably be compared in terms of their dynamics. This requires a spatial framework and a scale for the purposes of comparison of the dynamics. The spatial framework is imagined and its establishment

is in association with all surfaces formed in the retinal image⁵⁶ (Figures 2.22 a, b).



Relation between orientation of surfaces to the eye and the texture they present to it. Frontal plane surfaces present a uniform texture when the target field is uniform. The same surfaces orientated obliquely present a graded texture.



The appearance of the surfaces dealt with in Figure 2.22 (a)

Figures 2.22 a, b

⁵⁶ All other surfaces—those lying outside the frontal plane—form tapered textures in the retinal image. The viewer looks at such surfaces obliquely and, as is well known, the farther end of such a surface is geometrically more oblique to the viewer than its near floor. For example, as one looks down at the floor near one's feet, the floor lies almost in the frontal plane. As one views the floor farther and farther away from one's feet, obliquity increases. If one looks out along a hallway, the elements of the floor pattern become smaller and smaller. There are, of course, two reasons for the marked tapering of the texture of the retinal image: increasing distance and increasing obliquity of viewing it. The difference between viewing in the frontal plane and viewing an oblique surface is pictured in Figure 12.12. In the figure the two surfaces are marked off in equal spaces by lines running from the surface to the eye. The projected image of the oblique plane (the floor surface) is a tapered texture in the retinal image. Figure 12.13 shows the same sort of situation but as viewed by the perceiver. The one texture is seen as the wall, and the tapered texture is seen as the floor extending from near the viewer to the wall. (S. Howard Bartley, *Introduction to Perception*, Memphis State University, Harper & Row, Publisher, New York, 1980, pp.32, 281-9,282)

Spatial Frame

The defined architectonic space is laid on a three-dimensional coordination space and amendments are progressively made to it. The dynamic variables of the particular shapes are then assumed and coordinated. The establishment of this spatial framework is based on "The Modulor" and the hypotheses. A cubic space could be figured as the 'shape' of the three-dimensional framework with the size of its ground determined by the practical size of the proposed space.

A shape is an imagination of the assembly of its planes. As stated in the first hypothesis, the dynamics of a shape can be hypothesized as the direct proportional assembly of its planes. Consequently, a cubic space can be imagined with each surface representing the planes of a shape to be imposed onto this framework. Moreover, the size of the edge of this spatial framework is the same as that of the ground panel on which the defined initial layout stands and which is generated by "The Modulor".

Scale of Framework

The aim of the scale is to compare the individual dynamic variable of the modules with the base of those of their planes, in a specific coordinated situation within the space. This is in line with the hypothesis relating to the scale of the dynamics.

From the fourth hypothesis, it is implied that the relationship of this dynamic scale of the shapes can be represented in a three-dimensional spatial framework with each internal plane marked by $2260 \times 2260 \text{mm}^2$. The presence of this scale enables each of the six internal surfaces of the cubic space to be marked at $2260 \times 2260 \text{mm}^2$ in this framework. The dynamics of the shapes are perceived, measured and compared at the pre-determined coordination by the internal spaces marked in $2260 \times 2260 \text{mm}^2$ in the three-dimensional space and the possible module is selected in association with the relevant dynamic expectation.

The personal space occupied by a person, $2260 \times 2260 \times 2260 \text{mm}^3$ cube, represents the fundamental three-dimensional measurement scale unit (Figure 2.23). A group of shapes

systematically related to each other in terms of their size are comparable to a person⁵⁷. Thus, this framework reinforces the relationship of size between this unit and other modules and enhances the mutual spatial relationships of the shapes and human body.

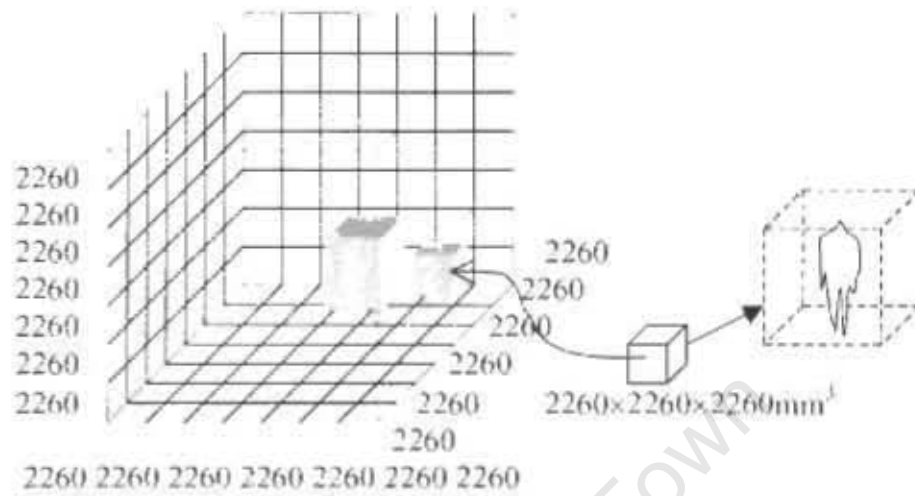


Figure 2.23

The final image of this three-dimensional framework is eventually formed. Its size should coincide with the size of the edge of the space that is supposed to be designed and each one indicated by $2260 \times 2260 \text{ mm}^2$.

The advantage of this spatial framework is that the dynamics of the modules can be directly and perceivably compared.

2.4.3 UTILIZATION

The defined initial layout fulfills this three-dimensional framework. There is a range of shapes produced by "The Modulor" and the possible locations can be coordinated according to the architectural factors in conjunction with the theme of the proposed space. Secondly, the dynamic variable of each of the planes of the modules can be measured. In cooperation with the architectural factors to be discussed in 2.5, the utilization involves two aspects: Space Laid and Amendments Made. This is practically applied in Chapter Three.

⁵⁷ Accordingly, a building will make sense to him only if he can visualize any one of its dimensions in relation to all the others. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 10-13, 64).

Space Allocated

The initial layout of the architectonic space previously defined under Architectonic Space will be imposed on this three-dimensional framework. Being the same size as the base ground, that is, the initial layout and the base of this three-dimensional framework, this initial layout exactly fits into the spatial framework (Figure 2.24). There is no problem with the orientation filling the layout. This initial layout is now ready for amendments to be made to it. The size of this square can be determined in accordance with that of the proposed project.

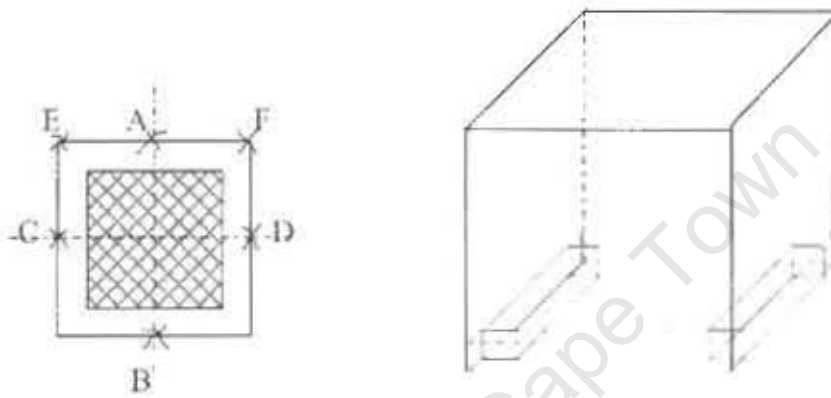


Figure 2.24

Amendments Made

The design of this architectonic space relies on the progressive amendments made to the defined initial layout within the three-dimensional framework. The amendments make changes to this initial layout in both shape and space (refer to 2.3.4).

The amendments made to the initial layout will be specifically discussed under Architectural Factors. In terms of the dynamic assumption made to the modules supposedly imposed on certain locations, the dynamic variables of each of the modular planes are displayed on the internal surface of the three-dimensional framework. It perceivably helps coordinate the relevant modules to be imposed.

The dynamic variable of the modules can be perceivably compared within this three-dimensional framework. The dynamic variables of the coordinated modules can be diffused into those of its three planes presented in the internal surfaces of the three-dimensional framework. Consequently, the modules can be compared in terms of the

dynamic variables of the three planes. Furthermore, the dynamics of the modules appearing on the internal surface of the three-dimensional framework can be perceptibly compared with the assumed dynamics of the modules. Thus, the modules to be imposed at a particular position can be determined by the comparison of the dynamics of the modules.

2.4.4 SUMMARY

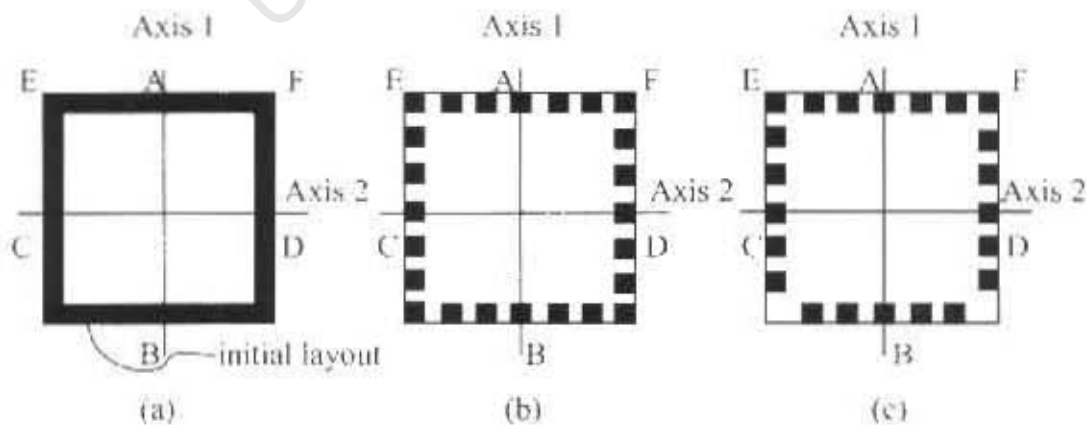
The spatial framework is set up. The initial layout can be laid and the evolution of producing the proposed space can begin.

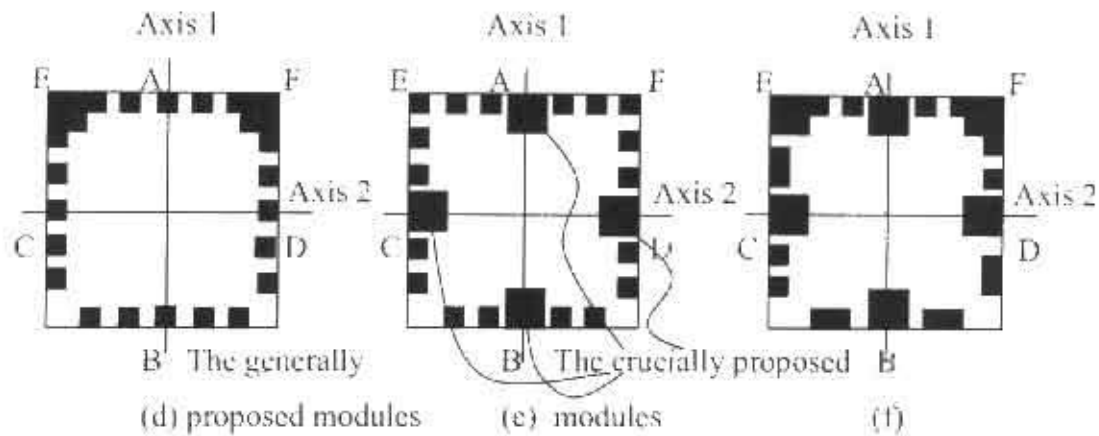
2.5 ARCHITECTURAL FACTORS

2.5.1 INTRODUCTION

The architectural factors are used to manage the initial layout so that the proposed architectonic space can evolve. These factors include the openness and closure, the corners and the axes. The dynamic variables of the proposed modules for making the amendments, especially those modules composed of the two axes, can be inferred in terms of the convergent dynamics predicted for the proposed space, so that these modules can be selected accordingly.

In order to clearly indicate the process of building up the proposed space, a series of six ground plans show the evolutionary process from the initial layout to the rough coordination of the modules imposed (Figures 2.25 a, b, c, d, e, f) as well as Figure 2.15. The square indicates the boundary of the space. The black squares simulate the fundamental unit and the symmetric axes are presented as well.





Figures 2.25 a, b, e, d, e, f

2.5.2 OPENNESS AND CLOSURE

In this section, the openings will be roughly coordinated on the initial layout (see 2.24 a, b, c). The changes are made to the initial layout as a means of generating the proposed space. These openings are made to promote the convergent dynamics for the proposed space, since the openness and closeness of blocks can reinforce this dynamics⁵⁸.

Two goals have to be reached. The first goal is to break this layout in order to access the court space. The second one is to adjust the spaces between the modules along the edge of the square-formed boundary. When this layout is broken up, three factors have an effect on the dynamic changes regarding the openings, namely number, size and location. These are the basic factors determining the pre-arrangement for the accesses to the proposed space.

LAYOUT LAID

This initial layout is managed within the defined spatial framework (see 2.4.2).

ACCESS SPACE

From the point of view of this study, the number of access spaces is not the primary

⁵⁸ Another factor that becomes truly architectural only when it is considered dynamically is the openness and closeness of buildings. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 6, 225)

issue. The concern here is how the openness affects the dynamics of the architectural theme of this kind of space. For the sake of convenience, and in terms of the minimum requirements, it was decided to make two openings to the initial layout. The size of the access, as well as the spaces between the proposed modules along one of the four edges, is discussed in the following section 'Space Juxtaposed'.

The implementation of the access space is very important both functionally and dynamically and so emphasizes its role on perceptual dynamics. This space can be specifically coordinated on the initial layout. The basic principles for creating the access space runs parallel to the same idea of creating the convergent dynamics and its role is to reinforce the proposed convergent dynamics. The dynamics of the space can be changed by either crossing or convergence⁵⁹ (Figure 2.26). The impression of a space is established at the very beginning of the tour of that space. As soon as a visitor steps into this gateway space his eye automatically grasps the surroundings and simultaneously obtains an impression. The impression of a complete space is an accumulation of every memorable event that touched the person whilst in that space.

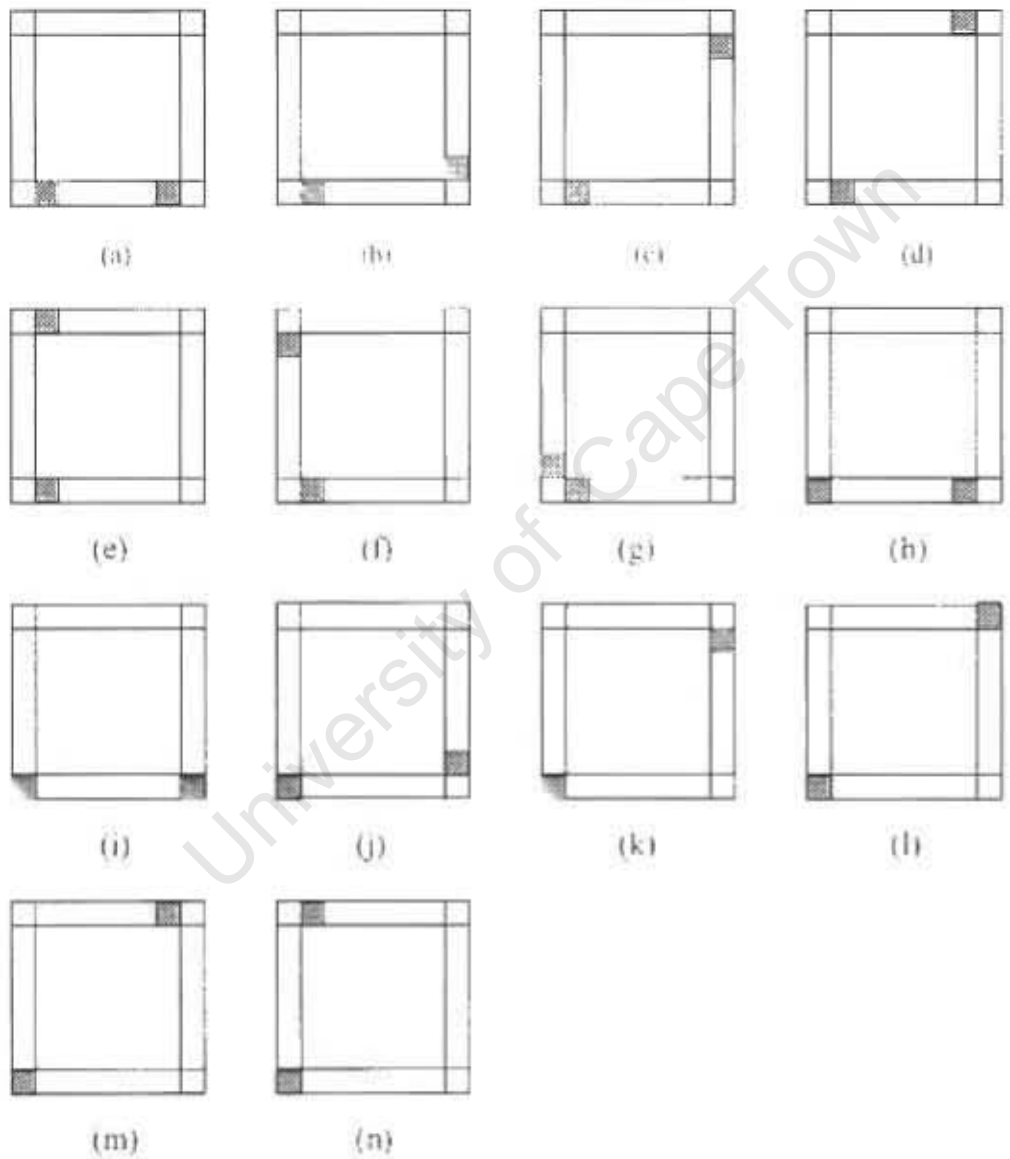


Figure 2.26

⁵⁹ In practice such problem situations can be fruitfully restructured when the two independent thoroughfares are unified in a cross pattern, which defines the area of overlap as a symmetrical centerpiece (Figure 2.24). This structural change reorganizes the visual character of the four corner buildings, each of which was split into two essentially independent and two-dimensional façade as long as they were conceived only in relation to the linear streets. The meeting of two flat fronts is now replaced by a three-dimensional conception, in which the corner buildings are seen as cubic solids, symmetrical in relation to their protruding edges and to both streets. This spatial restructuring vastly increases the figure power of the corner buildings. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 1-10, 82)

In order to select a plausible location of the access space, a number of the combinations have to be presented and compared. A number of the locations for the accesses should not be allocated, as they would drain the proposed convergent dynamics. The access is neither made in the middle of each of the four edges of the initial layout, nor at the locations directly facing each other.

A number of combinations are presented below (Figure 2.27 a, b, c...n). The black square represents the possible allocation of the accesses,



Figures 2.27 a, b, c, d, e, f, g, h, i, j, k, l, m, n

The selection of a possible pattern should be based on the promotion of the convergent dynamics for the proposed space. Two points are implicated. The first point is that the peripherally allocated linear blocks should be as integrated as possible to avoid any visual division that would weaken the link of the parts and thus drain the proposed convergent dynamics. The second point is that the possibility of the access spaces being visible to each other should be minimal. Thus, the layout patterns of the figures 2.27 (c), (d), (e), (k), (l) and (m) can be discounted, then figures 2.27 (a), (b), (f), (h), (i), (j) and (n) can be filtered out and the pattern of figure 2.27 (g) is superfluous. Eventually, it can be deduced that figure 2.27 (i) has the greatest advantage over the others. Therefore, this pattern of layout is used to allocate the access spaces.

SPACE JUXTAPOSED

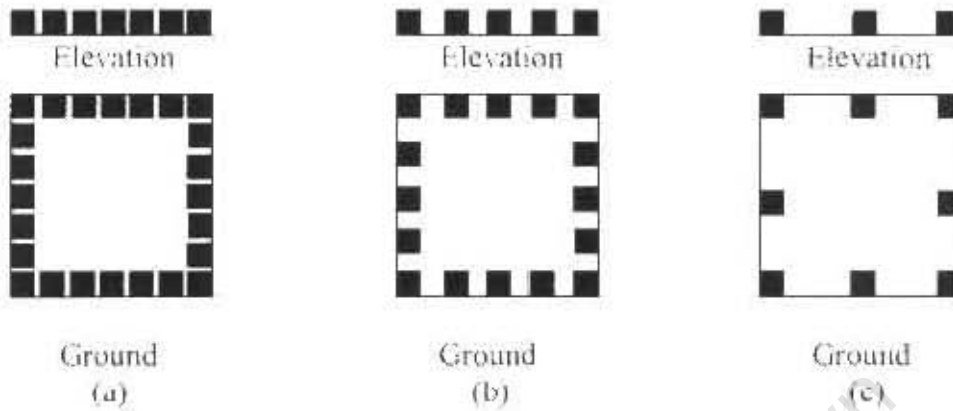
These spaces are between the supposedly imposed modules and they are made by breaking the initial layout at a number of points. They are peripherally spread along the edge of the square panel and are not at the middle and corner points (see Figure 2.25 b).

It is impossible, at this stage, to say precisely how many spaces there will actually be. As in the previous discussion, it is assumed that by making amendments to it, the convergent dynamic variable of the proposed space will not change significantly, as long as these spaces do not cause significant drainage of the dynamics. However, it is clear that the convergent dynamics will become stronger as the gap between the modules progressively moves closer to the juxtaposed spaces and therefore they should be located as close together as they can be⁶⁰. If these gaps become too enlarged, the blocks become less functional as a partition to form the court space⁶¹. For example, the convergent dynamics of a space declines as the gap increases along the boundary of the square-

⁶⁰ When open and closed spaces are given equal shares, the effect is of a screen which is dynamically neutral and simply provides the surface of the building with some transparency. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 27-29, 227)

⁶¹ The effect of such screens depends on the ability of their open and closed spaces to act together as a partition, which is a flat plane or more nearly a surface layer it will be perceived nevertheless as a coherent wall. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 36, 227-7, 228)

formed initial layout. The convergent dynamic power decreases from Figures 2.28 (a) and (b) to that in Figure 2.28 (c). The convergent dynamics of the court space in Figure 2.28 (a) is the strongest.



Figures 2.28 a, b, c

The cubic space of $2260 \times 2260 \times 2260 \text{mm}^3$ can be used to measure how close these juxtaposed spaces should be in terms of the hypothesis. In order to accommodate the theme of promoting the convergent dynamics, the spaces juxtaposed by the proposed modules have to be kept as small as possible, with reference to the size of the cube.

2.5.3 CORNER

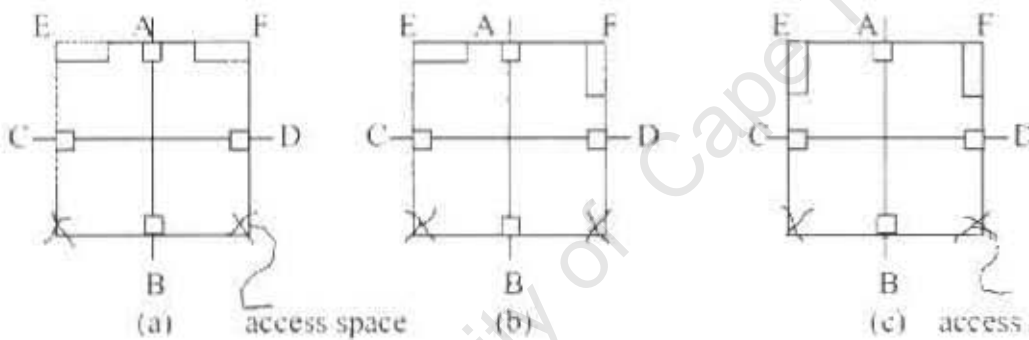
The amendments are made at the corners of the initial layout by imposing the relevant modules (refer to Figure 2.24 d). The closure at the corners is essential to set up the space in order to arouse the convergent dynamics. The proposed modules E and F are horizontally dominant. If the modules to be imposed at points E and F were the other way round it would not make any difference, since it does not alter the fact that there is an equal chance of the access space standing at the other two corners. The process of specification for the proposed modules can be imagined as a progressive growth in three dimensions. Firstly, the possible two-dimensional arrangement of them is presented, compared and determined. Secondly, a rough specification of the image can be made in terms of the dynamic variables inferred. Thus, the rough image of the arrangement of the proposed modules can be made.

ARRANGEMENT IN TWO-DIMENSIONS

The possible arrangement of the two proposed modules at points E and F is managed in a two-dimensional portrait (Figures 2.29 a, b, c). The local coordinates of E and F are shown at the two locations at which the two proposed modules are going to be imposed. The two small rectangular forms simulate the figures of the two proposed modules respectively and they are arranged at points E and F in order to choose a plausible arrangement.

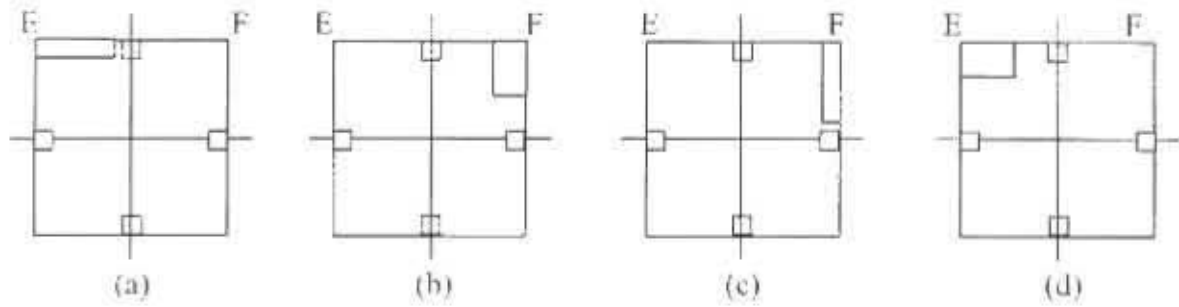
Possibility

The primary dynamic variable of the modules proposed at points E or F present horizontal dynamics, thus they both demonstrate linear forms. Their possible layouts are displayed in Figures 2.29 (a), (b) and (c).



Figures 2.29 a, b, c

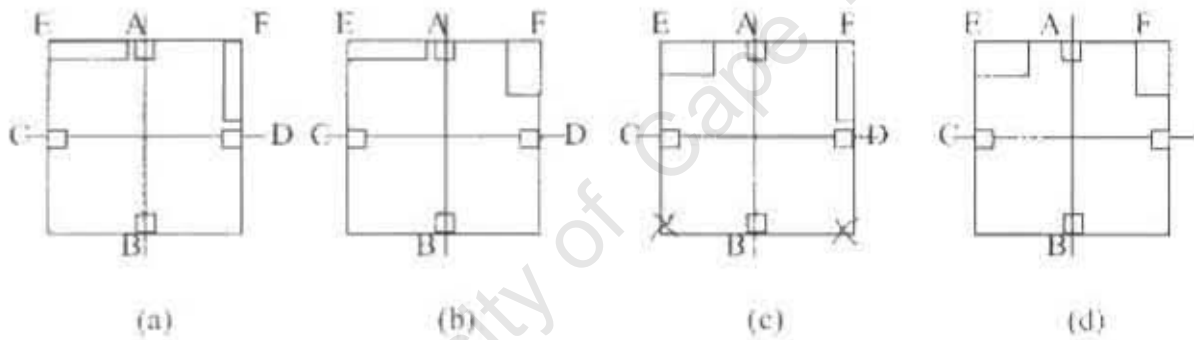
in order to avoid too much restriction of the scenery, figures 2.29 (a) and (c) should not be considered. The arrangement in Figure 2.29 (b) can be identified as the preferential layout in terms of the study. The adjustment of the two dimensions of the proposed forms, E and F, are made respectively and they are presented separately in Figures 2.30 (a), (b), (c) and (d). Further possible combinations are based on this.



Figures 2.30 a, b, c, d

Combination

The combinations in Figure 2.31 are based on four individual figures from Figure 2.30. The possible combinations of the figures are presented in Figures 2.31 (a), (b), (c) and (d). The dynamics of modules E and F in Figure (c) are in accordance with those of the other proposed modules A, B, C and D.



Figures 2.31 a, b, c, d

Dynamics Inferred

The arrangements in Figures 2.31 (a) and (d) can be abandoned because of their similarity, despite their different arrangement. There are two cross-hairs marking the point of access to the proposed space. With regard to the importance of the access space to perceptual dynamics, the dynamics of the breadth dimension of the form at corner E can enforce the status of the proposed module A in Figure 2.31 (c) much more than at corner F in Figure 2.31 (b). The flow of the horizontal dynamics performed by the thin form in Figure 2.31 (c) is seemingly situated more suitably than that of Figure 2.31 (b). From a general perceptual point of view, form F in Figure 2.31 (c) takes full advantage of

its location, and strengthening the horizontal dynamic flow which reinforces the perceptual connection between forms A and B. Thus, the arrangement in Figure 2.31 (c) becomes the most preferable.

THIRD DIMENSION ADDED

The third dimension considered is merely estimated. Their proper determination has to consider other factors and these factors have to accommodate each other. For example, in determining their height, the relations of those of the proposed modules A, B, C and D must be considered. This has to fit the practical modules.

The mainstream of the dynamics of the proposed modules is horizontally dominant except the one at point A. As in figures 2.31 (b) and (c), the flow of the streaming horizontal dynamics of shape F in Figure 2.31 (c) is much better from the point of view of access. This means that the dynamic variables of its frontal plane, d_{fc} , are not as strong as the dynamic variables of its frontal plane, d_{fr} . The feeling of depth, which supports the overall dominant shape A, is given by shape E in Figure 2.31 (c) rather than in Figure 2.31 (b). This implies that the dynamic variable of the side plane, d_{sc} is stronger than that of the side plane d_{sr} . Thus, the proportional relationship of the two dimensions can be roughly estimated.

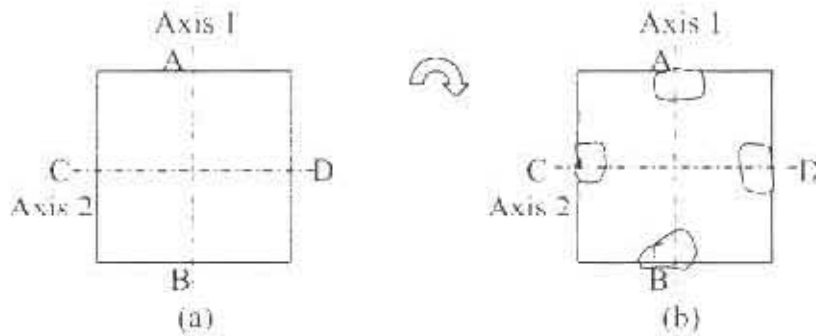
2.5.4 AXIS

This part aims at setting up the relationship of the dynamic variables between the proposed space and the proposed four modules primarily affecting it. Thus, the dynamic variables of these proposed modules can be inferred and these inferences are the basis for selecting the relevant modules from the standard modules (see Table 3.1).

DYNAMICS OF AXES AND THAT OF PROPOSED SPACE

Geometrically, an axis is an imagined line linking two points that symmetrically divide matter. The appearance of this can be made either by a series of concrete shapes or by two shapes. The axes in this study are composed of four proposed modules and they are situated at the four points A, B, C and D, which are at the middle of each of the four edges of this square-formed initial layout (Figure 2.32 a, b or Figure 2.15). The proposed

modules are then imposed on A, B, C and D respectively. The general allocation of the proposed modules as well as determining the different modules can be referred to in Figure 3.5.

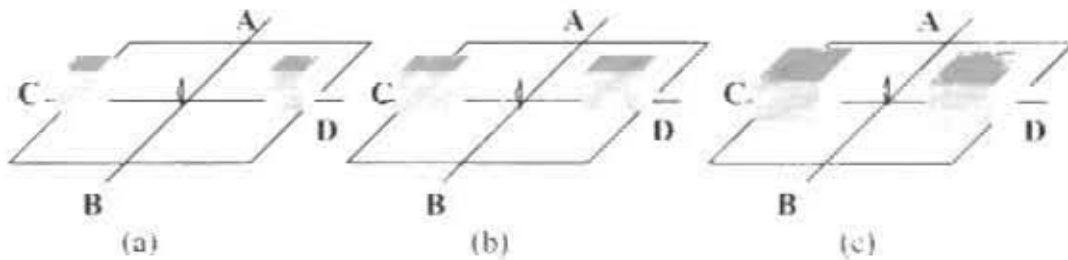


Figures 2.32 a, b

Those of the four proposed modules primarily affect the convergent dynamics of the proposed space. Firstly, the unique four local coordinates A, B, C and D make them physically and distinctively perceivable and rationally linked to each other⁶². This is based on some intrinsic attributes of visual perception such as shape and size consistency and the intuitive pursuit of a center. Shape and size constancy help the spatial layout to be recognized as it is physically, as the establishment of an entire impression of a space is based on an assembly of a variety of scenery. The visual patterns of the proposed space are divided into four major parts in terms of the condition of its surroundings, and the intuitive visual perception of the center of each of the four parts coincides with these four local coordinates. The hierarchical visual pattern for the establishment of the spatial center is primarily based on the four local centers. Secondly, a strong dynamic connection can be provided by each of the two axes and this connection can be perceived as a straight line (Figures 3.33 a, b, c). Geometrically, the shortest way to coordinate the local center of each of the four edges is by either of the two pairs of axes. Man is the perceptual center of visual dynamics. Perceptually, vision always chooses the most economical way to recognize two connected matter. The connection between an observer

⁶² A visual relationship can be directly perceived only when the two parties to it are present in the same image. ... and connected intellectually (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 27-33, 91)

and the target is the shortest, most economical one⁶³. Thus, a strong convergent dynamics can be imposed on this proposed space. Thirdly, theoretically, a center, no matter whether it is visible or invisible, could be comprehended as a point and it can

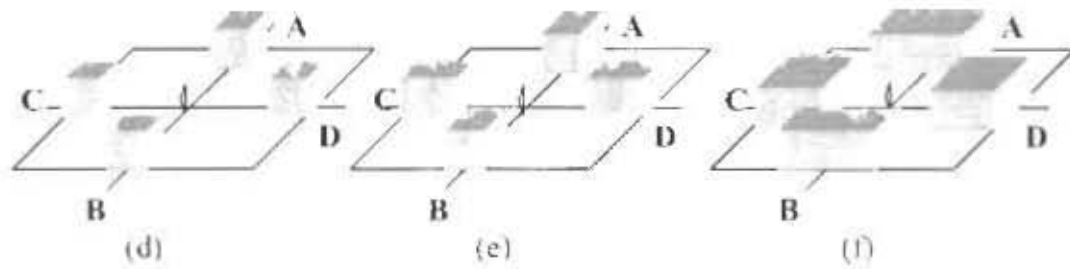


Figures 3.33 a, b, c

be located in terms of the Cartesian coordination system. For instance, a point can be allocated by X and Y within this system. In the fifth hypothesis it is assumed that there is a center in the proposed architectonic space from which the dynamic variable can be perceived, as a visitor completes touring this space. A strong straight dynamic connection can be set up between points A and B and between C and D disregarding their individual form. The identification of the center of this space should be at a very distinguishable level, so that the convergent dynamics of the proposed space can be perceived after a visitor tours this space and stands in the central area.

The following example clarifies this. The shapes were imposed at four points A, B, C and D. The dynamic condition between shapes at A and B is similar to that of C and D. The latter might be seen as the point at which a number of shapes will be imposed. If there is a visitor standing in a sedentary position in-between the two shapes, the dynamics experienced would vary as the shapes alternate in the placing of the two points. The dynamic pressure perceived from the four shapes increases from (a), (b) and (c) in the wake of the three-dimensional changes of the shapes (Figures 2.34 a, b, c). Thus,

⁶³ Note that the connection established by the observer between himself and his target is experienced as a straight line. In principle, that connection could take any shape among an infinite number of curves, twists, and loops of the most irrational kind. The economical choice of the shortest connection is an elementary application of gestalt psychology's principle of simplicity: any pattern created, adopted, or selected by the nervous system will be as simple as the given conditions permit. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp. 23-29, 11)



Figures 2.34 a, b, c

theoretically the convergent dynamics at this center is enforced. So it could be said that the two pairs of axes could enforce convergence. Finally, the other proposed modules, other than the modules comprising the two axes to be imposed kept both harmonious spatial relations with the human body and their consistency, if there are a number of architectonic spaces of this kind to be built. The dynamics involved in affecting that of the proposed space can be ignored.

Therefore, in summary, the four proposed modules at points A, B, C and D symmetrically composed of the two pairs of axes suggests that they primarily affect the specification of the convergent dynamics of the proposed space. The dynamics collectively delivered by these four modules represents that of the proposed space. Consequently, the dynamic variables of these four modules can be generally inferred from that of the proposed space. This implies that the identification of the center of this space can be enhanced as the level of the convergent dynamics of this space increases.

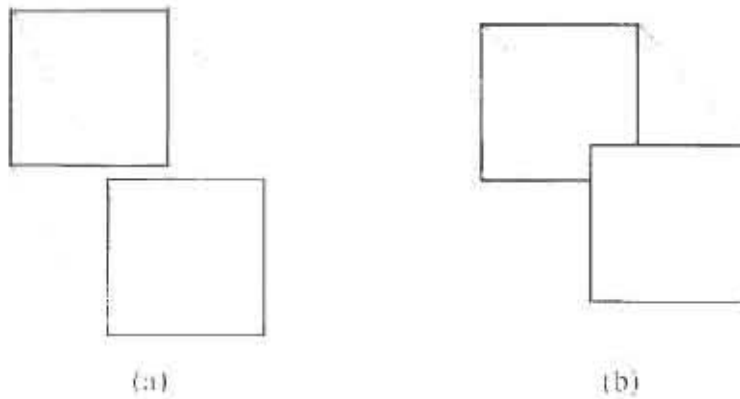
DYNAMICS OF AXES AND MODULES PROPOSED

It has argued that the dynamics of the proposed space can be represented collectively by those of the four modules comprising the two symmetric axes and, in the sixth hypothesis, it is postulated that the dynamics of the proposed space should arouse very strong convergent dynamics. Thus, the dynamic variable collectively presented by the four proposed modules should deliver very strong convergent dynamics and this means that each of the four proposed modules have to “work” together at their premium to promote this convergent dynamics.

From the general point of view, each proposed module is seen as an integral part of the whole. The dynamic performance of the planes of each of the proposed modules is seen integrally within the defined framework. As the first hypothesis suggests that the dynamics of its planes fundamentally affects that of each individual module, so the proper delivery of the dynamics of each of the proposed modules depends on those of each of its planes. As indicated in the scope of the study, the contents of the space are seen integrally rather than as parts of the whole. This implies that the elevations of some of the modules can be changed to be the other way round during the touring process. For example, at the start of the tour the front elevation of the module can be shifted to the side elevation of the same module. The planes of each of the proposed modules can be sorted. The elevations facing the court space are called frontal planes (elevations) and the ones between the modules are called the side planes (elevations). All the modules demonstrate horizontally dominant dynamics except for point A and the clearly identifiable center is promoted.

Different planes have different types of dynamic performances in association with their individual location (This is discussed in terms of the four points A, B, C and D respectively) and this performance basically promotes the proposed module. According to the properties of the dynamics, there are two-dimensional dynamics within a plane, either vertical or horizontal, as well as a certain degree of force. The dynamics of the planes is the synthesized embodiment of those of its two dimensions in association with these properties. The frontal planes contribute to determining the local coordinate where it is supposedly to be imposed and the flow of the dynamics, either upward /downward or weak/strong. If one of the shapes (Figures 2.35 a, b) stands within a spatial framework and its frontal planes supposedly increase or decrease in either horizontal or vertical dimensions without changing its location, the impression of this cube is seen as a stable point progressively changing as well. The ground planes contribute to the dynamics either converging towards the center or flowing along each of the edges of the boundary of the layout where it stands. The side plane determines how 'thick' the proposed

module is and this dynamics, along the breadth dimension, fundamentally contributes to this central-orientated tendency⁶⁴ (Figures 2.35 a, b) at the determined local coordinate within the defined spatial framework (these square panels are considered to be facing a viewer).



Figures 2. 35 a, b

The dynamic performance of the planes is based on those of its two dimensions and the prevailing dimension determines the performance of that of the planes, as stated in the second hypothesis that the dynamics of a plane can be represented in two dimensions and calculated according to the ratio of the two relevant dimensions of this module and the reference unit cube. This performance has to be in line with that of the plane to be promoted. Therefore this infers that the dynamics of the two dimensions of each of the relevant planes of the four proposed modules should present the best performance in

⁶⁴ The second kind of cue was the monocular cue. About seven were usually listed. We shall not discuss them at length, for we have pointed them out previously as examples of using one aspect of perception to explain other concurrent aspects. For interposition and elevation are two commonly given monocular cues (see Figures 12.10 and 12.11). To describe interposition is to describe what the observer sees rather than merely to tell the metric features of the stimulus. If one object is seen interposed between the observer and another object, then the object partly covered is seen as farther away. By resorting to these cues, the observer was supposed to build up his or her appreciation of the visual field, as it were, bit by bit. This way of dealing with relations between stimulus and response provides no initial description of overall field structure whereby to account for the roles played by restricted portions of the visual input. (S. Howard Bartley, *Introduction to Perception*, Memphis State University, Harper & Row, Publisher, New York, 1980, pp. 24-38, 281)

order to evoke the strongest convergent dynamics of the proposed space. Consequently, the dynamic variables of the four modules to be imposed, comprising the two symmetric axes, can be inferred in terms of the specific convergent dynamics of the proposed space. The dynamics in one dimension of a plane prevailing over that of the other, has to take full advantage of its practical position in order to promote that of the proposed space.

The dynamics in the prevailing dimension primarily affects those of each of the planes. Up to now, it can be inferred that the dynamic performance of the proposed module can be fundamentally influenced by the prevailing dynamics on each of its planes. The prevailing dynamics of either of its two dimensions in the ground plane contributes to the dynamics being either convergent towards the center or flowing along each of the edges of the boundary of the layout. The prevailing dynamics of either of its two dimensions in the front planes contributes either to the increasing upward dynamics or flowing along each of the edges of the boundary of the layout. The side planes indicate a 'thickness' of each of these modules and this depth primarily affects the convergent tendency of the modules.

In summary, the dynamic variables of the proposed modules, readily inferred from that of the proposed space, can be collectively interpreted and presented by a number of prevailing dynamics of a specific dimension of a plane in terms of orientation and degree of force.

The following demonstrates how the dynamics of the proposed module is inferred and the general layout can be referred to the figure 3.5.

DYNAMICS OF MODULE PROPOSED AT POINT A

In order to promote the proposed convergent dynamics, the dynamics of module A supposedly presents very strong vertical dynamics. Firstly, the module to be imposed on point A, facing the two openings of this space (Figure 2.35 a), is at the middle point of one of the four edges. This point is at a very prominent location to the entry space and it helps to symmetrically define this space. This also reinforces the discernment of the perceptual coordination of the spatial center in the third hypothesis. The vertical

dynamics of this proposed shape serves this aim since it defines the other dimensions⁶⁵ of the spatial framework. Secondly, the factor of distance dramatically decreases the dynamic influences of the other planes because of the distance between them and the accesses. As the impression of this space begins at the entrance, vision intuitively goes straight and then upwards. Thus, the very strong vertical dynamics of module A defines one of the symmetric axes of the overall space, which is essential to coordinate the center.

Ground Planes

The dynamics of the ground plane should appear relatively stable without a specific tendency to either direction in order to assist the main dynamic character of this plane. The prevailing dynamics of either of its dimensions can reduce the degree of the vertical dynamics of module A. Thus, there is no prevailing dynamics on this plane and the ratio of the two dimensions of the ground plane should appear roughly equivalent to each other.

Frontal Planes

The frontal plane is at the position which demonstrates vertical dynamics. Here, the prevailing dynamics is the dominant verticality of the proposed shape A. It seems to be that the stronger the rising dynamic, the more identifiable the symmetrical line of this space. However, as stated in hypothesis three, it is assumed that weight merely functions on the dominant vertical dynamics of the modules. If the ascending dynamics appears too great, the weight sense of the proposed shape will be reduced. This dynamics might not contribute to the function of defining the symmetrical connection of this space as expected. Thus, the vertical dynamic of this front plane at point A may be the greatest. However, as the height increases over a certain range, it is expected that the weight sense of this shape will decline simultaneously and this might affect the dynamic performance of module A.

⁶⁵ In our spatial system, the vertical direction defines the horizontal planes as the only one for which the vertical serves as an axis of. (Rudolf Arnheim, *The Dynamics of Architectural Form*, University of California Press, Berkeley and Los Angeles, California, 1977, pp, 5-6, 35).

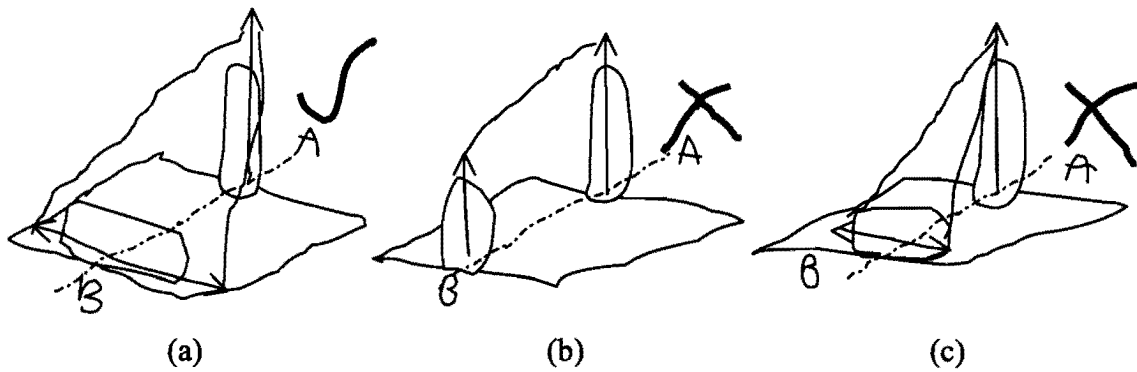
Side Planes

The dimensions of the side plane give a clear visible instruction about the presence of volume. The dynamics of module A presents very strong vertical upward dynamics. The horizontally central-oriented dynamics, which is the natural dynamics of the side plane, should be fairly small to reduce its disturbance. The width dimension of the dynamics should be relatively small in contrast to that of the height dimension and this dynamics has little dynamic impact on that of this plane. The dynamics of the side plane is also seen with much less significance due to the distance factor.

DYNAMICS OF MODULE PROPOSED AT POINT B

Module B is at the opposite side to module A and they both comprise axis one. The dynamics of module B should present very strong horizontal dynamics. Firstly, there are no other proposed modules having vertical dominant dynamics competing with that of module A, as in the previous description. Even if vertical dynamics appeared in module B, however less strong than that of module A, this dynamic connection could perceptually define a perpendicular plane with a rising tendency, which would contribute to over-symmetry and the tendency to disperse the identification of the spatial center. This is not in line with the theme of the proposed space (Figure 2.36 b). Secondly, this dynamics needs a balance for a well-established space. Since the proposed module B appears at the opposite point to point A, the proposed module has to contain the dynamics of the module at point A⁶⁶, which is postulated to have very strong vertical dynamics. It seems that with a slightly strong horizontal dynamics in module B it can not sufficiently contain that of module A (Figure 2.36 b). Consequently, the horizontal dynamics of the proposed module B has to be very strong. Thus, the primary dynamic variable of the proposed module at Point B should present very strong horizontal dynamics to contain that of the proposed module at Point A (Figure 2.36 a). Additionally, the module has to present horizontally central-orientated dynamics.

⁶⁶ A local imbalance can be remedied by a corresponding imbalance in the opposite direction. (Rudolf Arnheim, *The Power of The Center*, University of California Press, Berkeley and Los Angeles, California, 1982, pp. 35-36, 6).



Figures 2.36 a, b, c

Ground Planes

The dynamics of the ground plane can be inferred from the module. Its dynamics can be represented in two dimensions. The length dimension prevails (refer to Figure 2.36 a) with very strong dynamics. The breadth dimension should have quite strong central-orientated dynamics.

Frontal Planes

The dynamics of the frontal plane can be inferred from the module. Its dynamics can be represented in two dimensions. It prevails in the length dimension (refer to Figure 2.36 a) with very strong horizontal dynamics to balance that of module A.

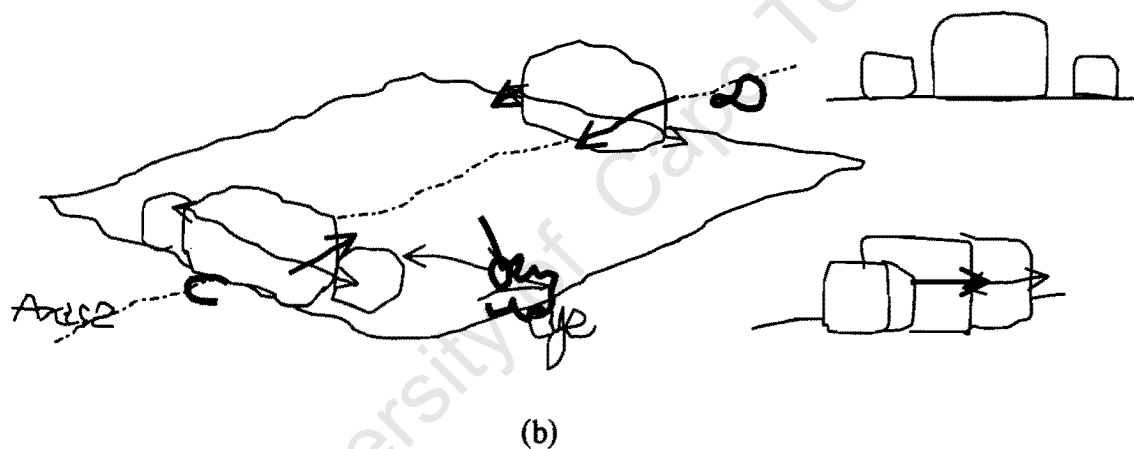
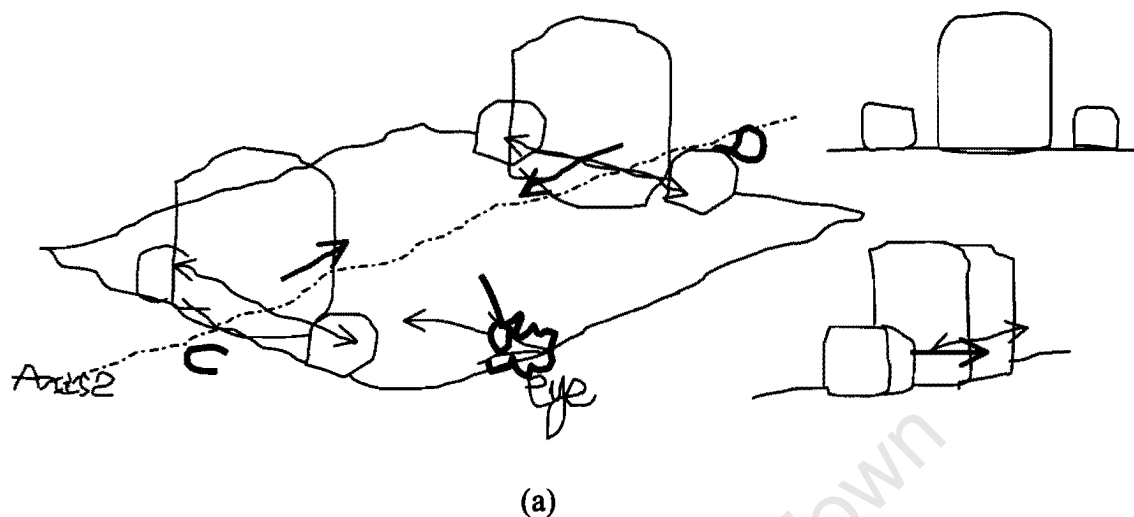
Side Planes

The side plane of the shape at point B is mainly responsible for promoting strong central-orientated dynamics. The dynamics here is in the prevailing breadth dimension over the other dimension. This dynamics should present quite strong central-orientated dynamics.

DYNAMICS OF MODULES PROPOSED AT POINTS C AND D

The proposed modules C and D comprise the second axis. The proposed modules C and D are identical to each other at points C and D. Though the dominant dynamics is horizontal, there should be quite strong central-orientated dynamics. The horizontal dynamics should be far less strong so as not to disturb the module perceived at this point.

The central-orientated dynamic should be strong enough to reinforce the convergent dynamics of the proposed space.



Figures 2.37 a, b

Ground Plane

The dynamics of the ground plane can be inferred from that of the module and this dynamics can be represented in two dimensions. The prevailing one along its length dimension (Figure 2.37 a, b) has less strong dynamics than that of the breadth dimension. However, the latter one should present quite strong central-orientated dynamics compared with those of the other proposed modules.

Frontal Plane

The dynamics of this plane can be inferred from the module, which primarily affects the stability of the module supposedly perceived as a point. This dynamic can be represented in two dimensions. The one along its length dimension (refer to Figure 2.36 a) prevails with a slightly stronger horizontal dynamics over that of the height dimension.

Side Planes

The side plane of the shape at point B is mainly responsible for promoting strong central-orientated dynamics as well. This dynamics in its breadth dimension should be stronger than that of the height dimension.

2.5.6 MODULES SELECTED

The proposed modules are chosen from the standard modules (refer to Table 3.1). The selection is based on the relationships between the inferred and actual dynamic variables assigned to the standard modules in terms of the definition of the dynamic “qualities”. The dynamic variables of the planes of the proposed modules have been inferred in terms of that of the proposed space. The dynamic variables of these are calculated in terms of the definition of the ‘quality’ of the dynamics. The sequential relationship of the dynamic variables of the proposed modules A, B, C/D, E and F can be specified. Consequently, the proposed modules can be selected.

DYNAMIC COMPARISON

The comparison of the dynamic variables of the proposed modules is carried out at points A, B, C, D, E and F and it aims at setting up the sequential order of the dynamic variables. The dynamic variables inferred from these modules at these local coordinates set up relationships with each other in terms of their dynamic values and they are merely ranked here.

It is postulated that the vertical dynamic variable of the proposed module at point A is the strongest and the horizontal dynamic variables of the proposed module at points B, C, D, E and F, ranked from the strongest to the weakest, are D_b , D_f , D_e , $D_c(D_d)$. The sequential relationships of the dynamic variables in two dimensions of the planes of these

proposed modules can be set up in terms of the previous discussion about their dynamic variables.

Ordinal Dynamic Relationships of the Ground Plane (B, C, D, E, F):

The dynamics in the two dimensions of the ground planes can be ordered, respectively. The dynamics in the length dimension of module B is postulated to be the strongest. The dynamic variables in the length dimension can be ranked from the strongest to the weakest, and are from the proposed modules B, E or F, C or D (described in short notation: $d_{gbl} > d_{gei} > d_{gfl} > d_{gcl}$ or d_{gdl}). The dynamics in the breadth dimension of module B is postulated to be the strongest. The ranking of the dynamics from the strongest to the weakest is from the proposed modules B, C or D, E to F (described in short notation:

d_{sbb} d_{sbc} or $d_{sdb} > d_{seb} > d_{sfb}$).

Ordinal Dynamic Relationships of the Side Plane (B, C, D, E, F):

These are the dynamics in the breadth and height dimensions of the side planes. The dynamics in the breadth dimension, more specifically the central-orientated dynamics, can be ranked from the strongest to the weakest. This order is the same as that of the breadth dimension described in the ground plane above.

Ordinal Dynamic Relationships of the Frontal Plane (B, C, D, E, F):

These dynamics are in two dimensions either in the length or height dimension. The dynamic variable in the length dimension of module B is postulated to be the strongest. The dynamics of the proposed modules B, E or F, C/D in the length dimension is from the strongest to the weakest ($d_{fbj} > d_{fej} > d_{fj} > d_{fcj}$ or d_{fdj}).

CORRESPONDING DYNAMICS

The selection of the proposed modules is based on the dynamic coordination of each other. Dynamic coordination is carried out between the dynamics of the standard modules assigned and those of the proposed modules inferred. This coordination can be rather called accommodating the dynamic variables between these two types. The

dynamic variables of the eligible modules chosen from the standard modules should be opted to approximate the proposed module inferred at the particular location as closely as possible. In association with the selection criteria, each of the proposed modules will be specifically selected from the standard modules in terms of these ranking relationships.

2.5.7 SUMMARY

The defined initial layout of the prototype of the proposed architectonic space has been put into a three-dimensional framework. The amendments are made up by breaking up the layout, in terms of the architectural factors discussed. The general location and picture of the proposed modules can be roughly determined and by progressive changes this layout is eventually replaced by the imposed modules. The modules primarily affecting that of the proposed space can be selected accordingly. Thus, the predicted dynamics for the proposed space can be created accordingly.

The principles developed will be applied for a practical architectonic space design in Chapter Three.

3. AN ARCHITECTONIC SPACE DESIGN

3.1 INTRODUCTION

This design is the practical application of the strategy of the dynamic theory. The specific level of the convergent dynamics of the proposed space, as predicted in 2.3.8, has to be set up to possibly evoke a relatively appropriate emotion. This dynamics of the space needs to be interpreted into the proposed modules and imposed on the local coordinates of the initial layout. The basis of selection of the proposed modules from the standard ones is that of the interference of these dynamic variables. Thus, the proposed modules can be selected in terms of accommodating their dynamic quality as predicted (2.2.3 and 2.2.4).

This architectural space aims to provide an open court space for people to engage in either public events or casual activities. This space is built on a 45m×45m base. This design merely demonstrates this design method. The process of the design is divided into seven steps. Through the steps, the abstract theme of the proposed space can gradually turn into a practical one. In order to clearly indicate the process, a series of six ground plans are given showing the evolutionary process from the initial layout to the rough coordination of the modules imposed (Figures 2.25 a, b, c, d, e, f).

The relevant spatial coordination of the imposed module, planes and dimensions can be referred to Figure 3.4.

3.2 DESIGN PROCESS

The proposed space is processed by making amendments to the initial layout extracted from its typical architectural space.

Step 1. Program Study and Initial Layout

The objective of this step is to set up a general spatial layout through studying the specific function of the proposed space. This layout is the prototype on which the amendments will be made (see 2.3.3).

Project study

The basic core function of the public space is to establish a desirable atmosphere for people's public social life. The social activities, in association with the relevant behavior, are an interpretation of the typical type of architectural space expected.

Initial Layout

A typical prototype of the initial layout can be generated. This initial layout of the proposed space is inferred as a square-shaped court space surrounding a rectangular closure form. This practical size of the ground, 45m×45m can be re-coordinated to 40.56×40.56m² (see Appendix 1) of the square panel, on which the proposed modules are allocated. Thus, the initial layout for the proposed architectonic space is a square-closed form at 40.56×40.56m² with its sectional size 2260×2260mm² (refer to Figures 2.15 and 2.2.3).

Step 2. Theme Abstracted and Dynamics Formalized

The objective of this step is to summarize the theme of this proposed space and then transfer it into dynamic terms. This architectural theme is eventually translated into promoting the spatial center (see 2.2.5) with the convergent dynamics practically performing this role, which is predicted in the specific level of the convergent dynamics. Thus, the theme of this space is assumed to promote a clearly identifiable center.

The convergent dynamics indeed plays the primary role in promoting the center. Thus, a very strong convergent dynamics is assumed to be at the level of about 6-7 (see 2.3.7) in order to promote a very identifiable center for this proposed architectonic space. The relationships of the convergent dynamic variable and those of the proposed modules, supposedly being imposed on the local coordinates of the initial layout, can be set up (refer to 2.3.6, 2.3.7 and 2.3.8).

Step 3. Module Generation, Standard Modules Selected and Dynamics Assigned

There are three purposes to this step. The first one is to produce a group of modules in terms of the practical project. The second is to classify these modules and select them for

a number of the standard modules (see 2.3.5). The third one is to assign dynamic values to these modules in terms of the definition of the dynamics.

The standard modules are the possible components to be constructed in the proposed space. The dynamic values are the basis for the proposed modules to be chosen to be relevant local coordinates on the initial layout.

Generation of Modules

The production of the modules uses 'The Modulor'- Le Corbusier's legitimate theory about the establishment of a harmoniously built environment. This process is divided into three steps: Coordinating with the table of 'The Modular', Displaying the 'panel', and Moving from two-dimensions to three-dimensions (see 2.3.5).

Coordination with the table of "The Modulor"

The size of this practical project has to be adapted close to that of a series of numbers in the table of 'The Modulor'. The estimated size of the ground of this proposed architectural project is assumed to be about $45 \times 45 \text{m}^2$. The series of numbers ascending in the table represent the area of a piece of land. The closest number to 45 m is 40.56m. Thus, the range of the series of numbers can be determined, written in bold in the table from 40.56m, 25.07m and 15.49m. In determining these series of numbers at least two meanings could be indicated. One is that the boundary of land needs to be determined. The 2-dimensional size of the plane for each module is determined as well. In this case, the boundary of this piece of land could be determined to be at 40.56m. Since all the sizes represent a variety of square forms, the square-formed ground base for the proposed architectonic space is $40.56\text{m} \times 40.56\text{m}$ coordinated from the table⁶⁷ (see Appendix 1).

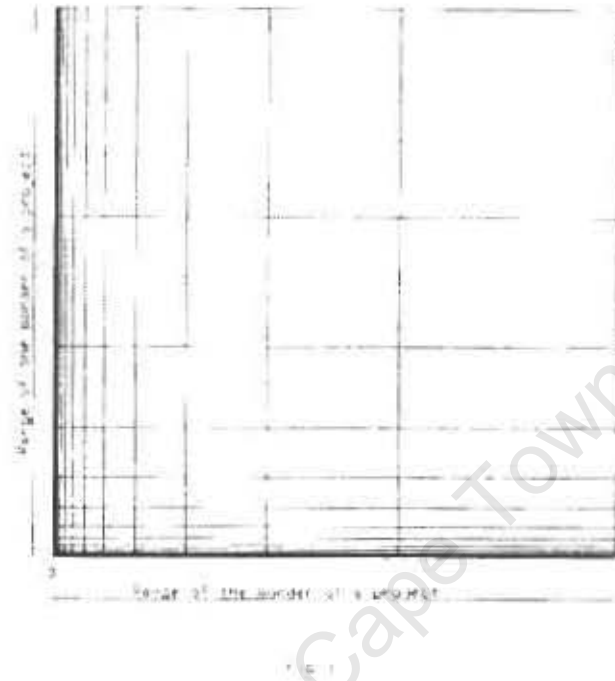
Display the "Panel"

The squared panel is presented in terms of practical size below (Figure 3.1 a, b) at $40.56 \times 40.56 \text{m}^2$. The smallest square is $2260 \times 2260 \text{m}^2$ at the lower left corner.

⁶⁷ A DEMONSTRATION: VALUES AND EXERCISES, VALUES, THE LIMITLESS NUMERICAL VALUES: (Le Corbusier, The Modulor, Faber and Faber Limited, 3 Queen Square London, 1954, p. 82)

From Two-Dimension to Three-Dimension

Up to now, the two-dimensional sizes for the modules have been determined. The size of the third dimension has to be given in order to produce the modules. The third



Standard Module Determined

Not all the modules will necessarily be used to design the proposed space. The standard modules are those selected as possible components for constructing the proposed space.

There are two reasons for making this selection. One is the smallest module of the cube $2260 \times 2260 \times 2260 \text{ mm}^3$ should be the reference unit for all the other modules. Thus, any modules smaller than this unit do not qualify for selection. The other four cubic modules indicated in Figure 3.2 possess similar dynamics to the fundamental unit of the cube because of their being proportionally enlarged and only one is needed for the basic scale of measurement. Thus, these four cubic modules are disqualified. The other reason is that the proposed modules have to possess distinct proportional differences. Thus, the modules that are undistinguishable from each other in terms of the three dimensions of the module itself are disqualified and therefore the two modules are disqualified as indicated in Figure 3.2. Finally, there are nine modules selected as the standard modules from this group to possibly be chosen to construct the proposed space (see Table 3.1).

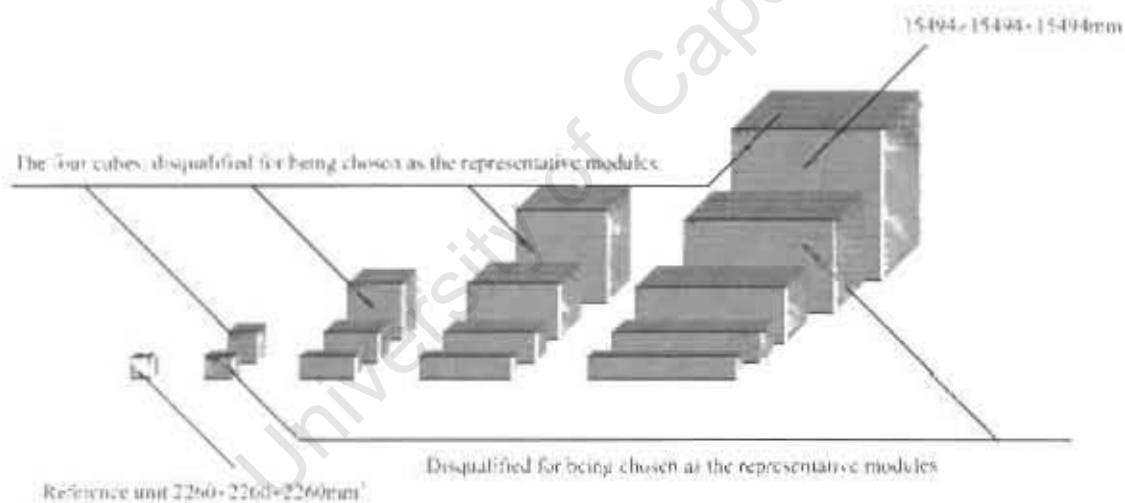
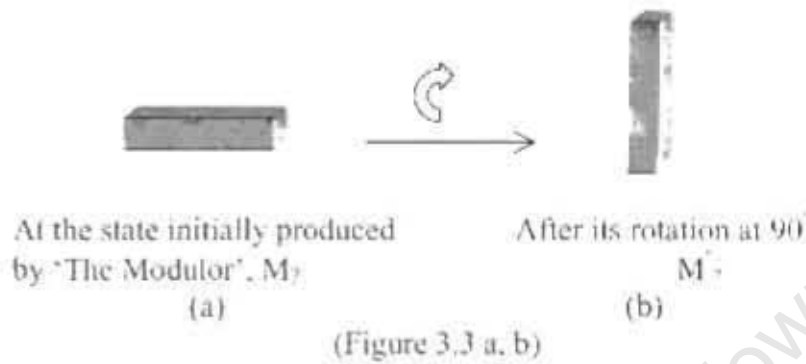


Figure 3.2

Additionally, there is a need to expose the dynamics of the modules in vertical dominance since vertical dynamics defines the other dimensional dynamics. These modules can be inverted from the modules standing in horizontal dominance to vertical dominance and this can be simply done by rotating the relevant modules by 90° (Figures 3.3 a, b). For example, M_7 is initially the module with its dominant dynamics in a

horizontal dimension, inverted from the module M_7 . The other modules can be done in the same way in response to the specific dynamics required at the points to be imposed, particularly, those modules to be imposed on point A. The M_3 , M_5 and M_7 are the modules to be inverted to the modules M'_3 , M'_5 and M'_7 with vertical dominant dynamics (see Table 3.2).



There are eventually twelve standard modules, nine with horizontal dominance M_1 , M_2 , M_3 , ... M_9 in Table 3.1, plus the other three with vertical dominance in Table 3.2.



Dynamic Value Assigned

Dynamic values are assigned to the standard modules in terms of the definition of the dynamics. These dynamic values are the base of the proper modules to be selected.

The dynamic value of the modules is the configuration of the dynamics of its planes and the dynamics of each plane can be calculated by the proportional comparison of the sizes of the edges between the plane of the shape and that of the reference cube, $2260 \times 2260 \times 2260 \text{mm}^3 (M_1)$. For example, the dynamic value assigned to the Module Two (M_2). The proportional ratio of the size of the edges of the frontal plane between M_2 and M_1 is: $\text{Length}(M_2) : \text{Length}(M_1) = 5918 : 2260 = 2.6$; $\text{Height}(M_2) : \text{Height}(M_1) = 2260 : 2260 = 1$ and the side plane is: $\text{Breadth}(M_2) : \text{Breath}(M_1) = 2260 : 2260 = 1$; $\text{Height}(M_2) : \text{Height}(M_1) = 2260 : 2260 = 1$. It can be said that the dynamic strength in the length and height dimension is 2.6 and 1 for the frontal plane, respectively, and in the breadth and height dimension 1 and 1, respectively. Collectively, the dynamics of the shape (M_2) might mean, if viewed from a presumed situation, that it has much stronger horizontal dynamics along its length dimension than that of the vertical rise in the height




dimension. Consequently, the dynamics of the sides are equal, and therefore more stationary. The calculation of the dynamics of the other modules works in the same way. The quality of each of the standard modules can be calculated and they are listed in Tables 3.1 and 3.2 below.

Table 3.1 Standard Module for Point B, C, D, E, F and other coordinates and Assigned Dynamics

Representative Modules and Their Dynamics								
Imagination	Function	Coding	Number	Volume (mm ³)	Dynamics of Frontal plane	Tendency	Dynamics of Side plane	Tendency
	Unit	M ₁		2260×2260×2260		Stable		Equal tendency in two dimensions
	General	M ₂		2260×5918×2260	L(M ₂):L(M ₁)=5918:2260 = 2.6 H(M ₂):H(M ₁)=2260:2260 = 1	Stronger along the length dimension	B(M ₂):B(M ₁)=2260:2260 = 1 H(M ₂):H(M ₁)=2260:2260 = 1	Equal tendency in two dimensions
	General	M ₃		3658×5918×3658	L(M ₃):L(M ₁)=5918:2260 = 2.6 H(M ₃):H(M ₁)=3658:2260 = 1.6	Stronger along the length dimension	B(M ₃):B(M ₁)=3658:2260 = 1.6 H(M ₃):H(M ₁)=3658:2260 = 1.6	Equal tendency in two dimensions
	General	M ₄		2260×9575×2260	L(M ₄):L(M ₁)=9575:2260 = 4.2 H(M ₄):H(M ₁)=2260:2260 = 1	Stronger along the length dimension	B(M ₄):B(M ₁)=2260:2260 = 1 H(M ₄):H(M ₁)=2260:2260 = 1	Equal tendency in two dimensions
	General	M ₅		3658×9575×3658	L(M ₅):L(M ₁)=9575:2260 = 4.2 H(M ₅):H(M ₁)=3658:2260 = 1.6	Stronger along the length dimension	B(M ₅):B(M ₁)=3658:2260 = 1.6 H(M ₅):H(M ₁)=3658:2260 = 1.6	Equal tendency in two dimensions
	General	M ₆		2260×15494×2260	L(M ₆):L(M ₁)=15494:2260 = 6.9 H(M ₆):H(M ₁)=2260:2260 = 1	Stronger along the length dimension	B(M ₆):B(M ₁)=2260:2260 = 1 H(M ₆):H(M ₁)=2260:2260 = 1	Equal tendency in two dimensions
	General	M ₇		3658×15494×3658	L(M ₇):L(M ₁)=15494:2260 = 4.2 H(M ₇):H(M ₁)=3658:2260 = 1.6	Stronger along the length dimension	B(M ₇):B(M ₁)=3658:2260 = 1.6 H(M ₇):H(M ₁)=3658:2260 = 1.6	Equal tendency in two dimensions
	General	M ₈		5918×15494×5918	L(M ₈):L(M ₁)=15494:2260 = 6.9 H(M ₈):H(M ₁)=5918:2260 = 2.6	Stronger along the length dimension	B(M ₈):B(M ₁)=5918:2260 = 2.6 H(M ₈):H(M ₁)=5918:2260 = 2.6	Equal tendency in two dimensions
	General	M ₉		3658×5918×5918	L(M ₉):L(M ₁)=9575:2260 = 4.2 H(M ₉):H(M ₁)=5918:2260 = 2.6	Horizontally along the length plus slightly upward	B(M ₉):B(M ₁)=5918:2260 = 2.6 H(M ₉):H(M ₁)=5918:2260 = 2.6	Equal tendency in two dimensions

* M₁, M₂, ..., M₉ means the number one module, ..., the number nine module; L, H, and B represent Length, Height, and Breadth respectively.

Table 3.2 Standard Module for Point A and Assigned Dynamics

Imagination	Function	Code	Volume (mm ³)	Dynamics of Frontal plane	Tendency	Dynamics of Side plane	Tendency
	General	M ₁	3658×3658 ×5918	L(M ₁):L(M ₁)=3658:2260 = 1.6 H(M ₁):H(M ₁)=5918:2260 = 2.6	Stronger in height dimension	B(M ₁):B(M ₁)=3658:2260 = 1.6 H(M ₁):H(M ₁)=5918:2260 = 2.6	Vertically upward The third strongest
	General	M ₂	3658×3658 ×9575	L(M ₂):L(M ₂)=3658:2260 = 1.6 H(M ₂):H(M ₂)=9575:2260 = 4.2	Stronger in height dimension	B(M ₂):B(M ₂)=3658:2260 = 1.6 H(M ₂):H(M ₂)=9575:2260 = 4.2	Vertically Upward The second strongest
	General	M ₃	3658×3658 ×15494	L(M ₃):L(M ₃)=3658:2260 = 1.6 H(M ₃):H(M ₃)=15494:2260 = 6.9	Stronger in height dimension	B(M ₃):B(M ₃)=3658:2260 = 1.6 H(M ₃):H(M ₃)=15494:2260 = 6.9	Vertically upward The strongest

Step 4. Dynamic Framework and Coordination For Proposed Modules

There are two purposes to this section. The first one is to fit the initial layout into the three-dimensional framework discussed (see 2.4) and the other is to coordinate the local coordinates on the initial layout, so that the proposed modules can be imposed (see 2.5). The determination of the local coordinates is in line with the promotion of the center of the proposed space and this is discussed from several architectural aspects (refer to Figures 2.25 b, c, d, e).

Initial Layout fitted into Three-dimensional Framework

This is referred to previously in 2.4.2. The cubic framework is 40.56m. The initial layout is modified gradually towards the proposed architectonic space. This layout fits the dynamic three-dimensional framework (see Figure 2.23).

Coordination For Proposed Modules

The coordination for the proposed modules is determined by the theme of the proposed space (see 2.3.6) and operated by aspects discussed in 'Architectural Factors' (see 2.5). The coordination of these modules that primarily influence the dynamic variable of the proposed space can be identified.

Axis

The modules building up the two axes crucially affect the dynamic variables of the proposed space (Figure 3.4). Their allocations at the middle points on either 'wing' of the initial layout can be identified (see 2.5.5).

Corner

There are two aspects to be discussed here (Figure 3.4). One is the space to access the proposed court space (see 2.3.5), and the other one is for the proposed modules to be imposed (see 2.5.4).

General Location

This location is where the modules to be imposed are other than those at the corners or middle points as illustrated in Figure 2.25(f). It can be referred to as the arranged black square. The gap is important to keep the contingent nature of the initial layout (see 2.5.3 Space Juxtaposed). The majority of the imposed modules adhere to the fundamental unit of $2260 \times 2260 \times 2260 \text{mm}^3$ except the ones either at the middle points or the corners (or longer than $2260 \times 2260 \text{mm}^2$).

The general layout pattern is thus readily determined. A further step has to be undertaken to decide these specific modules in terms of the theme of the proposed space. This includes specifying the proposed modules at points A, B, C, D, E and F.

Step 5. Dynamic Inference

This involves initially predicting the level of the convergent dynamics of the proposed space and then inferring this level to those of the proposed modules at the local coordinates especially in the middle and corners of the initial layout (Table 3.3). In order to infer the dynamic variables, the relationships of the dynamic variables need to be clarified (see 2.3.6 and 2.3.8).

Dynamic Variable of Theme (D_T) and Dynamic Variable of Proposed Space (D_S)

The theme of the proposed space is based on the promotion of its center. D_T approximates D_S , the convergent dynamics of the proposed space, and D_S is assumed

to be about the 6-7 level in terms of the scale of the convergent dynamics (see 2.3.8).

Dynamic Variable of Proposed Space (D_s) and Dynamic Variable of Modules (D_a , D_b , D_c , and D_d)

D_s is primarily affected by the dynamic variables of the proposed modules at A, B, C and D (refer to Figure 2.15). As their coordinates are specified, the dynamic variables of these modules should promote themselves the most, corresponding to that of the proposed space, respectively. Thus, the dynamic variables of these proposed modules can be specifically inferred (see 2.3.6).

D_a and D_b

The primary dynamic variable of module A presents a relatively strong vertical dynamics defining the other dimensions. The primary dynamic variable of module B should present very strong horizontal dynamics to contain that of module A (see 2.5.5).

D_c and D_d

Modules C and D are identical. The primary dynamic variable of the modules C or D should present very strong horizontal dynamics towards the center.

D_e and D_f

The dynamic variables of these two modules can be roughly inferred. Firstly, the arrangement of the two proposed modules to the corners is determined (see 2.5.4). Secondly, their dynamic variables are not as strong as those of the four modules, A, B, C and D, in coordinating the center of the proposed space. The dynamics of these two modules should demonstrate that the horizontal dynamics is dominant.

Dynamic Variable of Modules and Those of Their Planes

The first hypothesis postulates that the dynamic variable of a shape is an assembly of those of its planes. This quality of the planes can be calculated. If this quality is known, those of its planes can be inferred.

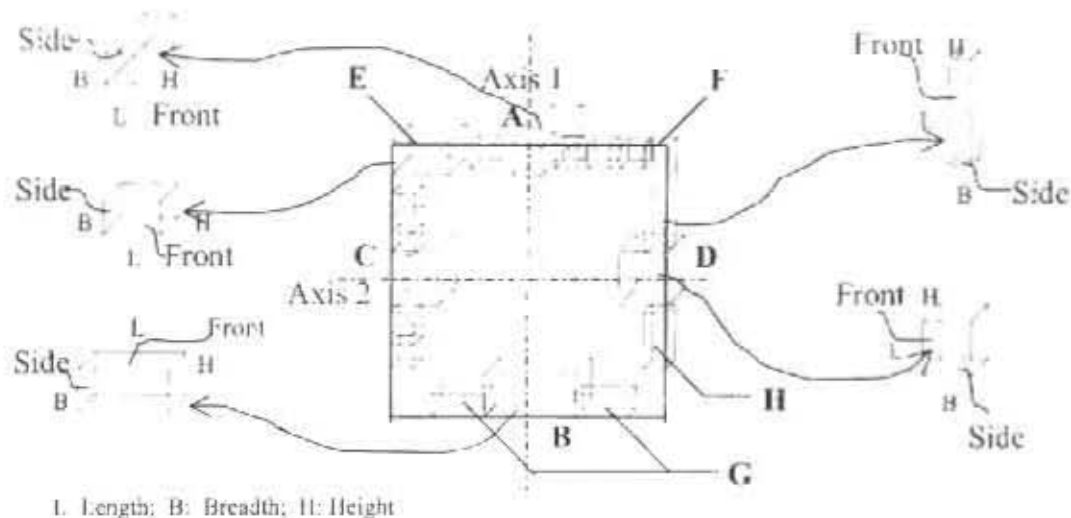


Figure 3.4

Dynamics of Planes of Module A

The primary dynamic variable of module A presents very strong vertical dynamics. This can be collectively represented by those of its planes and the dynamics of a variety of planes should present themselves mostly in individual situations. It is inferred that the dynamic variable of the ground plane of module A (d_{ga}) is relatively weak with a stable horizontal dimension and both the dynamic variables of the front and side planes of module A (d_{fa}) and (d_{sa}) are the strongest vertically.

Dynamics of Planes of Module B

The primary dynamic variable of module B presents very strong horizontal dynamics to contain that of module A. This can be collectively represented by its planes and the dynamics of a variety of planes should present themselves in individual situations. It is inferred that the dynamic variables of the ground plane of module B (d_{gb}) and the front plane (d_{fb}) are the strongest horizontally parallel to the ground edge and the dynamic variable of the side plane of module B (d_{sb}) is the strongest horizontally central-orientated.

Dynamics of Planes of Module C (D)

The dynamics can be collectively represented by its planes and the dynamics of a variety of planes should present themselves most in individual situations. Thus, it is assumed

that the dynamic variable of the ground plane of modules C or D (d_{gc} or d_{gd}) and the front plane of module B (d_{fc} or d_{fd}) is the weakest horizontally parallel to the ground edge: the dynamic variable of the side plane of the module B (d_{sc} or d_{sd}) is the strongest horizontally central-orientated.

Dynamics of Planes of Module E and Dynamics of Planes of Module F

Since the primary dynamic variable of modules E and F could present horizontal dynamics, the pulling strength from module F may seem to cause module A to flow rather than the other way round. Thus, it is assumed that the horizontal primary dynamics of module F is stronger than that of E.

Thus it seems to follow that the dynamic variable of the ground plane of module E (d_{ge}) is the third strongest horizontally parallel to the ground edge; the dynamic variable of the front plane of module F (d_{fe}) is the second strongest horizontally parallel to the ground edge; and the dynamic variable of the side plane of module E (d_{se}) is also the second strongest horizontally central-orientated.

It is therefore suggested that the dynamic variable of the ground plane of module F (d_{gf}) is the third strongest horizontally parallel to the ground edge; the dynamic variable of the front plane of module F (d_{ff}) is the third strongest horizontally parallel to the ground edge; and the dynamic variable of the side plane of the module F (d_{sf}) is the weakest horizontally central-orientated.

All the inferences of the dynamic variables are presented in Table 3.3 below.

Table 3.3 Dynamics Inferences of Modules, Planes, Dimensions

Dynamics Inferences	Dynamics of Dimensions			Dynamic Inferences	Dynamics of Planes			Dynamic Inferences	Dynamics of Modules
	d_k (in length)	d_b (in breadth)	d_h (in height)		d_m Ground	d_n Front	d_s Side		
The weakest, horizontally				The weakest, horizontal stable					Module A D_A
The weakest, horizontally				The strongest, vertically					
The strongest, vertically				The strongest, vertically					
The weakest, horizontally									Module B D_B
The strongest, vertically				The strongest, horizontally					
The weakest, horizontally				The strongest, horizontally					
The strongest, horizontally center-orientated				The strongest, horizontally					Module C or D D_C
unknown				The strongest, horizontally					
The strongest, horizontally				The strongest, horizontally					
unknown				The strongest, horizontally centralized					Module E D_E
The strongest, horizontally center-orientated				Much less than that of the module B					
A little strong, horizontally				Much less than that of module B					
Quite strongest, horizontally center-orientated				Very strong, horizontally centralized					Module F D_F
Quite strong, horizontally flowing				Quite strong, horizontally flowing					
Stronger than that in the breadth dimension of Module F, horizontally center-orientated				Stronger than that of the side plane of the module F, however smaller than those of the planes of Module A and B					
Quite strong, horizontally flowing				Quite strong, horizontally flowing					Module F D_F
unknown				Quite strong, horizontally flowing					
Less Strong than that of Module F, horizontally center-orientated				Quite strong, horizontally flowing					
Quite strong, horizontally flowing				See that about d_r					
unknown									
Less Strong than that of Module E, horizontally center-orientated									

Step 6. Proposed Module Determined

The proposed modules at the local coordinates are chosen from the standard modules in terms of the dynamic variables inferred (see Step 5). Specifically, the inferred dynamic variables of the planes of the proposed modules (see Table 3.3) have to practically accommodate those of the standard modules (see Tables 3.1 and 3.2). The coordination of the proposed modules is based on the closeness of the practical and inferred dynamics of the relevant planes (see 2.5.6). The planes Ground, Front and Side are the focus.

Module on Axes

There are four proposed modules A, B, C and D composing the two symmetric axes of the proposed space.

Module A

The dynamic variables of its planes can be inferred from that of the proposed module A and they are presented in Table 3.4-1. The selection of the modules is limited to modules M_3 , M_5 and M_7 (see Table 3.2). The dynamic variables of the ground and side planes remain the same within these three modules. The dynamic variable (d_{11}) in the height dimension of the frontal plane of the module M_7 is the strongest at 6.9 (see Table 3.2). The dynamic variable of M_5 is close to the requirements of the dynamics inferred at the proposed module at point A. Thus, the Module (M_7) can be coordinated as the module to be imposed on point A.

Table 3.4 – 1 Dynamic Variable Inferred to Dimension of Planes of Module A

Dynamics of Plane	Module A					
	d_{11} (Ground)		d_{12} (Front)		d_{13} (Side)	
Dynamics in Dimension	d_1	d_{11}	d_2	d_{12}	d_{13}	d_3
Dynamics Inferred	The weakest	The weakest	The weakest	The strongest	The strongest	The weakest

* d_1 means the dynamics along the length dimension; d_{11} the height dimension; d_2 the breadth dimension

Module B

The dynamic variables of its planes can be inferred from that of the proposed module B (Table 3.4-2). The dynamic variable (d_{11}) in the length dimension of the frontal plane of

the module M_8 is the strongest at 6.9 and in the breadth dimension quite strong at 2.6 (see Table 3.1). In accommodating these variables, the dynamic variable in the two dimensions of M_8 is close to the requirements of the dynamics inferred at the proposed module at point B. Thus, the Module (M_8) can be coordinated as the module to be imposed on point B.

Table 3.4 – 2 Dynamic Variable Inferred to Dimension of Planes of Module B

Dynamics of Plane	Module B					
	d_g (Ground)		d_h (Front)		d_b (Side)	
Dynamics in Dimension	d_L	d_B	d_L	d_H	d_H	d_B
Dynamics Inferred	Very strong	Very strong	Very strong	unknown	unknown	Very strong

* d_L means the dynamics along the length dimension; d_H the height dimension; d_B the breadth dimension

Module C or Module D

The dynamic variables of its planes can be inferred from that of the proposed module C or D (Table 3.4-3). The dynamic variable (d_L) in the length dimension of the frontal plane of the module M_7 is less strong at 4.2 than (d_L) in the length dimension of the frontal plane of the module M_7 and in the breadth dimension it is quite strong at 2.6 (see Table 3.2). The dynamic variable of M_7 is close to the requirements of the dynamics inferred at the proposed module at points C or D. Thus, the Module (M_7) can be coordinated as the module to be imposed on these points.

Table 3.4 – 3 Dynamic Variable Inferred to Dimension of Planes of Module C or D

Dynamics of Plane	Module C or D					
	d_g (Ground)		d_h (Front)		d_b (Side)	
Dynamics in Dimension	d_L	d_B	d_L	d_H	d_H	d_B
Dynamics Inferred	Weaker than that of Module B	Quite strong	Weaker than that of Module B	unknown	unknown	Quite strong

* d_L means the dynamics along the length dimension; d_H the height dimension; d_B the breadth dimension

Module At Corners

There are five modules M_6 , M_7 , ..., and M_8 , of which the horizontal dynamics flowing from the proposed modules to points E and F is stronger than those of the proposed module (M_6) to points C and D. Thus it is determined that M_8 be imposed on point B. Thus, the proposed modules E and F will be selected between M_6 and M_7 .

Module E and Module F

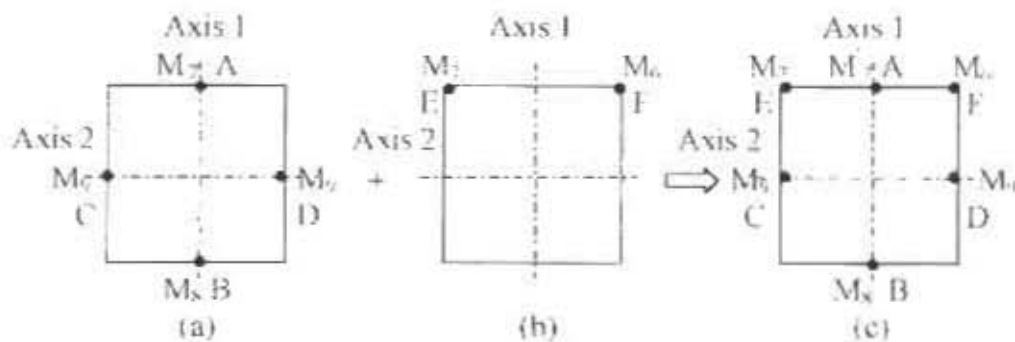
The dynamic variable in the breadth dimension of the proposed module E should be stronger than that of module F. The dynamic variable in the breadth dimension of M_6 is 1 and that of M_7 1.6 (see Table 3.1). Thus, M_7 becomes the proposed module to be imposed to the corner E and M_6 is the proposed module to be imposed on the corner F.

Modules Other Than These Above

The modules discussed here are those building up the general surrounding, other than those at the four middle points and the two corners of the basic layout. The majority of the modules conform to the fundamental cubes and this general layout can be seen in Step 4 under General Location. There is a little change. The module Two (M_2) replaces the cubes somewhere around the points marked as G, H and I (Figure 3.6). Since the changes of these modules remain under the frame of the initial layout with the section size $2260 \times 2260 \text{mm}^2$, their replacement will not affect the original convergent dynamics. There are two reasons to make the changes (see 2.5). The first one is to reinforce the convergent dynamics at point G and the other one is to prevent it from being too symmetrical by replacing M_2 at points H and I.

Step 7. Architectonic Space Presented

This step is the final stage of the consecutive design process in the construction of the proposed architectonic space. The graphic indication in Figure 3.5 (a), (b) and (c) intends to clearly show where the influentially specific modules go in this proposed space. The figure (c) is the result of the final assembling of the two figures (a) and (b). The square simulates the boundary of the space. The dots are the local coordinates on the layout on which the selected modules are going to be imposed and they consist of the two pairs of axes A, B, C and D at the corner points E and F. These modules are numbered at the coordinates and each of these individual graphic figures can be referred to in Table 3.1 in Step Three. These modules may produce the level of the convergent dynamics predicted for the proposed space. This space may, therefore, arouse a relatively appropriate emotion.



Figures 3.5 a, b, c

This designed architectonic space is toured imaginably through the route indicated and the visitor stands in the middle area to view the space as a whole, which will be viewed by the visitor at various points on the route. The entry on the left side has been chosen as the starting point of the tour (Figure 3.6). The route is marked by the dashed line

The perspective of this proposed space is presented as Space One in Appendix 3.

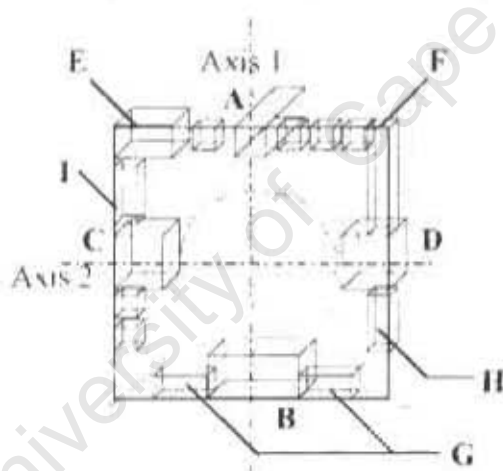


Figure 3.6

3.3 SUMMARY

The design of this proposed architectonic space has therefore been completed within a process involving seven steps. This space is designed in conjunction with the hypotheses. The emotion evoked in this space is assumed to be more suitable than the others. Consequently, a number of architectonic spaces need to be constructed in order to examine this design method. The experimentation for this approval will be carried out by means of a survey design in Chapter Four.

4. SURVEY DESIGN

4.1 INTRODUCTION

The research design was drawn up at the very beginning of the research process, so the plan may, indeed, have to be altered as the research progresses. Actually, in Chapter Three, the survey design has already taken shape, the hypotheses having been formulated and the relevant architectonic space specifically designed in association with them. Chapter Four is, in fact, a continuity of the process. It is involved with survey related matters, that is, the construction of the architectonic spaces, the planning of the questionnaire and the experimental performance.

This survey was carried out in practical terms by means of an experiment. The experimentation in this study is the practical examination of the formulation of the hypotheses in association with the previously developed "dynamic" design theory, in connection with the interaction between man and the exterior public space. More specifically, this experiment sets to find out whether there is any kind of rational relationships between the appropriate emotions, the level of the convergent dynamics and the clarity of special centers. The primary objectives of the experimentation are:

- (1) to determine whether different levels of convergent dynamics could be felt and identified,
- (2) to determine whether the appropriate emotion of one of the spaces corresponds to the specified convergent dynamics of the proposed space,
- (3) to determine whether a center of the proposed space is more identifiable than those of the others,
- (4) to determine if the appropriate emotion is felt from any of the architectonic spaces, and what the relationship of the levels of the convergent dynamics is between the one assumed to the proposed space, as designed in Chapter Three, and the one actually perceived by the respondents,
- (5) to determine if the areas of disagreement, if any, are attributed to a variety of people categorized by different socio-demographics or the professional education of the architects and whether there are some measurable differences between the non-architectural people and architectural professionals.

In order to test the dynamic design theory one must get public opinion on whether this theory is correct or not or if the hypotheses need to be adjusted. According to the hypotheses, if people felt the space in the same way as the assumption of the study and under the same circumstances, the levels of concentrated emotion might be able to be ranked and a general identification of the appropriate emotion could be made. This means that the architectonic space designed in Chapter Three has to be compared with a number of similar kinds of spaces and all of them have to be tested.

Thus, the first question on what and how these kinds of spaces will be built up is raised. What the measurement scales of the variables are is the second question. The third question is who the people are to look through all these spaces? In order to collect the data, the questions have to be composed. What kinds of questions are going to be asked? This is the fourth question. These questions are then discussed. Thus, the experimental data can be collected through the process of this survey as detailed in this chapter.

4.2 METHOD AND PROCEDURE OF DATA COLLECTION

The data collection process of the experiment must be carried out through a series of steps. This procedure must be presented in a logical order. It is, therefore, divided into four primary steps: Architectonic Space Presentations, Measurement Scale, Questionnaire Planning and Respondents' Group.

- Architectonic Space Presentation: to present a variety of perspectives for the subjects to look at
- Measurement Scale: on the convergent dynamics and clarity of the center
- Representative Sample: to represent the defined population for this study
- Questionnaire Planning: to instruct the survey performance and collect the data

4.2.1 ARCHITECTONIC SPACE PRESENTATIONS

In order to examine the 'dynamic' design theory, perspectives of architectonic spaces have to be presented to subjects. They are sorted into two sections: one is the architectonic space readily completed by means of the 'dynamic' theory in Chapter

Three, called the designed section and the others are those architectonic spaces, rather called the constructed architectonic spaces, which are discussed in the following chapter.

The objective of this presentation is to allow the subjects to look at the spaces and compare the variables of the spaces. There are three kinds of variables. The first one is the dynamic variable primarily affecting that of the spaces, which is the convergent dynamics being evoked by the imposed modules constructing the two pairs of axes. The second one is to do with the clarity of the center of the spaces, which is affiliated to the first one. The third one is the preference for the most suitable or appropriate space. Some relationships of the variables may be found. Consequently, the way of constructing these spaces has to be identical to that of the proposed space designed in Chapter Three. Everything must be exactly the same as that of the proposed space, except the imposed modules building up the two axes of the initial space base, which are alternately changed.

ARCHITECTONIC SPACE DESIGNED

The architectonic space designed, Space One (see Appendix 3) is the interpretation of the dynamic theory, presented in detail in Chapter Three.

ARCHITECTONIC SPACE CONSTRUCTED

The objective of these spaces is to assist testing whether the proposed space designed is more suitable than the others. This implies that these Architectonic Space need to be constructed in a very similar condition to that of the proposed one. A complete description illustrates how these spaces are constructed.

General Layout

The general layout for all these architectonic spaces are based on a similar model frame to that of the first space (Appendix 3). This means that their general layouts, including the ground base, are the same as the layout of the space used in Chapter Three, except for the modules at the four points (Figure 4.1 a) where the two pairs of axes are constructed. Thus, the construction of these spaces varies solely on the basis of the different combinations of modules on the two axes and these local coordinates are at points A, B,

C and D. The dynamic variables proposed by these modules on the axes crucially determine that of these spaces.

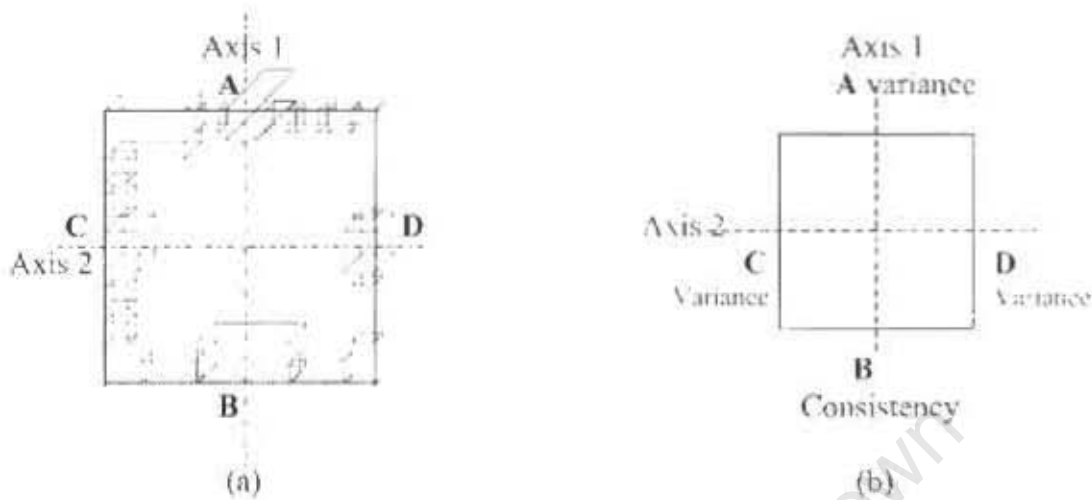


Figure 4.1 a, b

Modules on Axis 1 and Axis 2

The two symmetrical axes, Axis 1 and Axis 2, play a fundamental role in coordinating this dynamic center. Axis 1 is built up by points A and B and Axis 2 by points C and D (Figure 4.1 b). The figures of these spaces rely on the modules to be imposed on these local coordinates and their number is determined by the array of combinations of the modules. In order to reduce the numbers of combinations of Axis 1 and 2, module B is kept consistent along the side of entry to the architectonic space. Because this module is not at an eminent position, its consistency does not influence the dynamic variable. The modules C and D are identical to each other. Finally, the three points, A, C and D are the points on which the selected modules are going to be alternately imposed.

Module Selection

The modules are the ones to be imposed on the coordinate points A, C and D. The modules should be randomly selected from the standard modules but then there would be a massive number of combinations. This is not sound for the purposes of a survey and may confuse the respondents. The greater the number of combinations may mean subtler difference among these architectonic spaces rather than a smaller selection, which may

present relatively big differences. Obviously, the second option is more feasible. Consequently, the obvious distinction of the modules in their relevant dimensions should be the basic criteria for this selection. They are presented as follows:



Modules Imposed on A

These modules for possible selection are M_1 , M_5 , and M_7 (refer to Table 3.2). Firstly, they have obviously distinct dynamics in terms of verticality. Secondly, the dynamics in the length and breadth dimension do not change in the process of the construction but the dynamics of the height dimension does. The condition of the vertical dynamics at point A, which is assumed to be vertically dominant, can be examined.

Modules Imposed on C and D

Modules 3 (M_3) and 5 (M_5) have a quite distinct dynamic variable in terms of horizontality and they have been chosen from the standard modules in Chapter Three (see Table 3.1). M_3 and M_5 are chosen as the modules to be alternately imposed on points C and D (Table 4.1).

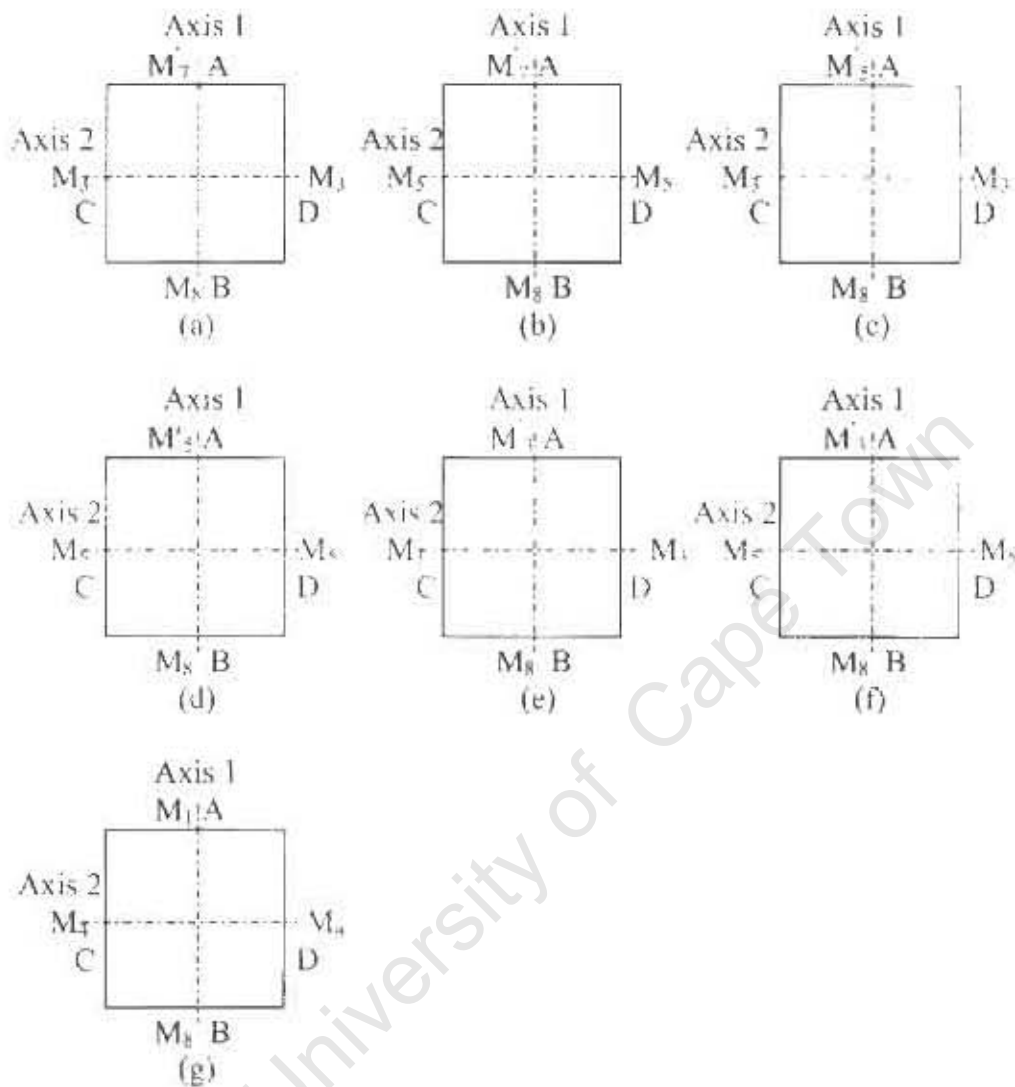
Table 4.1 Modules to be imposed on Points C and D

Figure	Code	Dynamic Dimension	Dynamic Ranking	Dynamic Change	Point to be Discussed of
	M_1	Horizontality and Verticality	Bigger in breadth Bigger in height Smaller in length	Three-dimension	Points C and D
	M_3	Horizontality and Verticality	Bigger in breadth Bigger in height Biggest in length	Three-dimension	Points C and D

Combination of Modules

A number of architectonic spaces are constructed in terms of the combination of modules A, B, C and D on the symmetrical axes (module B is kept consistent). The number of combinations are indicated below (Figures 4.2 a, b, c, d, e, f, g). Each square represents the boundary of the spaces. A, B, C and D indicate the four local coordinates on the two

pairs of the symmetrical axes. The two axes are marked by dashes. A total of seven combinations are produced. Thus, the seven architectonic spaces are constructed.



Figures 4.2 a, b, c, d, e, f, g

Additionally, another architectonic space needs to be constructed in terms of the previously predicted point that respondents might identify as the dynamic center of the space. In association with this point, the modules to be imposed on the points on the axes should be the ones that will make them less distinguishable from their surroundings as possible. Thus, the modules measuring $2260 \times 2260 \times 2260 \text{m}^3$ (M_1) and $2260 \times 9575 \times 2260 \text{m}^3$ (M_4) are eligible to be chosen from Table 3.1. Another architectonic

space 'g' could be constructed for this purpose (Figure 4.2 g). This architectonic space is number eight.

Perspectives

Collectively, there is a total of eight perspectives, from Space One to Space Eight representing the architectonic spaces (see Appendix 3). Space One is the one designed in Chapter Three. The other seven are those constructed by the combinations, numbered from Space Two, Space Three... .. Space Eight. The viewing points to the architectonic spaces to be presented are in the ideal condition as defined in this study, chosen to be at the same position, the same distance and the same angle to the target respectively, where each architectonic space could be eyed as completely as possible.

4.2.2 MEASUREMENT SCALE

The measurement scale of the convergent dynamics of the spaces and the clarity of the spatial center is discussed in 2.2.4 and 2.2.7. The level of the convergent dynamics of the spaces is divided into seven levels and the level of the clarity of center into three levels. The actual responses will be in terms of these scales.

4.2.3 REPRESENTATIVE SAMPLE

Usually surveys are concerned with large populations. Practically, it is necessary to draw a small group of people, representing the population, out of the larger population. The term 'sample' is used to indicate a smaller group, usually, but not always, a representative one, within a population. A 'representative' sample has the same characteristics as its population but is much smaller in number. However, it should be understood that samples are not necessarily representative or may only be representative of part of a population.

There are various methods by which a representative sample can be drawn, though these may not meet the exact standards of a probability sample. The sampling quota

method⁶⁷ is used to draw the representative sample. Thus, the population and its socio-demographic characteristics have to be defined in association with those of the region studied. Moreover, the so-called 'cells' and the socio-demographic characteristics have to be identified in the process of sampling to correspond to the parent population, so that the 'representative' sample can be drawn.

Population and Its Socio-demographic Characteristics Defined

The term 'population' is used to denote all those who fall into the category of concern of a study. This study deals with visual perception and its intrinsic attributes contributing to a relevant emotion. Almost everyone is an eligible candidate, except the visually impaired. Thus, the population is defined within a very broad range. The defined population is allocated in the Western Cape of South Africa.

Socio-demographic characteristics are the intrinsic attributes of the population and represent a variety of categories, such as sex, ethnicity and socioeconomic status, marriage status, etc. According to the definition of the method of the *sampling quota*, the population must possess a certain percentage of each of these factors in order for them to be part of the calculations. A 'cell' or quota within an overall sample is designed to have the same socio-demographic characteristics as its population, that is, the sample should have the same sex ratio as the population, the same ethnic and socioeconomic status groupings, the same proportion of married, single, divorcees and widowed members, etc. (In practice, fieldwork agencies tend to use rather fewer sampling variables.) Thus, a few sampling variables can be worked with.

In this study, the socio-demographic characteristics focused on are age and gender. These have the same ratio as those of the socio-demographic characteristics in the defined population. This population is made up of three main cells. They are sorted in

⁶⁷ One of these is called the *sampling quota* method used in framing the sample. A 'quota' in this context is a cell within an overall sample, designed to have the same socio-demographic characteristics as its population, that is, the sample should have the same sex ratio as the population, the same ethnic and socioeconomic status groupings, the same proportions of married, single, divorced and widowed members, and so on. When all the cells, or quotas, are put together they form a sample which should have the same socio-demographic characteristics as the population (A. N. Oppenheim, *Questionnaire Design, Interviewing and Attitude Measurement*, New Edition, Pitman Publishers, London and New York, 1966, 1992, pp. 8-21, 41).

terms of the range of age: being 5 – 24years, 25 – 44years and 45 – 64years. The factor of race is ignored.

The ratio of each socio-demographic characteristic must be calculated. Table 4.2 below shows the ratio of the socio-demographic characteristics in the population in Western Cape. These socio-demographic characteristics are extracted from official sources⁶⁸. The range of age in the official source is from '0' to '100' and the number of people in each age category are specified. The total population is about 3,284,051 in the Western Cape as indicated in the original table.

Table 4.2 People grouped by Age, Gender and Race

	African Black		Coloured		Indian/Asian		White		Unspecified		Column Grand Total	Ratio
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female		
5 - 24	138643	116227	416422	391946	8037	7655	101697	80179	13278	3429	1,281,713	39%
25 - 44	123671	155044	300743	291977	9254	9470	102869	160653	20988	34519	1,113,268	40%
45 - 64	63389	29589	125432	191124	6390	6029	91299	128218	9360	8601	689,130	21%
Row Grand	325703	340860	836597	975046	23381	23154	295865	369250	43626	59569	3,284,051	100%

Table 4.2-1 Gender Ratio

Range of Age	Male	Ratio (%)	Female	Ratio (%)
5 - 24	672077	20.5	609636	18.6
25 - 44	553525	17	761681	23.1
45 - 64	295570	9	393560	11.9
Column Grand Total	1521172	46.5	1764879	53.7%

Respondents' Group/Representative Sample Population

The defined population is represented by the respondents' group or representative sample. The *quotas sampling* is in line with this. The defined population can therefore be represented by such *sampling*. This is composed of a numbers of "cells" or "quotas". A *quotas sampling's* population is the addition of the total population of each "cell". When all the cells, or quotas, are put together they form a sample which should have the same socio-demographic characteristics as the defined population (A.N. Oppenheim, 1966, 1992). In this study thirty respondents were interviewed. The representative sample is compiled by putting the three cells together (Table 4.3). The

⁶⁸ Statistics South Africa, South Africa Census 96 Table1, Age by Population group and Gender for Person Weighted, Western Cape

percentage of gender in this sample is thirteen, seventeen (13 male and 17 female). Twelve respondents fell in the first age category, ranging from 5 – 24 (Male 6, Female 6); Twelve respondents were in the second age category ranging from 25 – 44 (Male 5, Female 7); and six respondents from the third age category ranging from 45-64 years (Male 2, Female 4). Thus, a representative sample was formed.

Additionally, ten architectural students were randomly selected from the School of Architecture and Planning at the University of Cape Town, South Africa. This selection was carried out by randomly selecting a name from the list acquired from the School of Architecture and Planning. The objective here is to see if there is a difference in the criticism of the architectonic spaces because of being professionally trained.

Table 4.3 Socio-demographic Characteristics in Cell

No. of Cell	Age Range	%	Numbers of People	Male	Female
No. 1	5 - 24	39	12	6	6
No. 2	25 - 44	40	12	5	7
No. 3	45 - 64	21	6	2	4
Grand Total	5 - 64	100	30	13	17

4.2.4 QUESTIONNAIRE PLANNING

The questionnaire is thought of as an important instrument of research and a tool for data collection. The questionnaire has a job to do: its function is that of measurement. In this study, the variables, the convergent dynamics, the clarity of the center and the most preferable space, are being measured by means of comparison. The answers to the questions should be contained in the questionnaire specification. Before beginning with the questionnaire, there should be a rough idea of the pattern that the enquiry is likely to follow: an analytical research conducted on a set of attitudes. A probability sample is then drawn up regarding the Cape Town population. The detailed specification of measurement aims must be precisely and logically related to the aims of the overall research plan and objectives. For each issue or topic to be investigated, and for each hypothesis to be explored, a precise operational statement is required about the variables to be measured.

Some general considerations had to be borne in mind before compiling the first question. These decisions fall into four groups: the method of data collection, the question modules, the questionnaire sample and the questionnaire performance.

Method of Data Collection

The self-administered questionnaire method was the method chosen to collect the data. Since the method of data collection involves interviewing, this ensures a high response rate⁶⁹ and accurate sampling. The interviewer bias should be minimized while permitting interviewer assessments, providing necessary explanations (but not the interpretation of questions) and giving the benefit of a degree of personal contact. Moreover, ways must be found to gain the respondents' co-operation and to motivate them to respond to the questions. Furthermore, it is necessary to find out if the reasons for the non-response are connected with the topic of this research, should one of the respondents refuse to answer.

Question Modules

Towards the end of the pilot study the questionnaire consisted of a series of question modules or sequences, each with a different variable. The order in which these modules appear on the final questionnaire should now be considered. Two sets of considerations must be borne in mind: the internal logic of the inquiry, and the likely reactions of the respondents. There were two different kinds of variables in this study: experimental variables and dependent variables. The experimental variable is the effect of the level of the convergent dynamics and clarity of center, predictably delivered by one of the architectonic spaces being presented. The dependent variables are the results, the effect-variables, the gains or losses produced by the impact of the experimental variables, the predicated outcome, and here they are the appropriate emotions observed by the respondents.

⁶⁹ The following factors have been found to increase response rates, either mail surveys or personal interviews or both (A. N. Oppenheim, *Questionnaire Design, Interviewing and Attitude Measurement*, New Edition, Pinter Publishers, London and New York, 1966, 1992, pp. 15-28, 811)

Order of Questions Within Modules

The order of the questions must now be considered. This unfolding was done by a method called the “funnel approach”⁷⁰, preceded by various “filter” questions⁷¹. Thus, for the purpose of questions regarding the kind of emotion that is supposed to result from the architectonic space and other related issues, some factual information about the respondent’s emotional impression of this space would be asked.

Obviously, if the respondent did not feel this kind of emotion at all then there is no point in asking about the related questions that follow. Therefore, the illustrative question sequence is preceded by a filter question such as, “Do you feel a kind of convergent dynamics being conveyed by the architectonic space being viewed?” If the response questions are not followed by any kind of choice, then the answers would have to be recorded in full. In terms of the specific circumstances, closed questions are the least productive, and the interviewee would be instructed to skip the next few questions and to proceed to the beginning of the next question sequence (a routing instruction).

Question Types

Broadly speaking, most questions are either “open” or “closed”. A closed question is one in which the respondents are offered a choice of alternative replies and are the usual way for the questions to be presented. However, a few questions might be asked as open questions.

Question Specification

In this section, each question should deliver the information related to the variables the survey is interested in, and, collectively, all the questions should be ordered to produce

⁷⁰ The funnel approach is so named because it starts off the module with a very broad question and then progressively narrows down the scope of the questions until in the end it comes to some very specific points. (A. N. Oppenheim, *Questionnaire Design, Interviewing and Attitude Measurement*, New Edition, Pinter Publishers, London and New York, 1966, 1992, pp.41-43, 110)

⁷¹ A “filter” question is used to exclude some respondents from a particular question sequence if those questions are irrelevant to them. (A. N. Oppenheim, *Questionnaire Design, Interviewing and Attitude Measurement*, New Edition, Pinter Publishers, London and New York, 1966, 1992, pp. 38,39, 111)

the specific final result that this study is trying to explore.

It is necessary here to briefly outline the methodology of this research again. The objective of the research is to set up an appropriate emotion for a public activity exterior space by means of the defined dynamics. Thus, it is hypothesized that an appropriate emotion might be represented by the dynamics within the defined architectural framework. The dynamics has to be rationalized within a defined framework and the dynamics is always conveyed by means of a shape. Thus, there might be a rational relationship between the convergent emotion and the dynamics conveyed by shapes comprising the architectural space within a defined framework and an appropriate emotion joining these two. According to this assumption, and through the preceding arguments, the suitable convergent emotion might be coordinated by the representation of the rationalized dynamics within the defined framework. It is by means of “The Modulator” that it could be quantifiably hypothesized that an appropriate, convergent emotion might be set up in terms of the dynamics of an architectonic space within a defined architectural framework. The quality of the dynamics of each module is generated in the 3-dimensional framework. The hypothesis can be represented architectonically. Thus, within the defined number of modules, and in terms of this theory, an appropriate emotion for the architectonic space might be constructed.

In order to prove the hypotheses, the straightforward way would be to build up a number of architectonic spaces and let people chose the one that had the most appropriate emotion. A number of architectonic spaces would be built up and the people could choose which one possesses the appropriate emotion. The proportional rate of the emotion can be statistically analyzed. Thus, an architectonic space with the greatest appropriate emotion might be identified. If the one proclaimed by the respondents is the same as the hypothesis, it might be said that the assumption is right and the theory works. If the one proclaimed is not, it means that the assumption might be wrong and a further analysis needs to be carried out to find out what was wrong with this assumption and an adjustment or recommendation made. Therefore, the goal of the experiment can be approached following this methodology.

The specific questions must be composed to link with the architectural presentation. Each question needs to be coordinated so that the questions asked are orientated towards

the very specific problem, the range of the questions, and the variables. There are three types of variables involved - the dynamic variable, the clarity of the center variable and the appropriate emotion variable. It has already been mentioned that the order of the questions should be carefully arranged. The questions are set and the order of the questions unfolded within each module according to the method called the “funnel approach”, preceded by various “filter” questions. The question module starts off with a very broad question and then progressively narrows down the scope of the questions until in the end it comes to some very specific points. The broadest question is calculated in terms of the objective of the study and its variables by asking: *“After completely viewing each of these architectonic spaces by intimately standing at the center of them, could a kind of convergent dynamics be evoked?”* Moreover, the range of the questions could be the two endings of these questions. Obviously, the very specific points relating to very specific questions, are the narrowest ones. In other words, the down-limit of the range of the questions was determined and then the upper limit identified. *“Please, rank the levels of the convergent dynamics on the measure scale and among all these architectonic spaces, which one you think is relatively more appropriate than the others.”* As previously discussed, the questions that reflect the implications of the hypotheses are directly related to two pairs of modules composed of two axes. The point of the questioning is to discover the representative modules for each one of the two axes. Thus, the respondents could be asked, *“Could you feel that there was center in those architectonic spaces? And so on.”*

Questionnaire Sample

A complete questionnaire for the specific performance of this survey is attached separately (see Appendix 2). It includes the instruction of the survey performance, the questions, the architectural perspectives, the tables and the measurement scale.

For the sake of clarity, the fundamental instrument for the data collection includes:

Table 4.5: Personal Background Information

Table 4.6: Levels of Convergent Dynamics

Table 4.7: The Most Suitable Space Preferred

Table 4.8: Level of Clarity of Center of Space

Measurement Scale: Applied to Table 4.6 and Table 4.8

Architectural Perspectives No.1-8 representing the eight spaces: see Appendix 3.

Questionnaire Performance

As mentioned previously, individual interviewing has been chosen as the most efficient way to approach the respondents. The instructions should be explicitly explained to every respondent to make sure the respondents follow the procedure precisely.

In order to reduce the possibility of bias and error, the influence of the factors suspected of interfering with the mood of every individual, and thus interfering with the conclusion will be reduced to those factors discussed in the defined scope, such as occupation, age, gender, etc. For example, the time and place of the interview had to be as similar as possible although it was very hard for the interviewer to keep the circumstances constant. The environment had to have as little disturbance as possible and so the disturbing elements, such as noise, smoke, etc, needed to be controlled.

4.3 SUMMARY

In this chapter, the survey design for this study is completed and it is practically represented in a questionnaire.

5. SURVEY DATA ANALYSIS

5.1 INTRODUCTION

The objective of this chapter is to analyse the survey data in order to test the hypotheses and investigate whether there is any relationship between the responses of the various subjects. Any findings from the analysis are duly noted. This process is divided into two main parts: the data analysis and the findings.

Exploratory statistical analysis (ESA) is applied to the analysis of the data. Specifically, the techniques of the mean, the confidence interval, and chi-square have been used to analyze the relevant data. The concept of the mean helps calculate the “central” tendency of the variables from different sources. The confidence interval helps examine whether the postulated variables of the proposed space are sound in order that the hypotheses can be tested. Chi-square helps explore whether there are any relationships between the different subjects in response to the relevant variables.

Three independent variables are tested from three sources: from those hypothesized by the researcher, from the non-architectural respondents and from the architectural students. Thus, besides the hypotheses testing, the comparisons of the data are made between these sources. The relevant findings are then explored.

5.2 DATA ANALYSIS

The process of data analysis is divided into the survey data gathered, the analysis method and the testing of the hypotheses.

5.2.1 SURVEY OF DATA

The survey responses were collected by a single interviewer throughout using the questionnaire designated in attachment two (see Chapter Four). Whether the sample population matches the target population in all important respects, in terms of the socio-demographic characteristics, will be questioned. This stage involves the cleaning of the data set. The three independent variables, the levels of the convergent dynamics of the spaces, the preferred space and the levels of clarity of the spatial center have been accumulated separately.

PRACTICAL DATA

The data set suggests its own checking procedures and starts by running frequency distributions on the main sampling variables. This can be referred to in Table 4.4 in Chapter Four.

The practical sampling presented in terms of the socio-demographic characteristics in Cell is shown in Table 5.1 below. In terms of the initial definition of the range of the data (Table 4.3), a few data were missed out. However, the big picture of the representative respondents in terms of the general categories of gender remains the same and those in terms of age remain similar to that of the population. There are some differences in terms of the gender factor percentage. In terms of the fourth hypothesis, as well as the objective of this study, collectively, this difference does not majorly affect the correctness of this survey since our focus is to look at the defined questions from the general point view. A few people failed to complete the process. This could be caused by the manner of collecting the data itself, which was not really an easy-going process, and made a few respondents fearful of failure. A potential respondent had to carefully read the instruction, intimately view the spaces, perceptually compare them, and then answer the questions by ticking the tables. The majority of the respondents proceeded relatively comfortably with the interview process.

The total number of the respondents, in terms of gender, remained the same between the representative sample and the population. There are some differences indicated here in terms of age. From the age group aged from five to twenty-four, there were in reality eleven respondents instead of the original twelve, six male instead of the five and five female instead of the original seven. From the age group twenty-five to forty-four, there were twelve respondents, four male instead of six and the females remain unchanged. From the age group aged from forty-five to sixty-four, there were seven respondents instead of six, three male instead of two.

The ten architectural students were initially chosen with no special requirements other than being architectural students and this remained the same.

Table 5.1 Socio-demographic characteristics in Cell

No. of Cell	Age Range	%	Numbers of People	Male	Female
No. 1	5 – 24	37	11	6	5
No. 2	25 - 44	40	12	4	8
No. 3	45 - 64	23	7	3	4
Grand Total	5 - 64	100	30	13	17

VARIABLES

The independent variables are classified into three types I, II and III. They are the convergent dynamics (Variable I), the most preferable space (variable II), and clarity of the center (Variable III). Space One designed in Chapter Three has the highest level of convergent dynamics and a distinguishable center, thus it may be the most preferable space. These variables are accumulated separately in terms of the different subjects and gathered from the responses indicated in three tables, Table 4.6, 4.7 and 4.8. The frequency distributions are divided into two main parts in terms of Non-architectural Respondent and Architectural Student. A numerical value appears in the space of each of the tables representing the frequency distribution at the relevant level as commented by the respondents.

Variable I—Convergent Dynamics

The frequency distributions from the non-architectural respondents were further categorized in terms of Age-Gender factors and accumulated in six tables Table 5.2-1, 5.2-2, 5.2-3, 5.2-4, 5.2-5, and 5.2-6 (see Appendix 4), respectively, and those from the total of non-architectural respondents and architectural students are presented in Table 5.2-7 and Table 5.2-8 below.

Table 5.2-7 Ranking of Convergent Dynamics Felt by Non-architectural Respondents

Ranks No.	(0), (1) - (7) Ranking of Convergent Dynamics								Total	Percentage
	0	(1)	(2)	(3)	(4)	(5)	(6)	(7)		
Space 1	4	3	1	3	1	5	6	6	29	13.2%
Space 2	1	3		5	4	4	6	2	25	11.4%
Space 3		2	3	7	3	9	3	1	28	12.8%
Space 4			2	6	11	1	3	2	25	11.4%
Space 5	1		1	5	10	7	5	2	31	14.2%
Space 6	1	1	5	5	4	8	2	2	28	12.8%
Space 7		5	1	5	4	4	6	1	26	11.9%
Space 8	4	5	1	5	2	2	1	7	27	12.3%
Total	11	19	14	41	39	40	32	23	219	
Percentage	5%	8.7%	6.4%	18.9%	17.8%	18.3%	14.6%	10.5%		100%

Table 5.2-8 Ranking of Convergent Dynamics Felt by Architectural Students

Ranks No.	Ranking of Convergent Dynamics								Total	Percentage
	0	(1)	(2)	(3)	(4)	(5)	(6)	(7)		
Space 1				1		4	2	3	10	12.7%
Space 2			3	1	2	2		2	10	12.7%
Space 3			1		3	1	3	2	10	12.7%
Space 4			1	3	3	2		2	11	13.9%
Space 5		1		1	4	1	1	1	9	11.4%
Space 6			3	3	4				10	12.7%
Space 7	1		2	4	1		1		9	11.4%
Space 8		7		1	1			1	10	12.7%
Total	1	8	10	14	18	10	7	11	79	
Percentage	1.3%	10.1%	12.7%	17.7%	22.8%	12.7%	8.9%	13.9%		100%

Variable II---Space Preferred Most

The frequency distributions from the non-architectural respondents were further categorized in terms of Age-Gender factors and accumulated in six tables Table 5.3-1, 5.3-2, 5.3-3, 5.3-4, 5.3-5, and 5.3-6 (see Appendix 4), respectively, and those from the total of non-architectural respondents and architectural students are presented in Table 5.3-7 and Table 5.3-8 below.

Table 5.3-7 The Most Preferable Space by Non-architectural Respondents

Number of Space	Frequency distribution	Percentage (%)
Space 1	6	20%
Space 2	5	17%
Space 3	4	13%
Space 4		
Space 5	3	10%
Space 6	3	10%
Space 7	1	3%
Space 8	8	27%
Total	30	100%

Table 5.3-8 The Most Preferable Space by Architectural Students

Number of Space	Frequency distribution	Percentage (%)
Space 1	1	10%
Space 2		
Space 3	1	10%
Space 4	1	10%
Space 5	5	50%
Space 6	1	10%
Space 7	1	10%
Space 8		
Total	10	100%

Variable III---Clarity of Center

The frequency distributions from the non-architectural respondents were further categorized in terms of Age-Gender factors and accumulated in six tables Table 5.4-1, 5.4-2, 5.4-3, 5.4-4, 5.4-5, and 5.4-6 (see Appendix 4), respectively, and those from the total of non-architectural respondents and architectural students are presented in Table 5.4-7 and Table 5.4-8 below.

Table 5.4-7 Clarity of Center Felt by Non-architectural Respondents

Number of Space	Very Clear(3)	Clear (2)	Least Clear (1)	Total	Percentage
Space 1	9	5	4	18	14%
Space 2	6	9	1	16	12.4%
Space 3	5	6	7	18	14%
Space 4	2	11	1	14	10.9%
Space 5	3	12	1	16	12.4%
Space 6	6	5	3	14	10.9%
Space 7	6	5	3	14	10.9%
Space 8	8	3	8	19	14.7%
Total	45	56	28	129	
Percentage	34.9%	43.4%	21.7%		100%

Table 5.4-8 Clarity of Center by Architectural Students

Number of Space	Very Clear (3)	Clear (2)	Least Clear (1)	Total	Percentage
Space 1	7	1	1	9	14.3%
Space 2		3	6	9	14.3%
Space 3	1	3	4	8	12.7%
Space 4		5	4	9	14.3%
Space 5	1	7	1	9	14.3%
Space 6	1	3	4	8	12.7%
Space 7		4	6	10	15.9%
Space 8	1		7	8	12.7%
Total	11	26	26	63	
Percentage	17.5%	41.3%	41.3%		100%

5.2.2 METHOD OF ANALYSIS

There are two main purposes for choosing the analysis method in this study. The first one is for the testing of the hypotheses and the other method is to explore any significant relationships. This chapter will hopefully gain insight into data by means of statistical methods and techniques – the exploratory data analysis, summary analysis (arithmetic mean), confidence interval and chi-square.

For the first purpose, that of hypothesis testing, there is basically one analysis technique involved and that is the confidence interval (referred to as C.I.). For the second purpose of exploring possibly significant relationships, the arithmetic mean and chi-square is applied. In this way the survey should be adequately analyzed. Statistical terms and formula need to be explained, as well as a description of how the formulae have been practically applied.

The confidence interval method⁷³, specifically the use of the confidence interval for testing hypotheses about proportion, has been used as the instrument for testing the hypotheses. When there is a C. I., it is highly likely that the interval will contain a “parameter”, the particular mean of the relevant variable. Any way of viewing it is to say that any number outside the C. I. is not likely to be the value of a “parameter”. Any hypothesis that proposes a value outside the confidence interval as the mean of the population is rejected (Figure 5.1). For example, it was predicted that ten percent of high school students wear glasses. After a proper survey and an analysis of the data, the C. I. is calculated at about 3%-6%, which tells the factual percentage of high school students wearing glasses. The ten percentage prediction is outside the C. I. Thus, the prediction is unjustified.

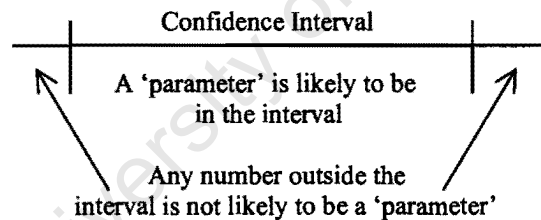


Figure 5.1

$$SE = \{[p \times (1-p)]/n\}^{1/2}$$

$$C. I. = (p - z * SE, p + z * SE)$$

⁷³ Goteti Bala Krishnamurty, Patricia Kasovia-Schmitt, David J. Ostroff, Statistics (An Interactive Text For The Health And Life Science, Jones and Bartlett Publishers International, 7 One Exeter Plaza, Boston, MA 02116, 1995, pp.23, 464-22, 465)

SE: standard error of the population

p: proportion

z: cumulative standard normal distribution

Besides testing the hypotheses, it was interesting to find out whether there were any relationships between the relevant variables when the average respondents commented on the spaces in response to certain variables. In this process, the arithmetic mean was applied as well as the exploratory data analysis. The particular graphic techniques employed in EDA, such as mean plots, were used to maximize the natural pattern-recognition abilities.

A summary analysis is simply a numeric reduction of a historical data set. Quite commonly, its purpose is to simply arrive at a few key statistics (for example, mean and standard deviation), which may then either replace the data set or be added to the data set in the form of a summary table. The arithmetic mean shows the measure of the central tendency of the respondents' replies. This measure produces the preferred evaluation in response to the relevant variables from the architectonic spaces.

$$\bar{X} = (\sum X_i)/n$$

$\sum X_i$: summing of all observations

n: the total number of observations

Graphic techniques have been used as the platform to analyze the historical data. The reason for the heavy reliance on graphics is that by its very nature the main role of EDA is to open-mindedly explore, and graphics gives the analysts the ability to do so, encouraging the data to show structural ideas and gain new, often unsuspected, insight into the data. When this is used in combination with the human being's natural pattern-recognition capabilities, it is all the more able to fulfill its purpose.

Moreover it is also interesting to explore whether there are any relationships between the relevant variables in terms of the responses from the average respondents and the architectural students. The chi-square statistic, often used to test categorical data in

tables, is used to measure the strength of association. Moreover, it is used to test whether the frequency distribution of a variable measured on a categorical scale fits a certain known theoretical distribution. For example, here it was used to examine possible differences in response between non-architectural students and architectural students.

$$\chi^2 = \sum_{i=1}^k (f_i - e_i)^2 / e_i$$

f_i : the observed frequencies of the variable for each category

e_i : expected values for that variable predicted by the theoretical distribution

5.2.3 HYPOTHESIS TESTING

The hypotheses were tested using the confidence interval for proportion. Any hypothesis that postulates a proportion outside the confidence interval was rejected, and any hypothesis postulating a proportion inside the confidence interval was accepted. In this study, there are specific values hypothesized about the three independent variables presumably echoing the majority of people. Thus, it can be directly interpreted - that if the proportion of the hypothesized variable is inside the confidence interval, the hypothesis will be accepted; otherwise not.

The necessary data distributions were traced from the relevant samples. The relevant terms in calculating the C.I. can be calculated such as “p”, the proportion of the sample having the property in question. The sample should look at the data distribution from the total average respondents. “z” can be found from the standard table called Normal Distribution. Thus, the confidence interval can be worked out. Moreover, the confidence interval should be compared with the proportion range in terms of the hypothesized variables. If this proportion is outside the confidence interval, the hypothesis will be rejected; otherwise it will not. Thus, it is possible for the hypotheses to be tested.

Each of the three variables is examined respectively as follows.

Variable I---Convergent Dynamics

One can start by calculating the confidence interval. The relevant data can be traced from Table 5.2-7. It is assumed that the sixth (6) level of the convergent dynamics is preferable by most people.

$$SE = \{[0.03 \times (1 - 0.03)] / 219\}^{1/2} = 0.01$$

$$\begin{aligned} \text{C.I.} &= [0.03 - (2 \times 0.01), 0.03 + (2 \times 0.01)] \\ &= (0.01, 0.05) \end{aligned}$$

The confidence interval calculated is too narrow. In fact, the hypothesis postulating a/the proportion is outside of this confidence interval. It follows that its range is outside of the confidence interval and, therefore, this assumption of convergent dynamics at 6-7 level for the space one is rejected.

Variable II---Most Preferred Space

The relevant data can be traced from Table 5.3-7. The most preferable space is the space eight responded from the none-architectural respondents (27% of this population).

However, it is assumed that space one is the most favored (This space is constructed in Chapter Three).

The confidence interval for Space Eight is the most preferable:

$$SE = \{[0.27 \times (1 - 0.27)] / 30\}^{1/2} = 0.08$$

$$\begin{aligned} \text{C.I.} &= [0.27 - (2 \times 0.08), 0.27 + (2 \times 0.08)] \\ &= (0.11, 0.43) \end{aligned}$$

The confidence interval for Space One is the most preferable:

$$SE = \{[0.20 \times (1 - 0.20)] / 30\}^{1/2} = 0.07$$

$$\begin{aligned} \text{C.I.} &= [0.20 - (2 \times 0.07), 0.20 + (2 \times 0.07)] \\ &= (0.06, 0.34) \end{aligned}$$

Firstly, the space that was most favored was not, in fact, the one assumed. Secondly, though a number of the respondents favored the eighth space, its confidence interval was still quite narrow. Thus, the assumption about Space One being the preferred space is

rejected. However, the architectural students seem to overwhelmingly enjoy Space Five. This is compared to the responses from the non-architectural respondents.

Variable III—Clarity of Center

The relevant data can be traced from Table 5.4-7. It is assumed that most respondents would choose the level of clarity of the third (3) level of the spatial center of the space one.

$$SE = \{[0.07 \times (1 - 0.07)] / 129\}^{1/2} = 0.02$$

$$\begin{aligned} \text{C.I.} &= [0.07 - (2 \times 0.02), 0.07 + (2 \times 0.02)] \\ &= (0.03, 0.11) \end{aligned}$$

The confidence interval calculated is narrow and its range is outside of the confidence interval and so the assumption of clarity of the level of the center of the space at the level 3 is rejected.

In summary, the variables of the proposed Space One could not deliver what was predicted. However, the data comparison may summarize suggestive regular patterns.

5.2.4 DATA COMPARISON

The intention of this section is to find out whether there are any possible relationships among the variables under the three types of independent variables. The comparisons were carried out in two levels in terms of the relevant subjects, that is, between the average respondents themselves and between the average respondents and the architectural students. This is specified in the following section.

Arithmetic mean and chi-square were used to analyze the data. Arithmetic mean gives a typical “central” value. The technique of mean-plot in association with the mean can give great graphic insight into the relationships of the variables. Chi-square tests were held in an attempt to explore whether there are any significant relationships of the variables between the average respondents and the architectural students.

The comparisons were carried out with three independent variables, A, B and C in terms of the different subjects.

Subject

In this study there are two main types of subjects - the non-architectural respondents, and the non-architectural respondents and the architectural students. Within the former group, this research is only interested in finding out possible relationships of the variables in certain groups of people. Consequently, the former one can be further classified into two types, different age, same gender and same age, different gender. The table indicates the number of the subjects. Thus, the five subject groups are listed in the table plus the group comparing the non-architectural respondents and the architectural students. The three variables were analyzed in terms of the six certain subjects, respectively.

Table 5.5 Subjects Combined within Non-architectural Respondents

1	5-24 Male & 25-44 Male; 5-24 Male & 45-64 Male; 25-44 Male & 45-64 Male
2	5-24 Male & 5-24 Female
3	25-44 Male & 25-44 Female
4	45-64 Male & 45-64 Female
5	5-24 Female & 25-44 Female; 5-24 Female & 45-64 Female; 25-44 Female & 45-64 Female

Variable I—Convergent Dynamics

The mean examined whether there are any links between the dynamic variables distributed by different people. The mean levels of the convergent dynamics are tabled as below.

Table 5.6 Mean level of Convergent Dynamics

	Space 1	Space 2	Space 3	Space 4	Space 5	Space 6	Space 7	Space 8
5-24, M	2	4.5	4.6	4	3.6	3	4	3.6
5-24, F	2.6	3	4	3.5	4.4	2.8	4.8	5
25-44, M	5.7	5	5.3	5.7	5.3	5	2.8	3.8
25-44, F	4	4.4	3.5	3.8	4.9	4.4	3.9	3.4
45-64, M	4.3	4.3	4	4	3.7	4	3.7	3.3
45-64, F	4.8	3.3	1.8	4.5	3	3	2.3	2.5

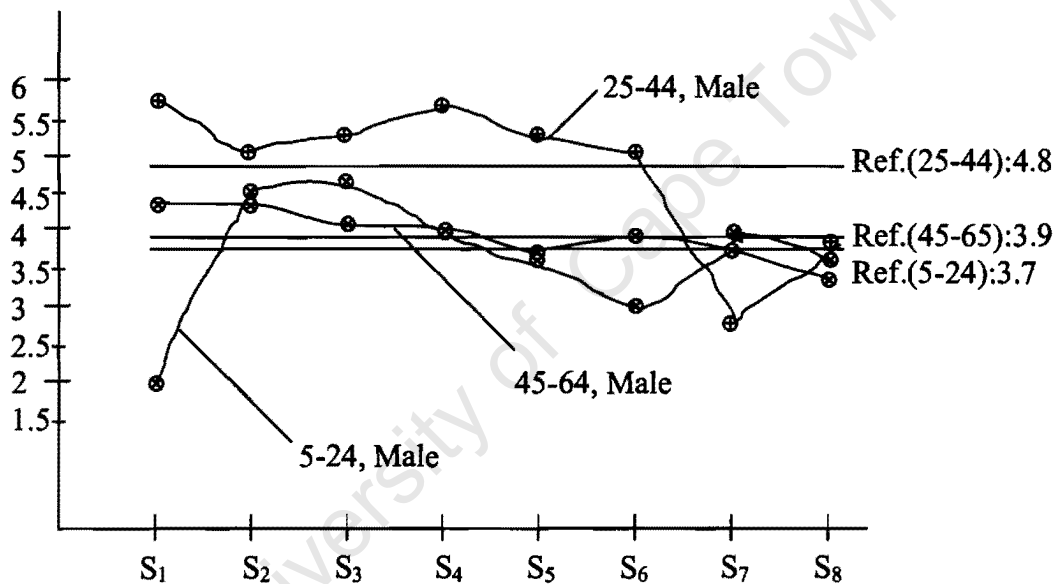
Mean plots were used to see if the mean varies and they are formed by vertical and horizontal axes. The numerical marks on the vertical axis represent the level of mean of the convergent dynamics 0, 1, 2, 3, 4, 5, 6, and 7 (refer to Table 4.6). The marks S_1 , S_2 S_8 on the horizontal axis represent the ordinal of the architectonic spaces. A reference line is plotted at the overall mean.

From a broad point of view, the overall convergent dynamic tendency may somehow appear to have a pattern. It, however, only shows a figure, because it is not a contingent

process. Further investigation will compare the deviations of the levels of the convergent dynamics.

Male: 5-24 years, 25-44 years and 45-64 years

There is no obvious pattern of the overall convergent dynamic tendency of the three sets of means. However, the fragments of spaces four and five seem to have a similar slope rate. There seems to be a common perception about the level of the convergent dynamics of space eight. The overall distribution of the means between the ages 5-24 and 45-64 for males is quite close.



Horizontal Axis: the ordinal number of spaces
 Vertical Axis: the level of the convergent dynamics

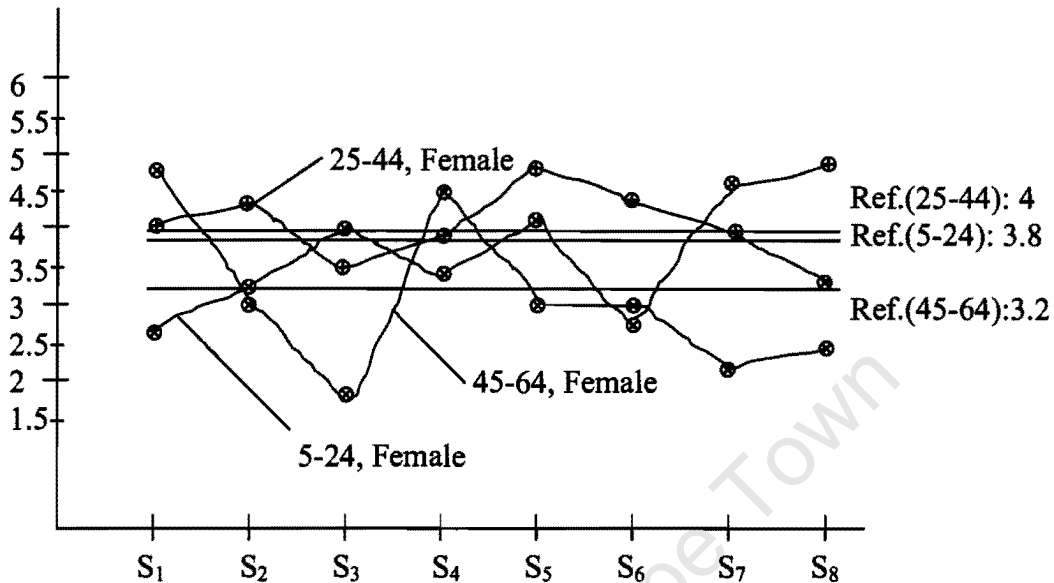
Ref. : the reference line

(a)

Female: 5-24 years, 25-44 years and 45-64 years

There is no obvious pattern of the overall convergent dynamic tendency of the three sets of means. There are quite big fluctuations during each course. There seems to be a common perception about the level of the convergent dynamics of space four though there are a few deviations among them. The overall distribution of the means of the

level of the convergent dynamics between the ages of 5-24 and 25-44 for females is quite close.



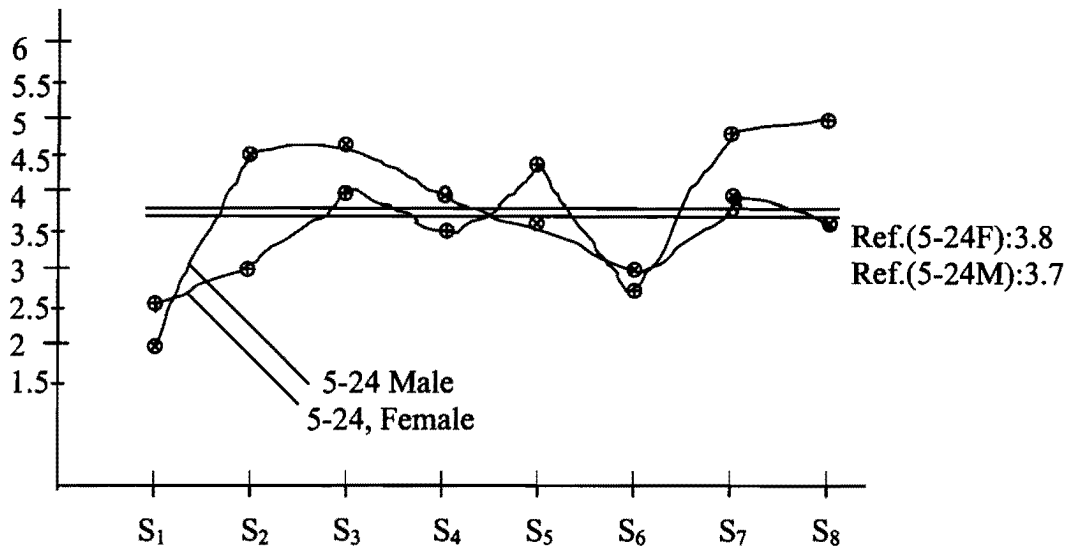
Horizontal Axis: the ordinal number of spaces
 Vertical Axis: the level of the convergent dynamics

Ref. : the reference line

(b)

Male and Female: 5 - 24 years

There is no obvious pattern to the overall convergent dynamic tendency of these sets of means. However, the fragments of spaces three and four seem to have a similar negative gradient. Spaces one and two and space six and seven both have similar sharp gradients. Spaces five and six both have negative gradients. Therefore, there seems to be a common perception about the level of the convergent dynamics of space six. The overall distribution of the means is quite close. The tendency of these two courses share more similarities than differences.



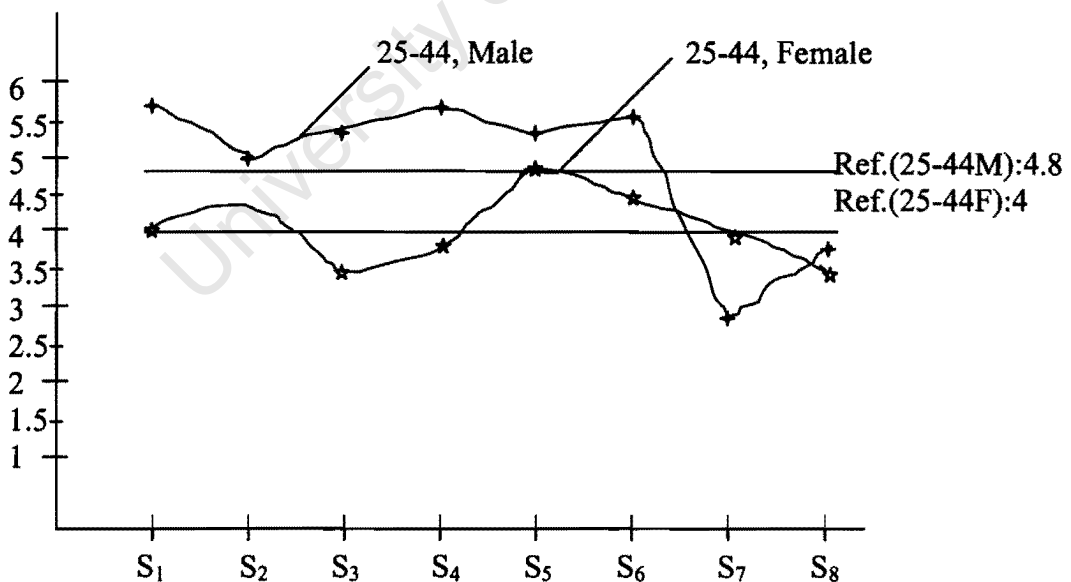
Horizontal Axis: the ordinal number of spaces
Vertical Axis: the level of the convergent dynamics

Ref. : the reference line

(c)

Male and Female: 25-44 years

There is no obvious pattern here. There seems to be a similar perception about the level of the convergent dynamics of space eight, though there are few deviations between them. The overall distribution of the means of the level of the convergent dynamics is quite different.



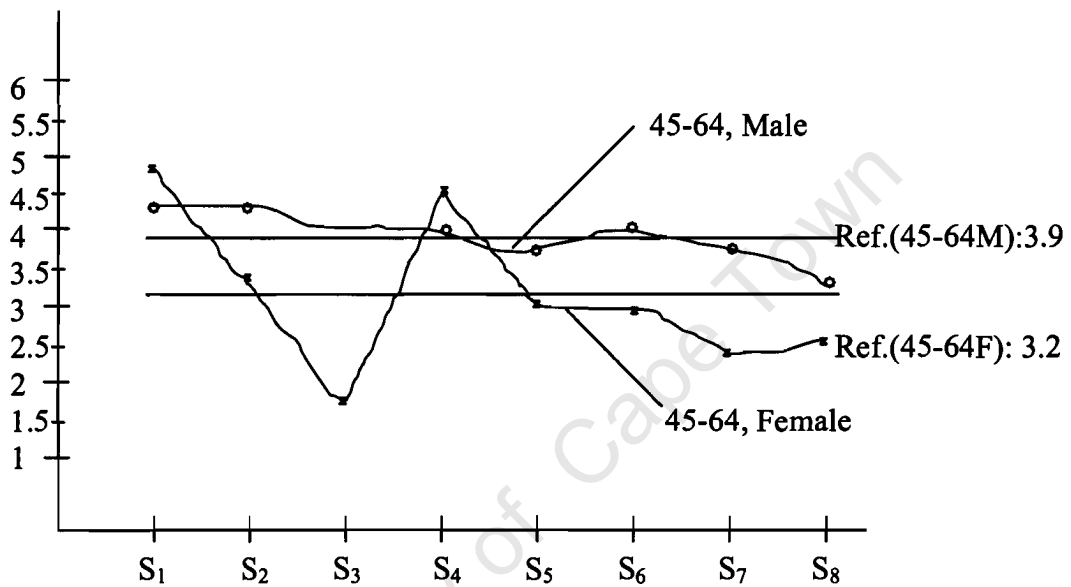
Horizontal Axis: the ordinal number of spaces
Vertical Axis: the level of the convergent dynamics

Ref. : the reference line

(d)

Male and Female: 45-64 years

There is no obvious pattern of the overall convergent dynamic tendency of the three sets of means. However, the fragments of space five to space eight seem to have a similar negative gradient despite the difference of tendency between spaces seven and eight. There seems to be a similar perception about the level of the convergent dynamics of spaces one and four though there are a few deviations. The overall distribution of the means of the level of the convergent dynamics is also quite different.



Horizontal Axis: the ordinal number of spaces
 Vertical Axis: the level of the convergent dynamics
 Ref. : the reference line

(e)

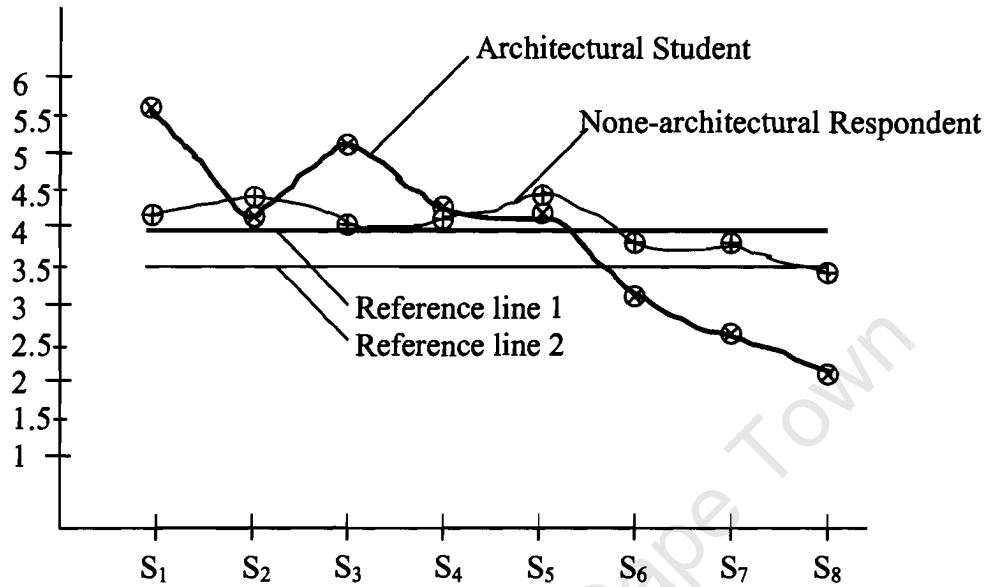
Non-architectural Respondent and Architectural Student

Table 5.7 Mean level of Convergent Dynamics (Non-architectural Respondents & Arch. Students)

	M ₁ (S ₁)	M ₂ (S ₂)	M ₃ (S ₃)	M ₄ (S ₄)	M ₅ (S ₅)	M ₆ (S ₆)	M ₇ (S ₇)	M ₈ (S ₈)
non-arch. Respondent	4.2	4.3	4	4.1	4.4	3.9	3.9	3.5
Architectural Student	5.6	4.1	5.1	4.3	4.2	3.1	2.7	2.1

There is no obvious pattern of the overall convergent dynamic tendency of the three sets of means. However, the fragments of space four to eight seem to have a similar negative

gradient. There seems to be a similar perception about the level of the convergent dynamics of spaces two, four and five, though there are a few deviations among them. The overall distribution of the means of the level of the convergent dynamics is slightly different.



Horizontal Axis: the ordinal number of spaces
Vertical Axis: the level of the convergent dynamics

Ref. : the reference line

(f)

Figure 5.2 a, b, c, d, e, and f

The convergent dynamic tendency figure of the set of the eight spaces can be drawn in this way. Two figures have been presented and categorized by the non-architectural respondents and the architectural students, respectively (Figure 5.2). Two reference lines, reference line 1 and reference line 2, have been plotted at the overall mean plots. The reference lines accompanies each of these two figures, reference lines 1 and 2 to the architectural students curves and the non-architectural respondents curves, respectively. The values of the overall means of the reference lines are 4 and 3.5.

Chi-square Test

The calculations should indicate whether there is any relationship between the non-architectural respondents and the architectural students. As already stated this calculation

can be performed by the use of the calculator. Chi-square tests were calculated for the eight spaces. There is a statistical significance in Space Seven (Table 5.8-5) and no statistical significance in the other spaces. (Tables 5.8-1, 5.8-2, 5.8-3, 5.8-4, 5.8-6 (see Appendix 5).

Table 5.8-5 Space Seven

	0	1	2	3	4	5	6	7	Total
Non-arch Respondent	0	5	1	5	4	4	6	7	32
Architectural Student	1	0	2	4	1	0	1	0	9
Total	1	5	3	9	5	4	7	7	41

Degrees of freedom: 7
 Chi-square = 14.46569664903
 p is less than or equal to 0.05.
 The distribution is **significant**.

Variable II—Most Preferred Space

Table 5.3-1 indicates that thirty-three percent (33%) of this age-gender group favored spaces two and three respectively and seventeen percent (17%) enjoyed spaces one and seven. No other preference was indicated.

Non-architectural Respondent and Architectural Student

Again, there appears to be a significant difference in the appreciation of the spaces between the non-architectural respondents and the architectural students. There was a decrease in response to the most preferable architectural space by the average respondents from space eight, space one, space two, space three, space five and space six, to space seven as can be viewed in Figure 5.3 below. There was no response to space four. Space eight was the most appreciated, space one the second most and space two was in third place.

However, all spaces were responded to, and the results seem quite even, except for space five as can be seen in Figure 5.3 below. Architectural students showed a distinct preference for space five.

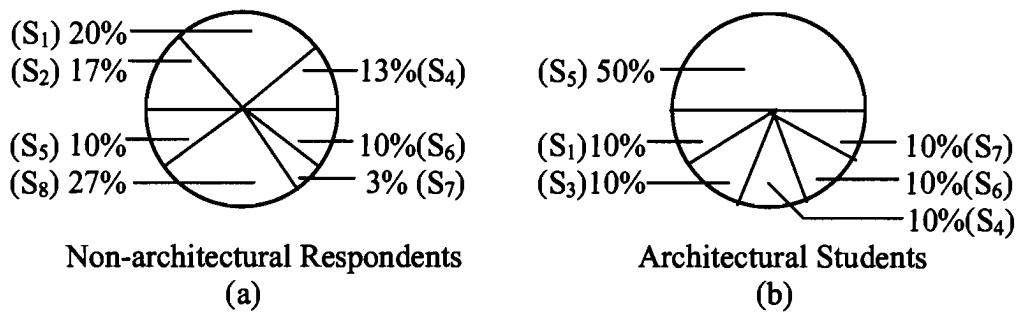


Figure 5.3 a, b

Chi-square Test

Chi-square Tests were performed for the eight spaces as follows. There was no significant statistical appearance in the spaces at all in Table 5.9-1, 5.9-2, 5.9-3, 5.9-4, 5.9-5 (see Appendix 5).

Variable III—Clarity of Center

This examines whether there are any links between the dynamic variables distributed by different people. The mean levels of the convergent dynamics are tabled below.

Table 5.10 Mean of Level of Clarity of the Center

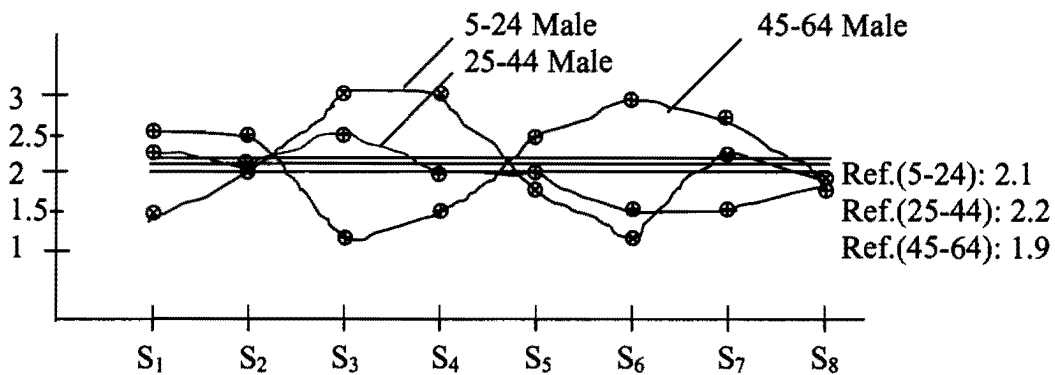
	Space 1	Space 2	Space 3	Space 4	Space 5	Space 6	Space 7	Space 8
5-24, M	1.5	2	3	3	1.7	1.3	2.3	1.8
5-24, F	3	2.5	1	2	2.3			1
25-44, M	2.6	2.5	1.3	1.5	2.5	3	2.7	1.8
25-44, F	2.2	2.2	2.2	2	2.3	2.7	1.8	2.3
45-64, M	2.3	2	2.5	2	2	1.5	1.5	1.7
45-64, F	1.5	2	1.5	2.3	2	2.3	2	2.3

Mean plots are formed by the vertical and horizontal axis. The numerical marks on the vertical axis represent the level of means of clarity of centers 1, 2 and 3. The marks S_1, S_2, \dots, S_8 on the horizontal axis represent the ordinal of the architectonic spaces.

5-24 Male/25-44 Male/45-64 Male

There is no obvious pattern of the overall convergent dynamic tendency of the three sets of means. The two sets of means share more similarities than differences. There seems to be a common perception about the level of the convergent dynamics of space eight.

The overall distribution of the means of the level of the convergent dynamics between females aged 5-24 and 25-44 is quite close.



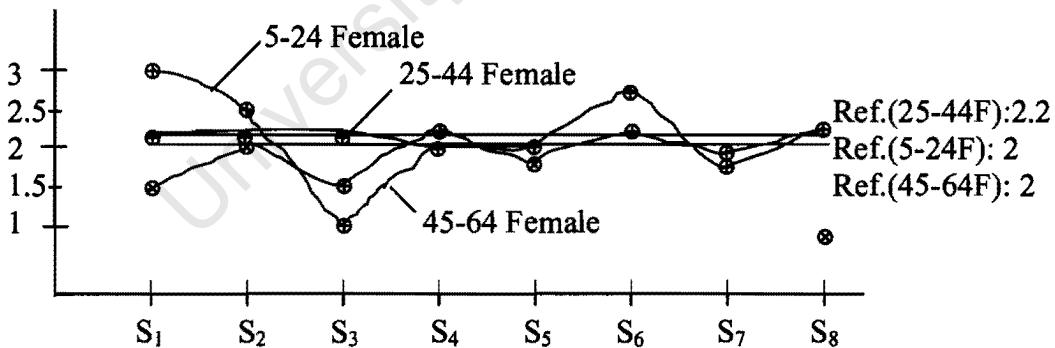
Horizontal Axis: the ordinal number of spaces
Vertical Axis: the level of clarity of the center

Ref. : the reference line

(a)

Females: 5-24, 25-44 and 45-64 years

There is no obvious pattern of the overall convergent dynamic tendency of these three sets of means. The two sets of means also share more similarities than differences. There seems to be a common perception about the level of the convergent dynamics of spaces four, five and seven though there are a few deviations. The overall distribution of the means of the level of the convergent dynamics is quite close between females aged 5-24 and 25-44.



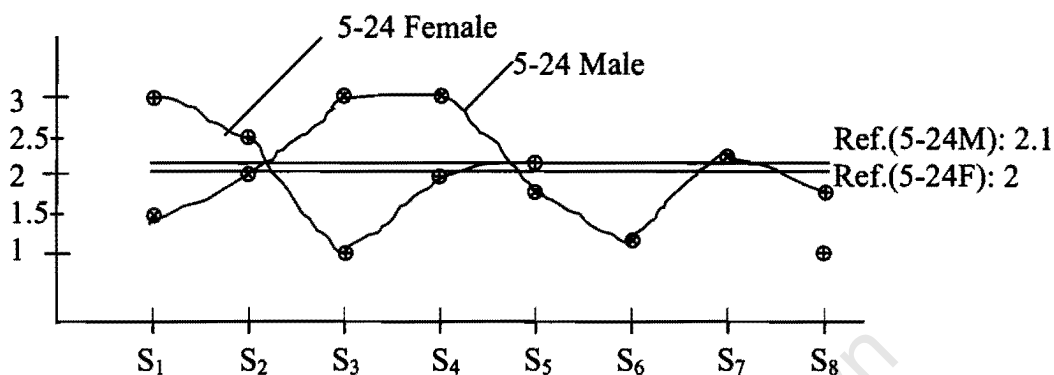
Horizontal Axis: the ordinal number of spaces
Vertical Axis: the level of clarity of the center

Ref. : the reference line

(b)

Males and Females: 5-24 years

There is no obvious pattern here. There are quite big fluctuations in each course. There seems to be a similar perception about the level of the convergent dynamics of space five though there are a few deviations between them.



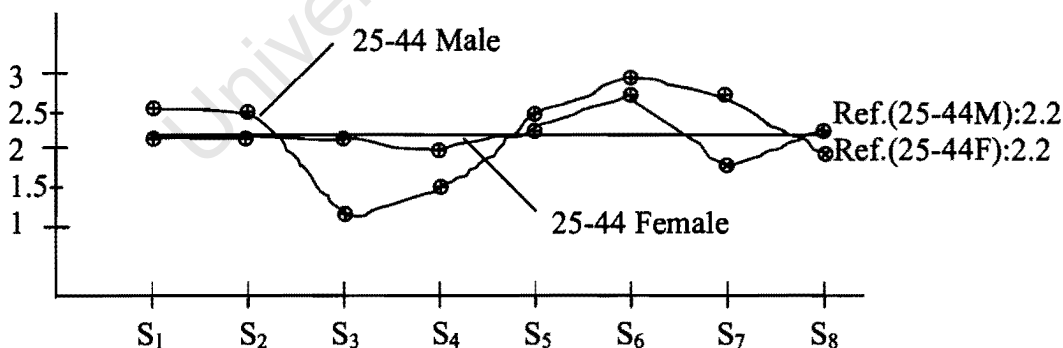
Horizontal Axis: the ordinal number of spaces
Vertical Axis: the level of clarity of the center

Ref. : the reference line

(c)

Male and Female : 25-44 years

There is no obvious pattern here. The two sets of the means have more in common than any differences. There seems to be a similar perception about the level of the convergent dynamics of spaces five, six and eight though there are a few deviations. The overall distribution of the means of the level of the convergent dynamics is quite close.



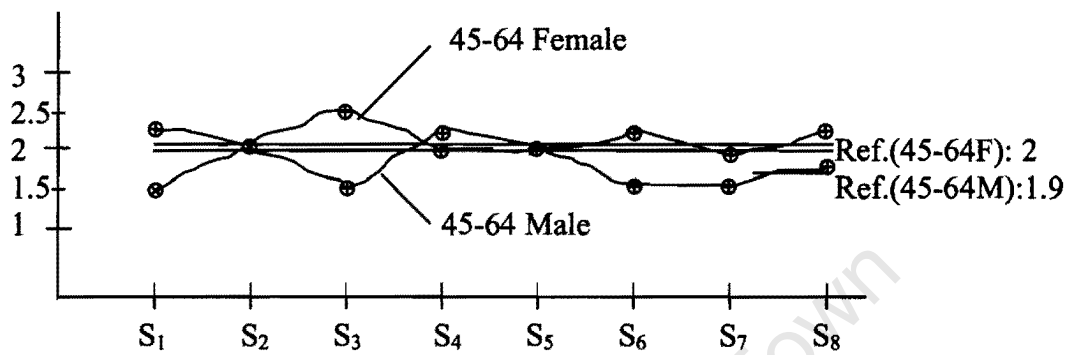
Horizontal Axis: the ordinal number of spaces
Vertical Axis: the level of clarity of the center

Ref. : the reference line

(d)

Male and Female : 45-64 years

There is no obvious pattern of the overall convergent dynamic tendency of these three sets of means. The two sets of means almost mirror each other. There seems to be the same perception about the level of the convergent dynamics of spaces two and five. The overall distribution of the means of the level of the convergent dynamics is quite close.



Horizontal Axis: the ordinal number of spaces
Vertical Axis: the level of clarity of the center

Ref. : the reference line

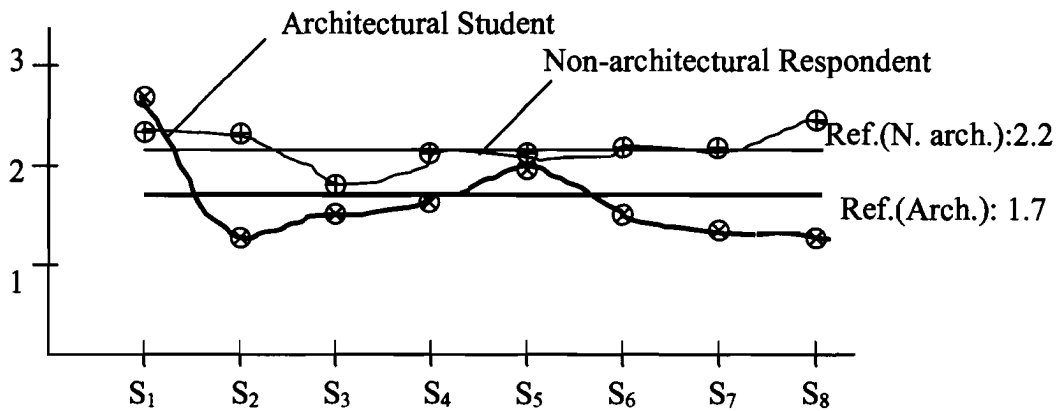
(e)

Non-architectural and Architectural Student

Table 5.11 Mean of Clarity of the Center (Non-architectural Respondents and Arch. Students)

	Space 1	Space 2	Space 3	Space 4	Space 5	Space 6	Space 7	Space 8
Non-arch Respondent	2.3	2.3	1.9	2.1	2.1	2.2	2.2	2.4
Architectural Student	2.7	1.3	1.5	1.6	2	1.5	1.4	1.3

There is no obvious pattern here. However, the fragments of spaces three to five seem to have a similar positive gradient. There seems to be a similar perception about the level of the convergent dynamics of spaces one and five though there are a few deviations. The overall distribution of the means of the level of the convergent dynamics is quite different.



Horizontal Axis: the ordinal number of spaces
Vertical Axis: the level of clarity of the center

Ref. : the reference line

(f)

Figure 5.4 a, b, c, d, e, and f

By these means, the levels of the clarity of the special center tendency figure of the set of the eight spaces can be drawn as well. Two figures have been presented and are categorized by the Non-architectural respondents and the architectural students, respectively (Figure 5.7). Two reference lines have been plotted at the overall means for these two plots. There is a reference line plotted accompanying each of these two figures, for the architectural students curves and the non-architectural respondents curves, respectively. The values of the overall means of reference lines are 2.2 and 1.7.

The course of the tendency is quite different. The overall course either increases or decreases the levels of clarity of the center of this set of eight spaces is being gently changed. Adversely, the change of such a course from the architectural students is quite violent, especially from space one to space two sharply decreased. However, these two different groups of people share something in common. Both space one and two have a sense of declination of the clarity of the center, despite this sense from the architectural students decreased sharply. From space three to space four and then to space five, the sense of this clarity increases at a similar rate. Moreover, the responses to the level of clarity of the center from both the non-architectural respondents and the architectural students almost overlap.

Chi-square Test

The calculations should indicate whether there is any relationship of the relevant variables between the non-architectural respondents and the architectural students. Chi-square tests were performed on the eight spaces. There is a statistical significant in two spaces the space two and the space seven (Table 5.8-5) and no statistical significant for the other spaces in Table 5.12-1, 5.12-3, 5.12-4, 5.12-5, 5.12-6, 5.12-8 (see Appendix 5). For Spaces Two and Seven, differences in response to the clarity of the center exist between non-architectural students and the architectural students.

Table 5.12-2 Space Two

	1 (least clear)	2 (median clear)	3 (very clear)	Total
Non-arch Respondent	1	9	6	16
Architectural Student	6	3	0	9
Total	7	12	6	25

Degree of freedom: 2
 Chi-square = 11.5141369047619
 p is less than or equal to 0.01.
 The distribution is **significant**.

Table 5.12-7 Space Seven

	1 (least clear)	2 (median clear)	3 (very clear)	Total
Non-arch Respondent	3	5	6	14
Architectural Student	6	4	0	10
Total	9	9	6	24

Degree of freedom: 2
 Chi-square = 6.62857142857143
 p is less than or equal to 0.05.
 The distribution is **significant**.

5.3 FINDINGS FROM THE ANALYSIS

The originally assumed independent variables have been rejected by the hypothesis testing process.

In respect of the convergent dynamic variables, there is no obvious overall tendency of the set of means of the eight spaces. From the overall tendency of the flow, the ability of young respondents to perceive the levels of the convergent dynamics of these spaces seems to be keener than that of the elderly group. The overall frequency distribution of the levels of the convergent dynamics falls in the 3.5-5.5 range. The curve from the

female group fluctuates more than that of the male group. In space four, the level of the convergent dynamics seems to be relatively consistent around the 35-5.5 level regarding the defined scale range. From analyzing the overall tendency of the flow, the architectural students seem to have a greater ability to perceive the levels of the convergent dynamics than that of the non-architectural respondents. They also have a similar declining tendency of their curves, despite their difference in the rate of the declination.

In choosing the most preferable space, the non-architectural respondents and the architectural students react in a significantly different mood. The most favored space for the architectural students is space five (50%). There is no particularly overwhelming space favored by the non-architectural respondents but the first three ranks are given to space eight (27%), space one (20%), and space two (17%).

In respect of the level of clarity of the center of these spaces, it seems that no matter how the levels of the convergent dynamics change, it does not generally affect the perception of identifying the spatial center and are around the second level of clarity. The level of clarity of space five is commonly shared between the non-architectural respondents and the architectural students, as well as within the average respondents at 2.3 regarding the defined scale range. Following the overall flow the tendency shows that architectural students are able to perceive the levels of clarity of the spatial center more keenly than that of the non-architectural respondents. This ability seems to be less keen as the age increases. The clarity of the center of space eight is at the level 1.5-2.5 regarding the scale range, except for the female group between ages five to twenty-four.

The chi-square test for space seven indicated a statistically significant distribution from both the non-architectural respondents and the architectural students in respect of the convergent dynamics. There is also a statistically significant distribution from both the average respondents and the architectural students for space two and seven in respect of the clarity of the center of the space. There is no statistical significance in the most preferable space between the non-architectural respondents and the architectural students.

5.4 SUMMARY

In this section, the survey data were gathered and statistically analyzed. The hypotheses were tested, the data were longitudinally compared and the findings were made.

University of Cape Town

6. CONCLUSION AND RECOMMENDATION

6.1 INTRODUCTION

This section argues the impact of the results of the analysis on the hypotheses of this study - in attempt to establish a relatively suitable built environment with the defined dynamics. It takes two separate approaches to draw the conclusion of this study.

Firstly, the variables between the average respondents' and the predicted responses were compared. An adjustment to the hypotheses will be made. The hypotheses were tested in a routine, logical way. This is basically that null hypotheses were made by each of the original hypotheses. If a null hypothesis is rejected in terms of the findings of the variables in Chapter Five, the hypothesis can be accepted. Otherwise, the contrary will occur. Finally, a general conclusion of this study can be drawn.

Secondly, the variables among the three: the predicted responses, the average respondents', and the architectural students' responses were compared. Effort has been invested on how differently the opinion of the dynamics is between the average respondents and the architectural students. It might be worthwhile to know how differently the average respondents and the architectural students evaluate their surroundings. It is useful for the practitioner, with their architectural training, to consciously be aware of their clients' feeling in this regard. A further adjustment of these hypotheses might be more useful. A recommendation can eventually be made.

This chapter looks at the interpretation of the analysis finding and hypotheses adjustment, the general conclusion of the study, and the recommendation.

6.2 FINDINGS : INTERPRETATION AND HYPOTHESES TESTING

The hypotheses were tested by assessing whether each of the relevant null hypotheses will be accepted or rejected. The rejection of a null hypothesis means the confirmation of the relevant alternative hypothesis. The hypothesis testing was carried out from the hypothesis one to six.

The null hypothesis about hypothesis one: the dynamics of a shape is not an assembly of the dynamics of its visible planes in direct proportion and that the dynamics of its visible planes can not be calculated by the ratio of its two dimensions within the defined spatial framework. Though the overall tendency of the curve is to decrease

(Figure 5.3 f) from the highest level to the lowest and two peaks appear on space two and the five, the ratio of decay or increase is really small compared with the proportional changes of those modules composing the two pairs of the axes from the space one to eight. Thus, the null hypothesis seems to be accepted. Consequently, hypothesis one does make some sense but is rejected from the overall point of view.

The null hypothesis about hypothesis two: the dynamics of each plane of each module can not be calculated from the ratio of the two dimensions to those of the reference cube, simulating the space occupied by a human body, within the spatial framework. One needs to look at the eight perspectives in Appendix 3 and Figure 5.3 (f) and then how the proportional changes of the modules affect the level of clarity from space one to three and then from space three to eight.

There are only proportional changes to module C and D and they are identical in spaces one, two and three, respectively. As modules C and D decrease three-dimensionally in space one to those of modules C and D in space two, then horizontally significantly increase the length of the modules to those of modules C and D in space three, intuitively the level of clarity of the center declines and this can be seen in Figure 5.7 (f). Analogously, the levels of convergent dynamics of the spaces change proportionally as the planes of the modules change. Thus, the dynamics of each of the planes can be calculated by the ratio of the two dimensions to those of the reference cube. The null hypothesis is rejected. Consequently, hypothesis two is accepted.

The null hypothesis about hypothesis three: the sense of weight only functions when the vertical dynamics are dominant within the defined spatial framework and consequently it can not be eliminated from any scale. Spaces one, two and three will be examined by means of the null hypothesis (see Appendix 3) since they have a vertically dominant dynamics and in module A, these dynamics equal each other respectively. Thus, the impact of the sense of weight on modules C and D can be investigated. Moreover, the variables to be examined are both the convergent dynamics and the clarity of the center.

Firstly, how the sense of weight of modules C and D affect the convergent dynamics in spaces one, two and three. The level of the convergent dynamics of these spaces increases to a peak at a relatively high level of about 4.2 then declines to the lower level

of about 3.9 as the size of the modules at points C and D change (see Appendix 3 and Figure 5.3 f). This implies that the weight sense does not have much impact on the changes of the convergent dynamics. Thus, the null hypothesis seems to be rejected in this regard.

Secondly, how the sense of weight of modules C and D affects the level of clarity of the center of the spaces one, two and three need to be examined. The level of clarity of the center of these spaces declines as the size of the modules at points C and D decreases (see Appendix 3 and Figure 5.7 f). The module at points C and D in space two is much smaller than those of space three. This implies that the weight of sense dose not have much impact on the level of the convergent dynamics. Thus, the null hypothesis is rejected in this regard as well. Consequently, hypothesis three is accepted.

The null hypothesis about the hypothesis four: Personal experience and background will affect the ability to be critical of the emotion evoked from the defined architectonic space. There is no absolute prevailing percentage of average respondents choosing a preferred space. The overall percentage distribution from the top three reveals space eight (27%), space one (20%) and space two (17%) (Figure 5.3). The overall frequency distribution of the level of the clarity of the center of these spaces is at level 2.2 (Figure 5.4 f) regarding the defined scale range. The null hypothesis four is accepted. Thus, this hypothesis is rejected.

The null hypothesis about hypothesis five: There is no center in the proposed architectonic space at which point the dynamic variable of this space can be perceived as the touring of this space is completed. Surprisingly, on the scale of 1, 2 and 3, the average respondents responded at level 2.5. This is above the average level (2.2) of the average respondents. The average respondents perceived a center quite clearly. Thus, this null hypothesis is rejected. Thus, the hypothesis five is accepted.

The null hypothesis about the hypothesis six: The dynamic variable of the architectural theme for the proposed architectonic space should not demonstrate a relatively stronger concentrated dynamics than the others that are built based on the same available shapes in the same condition and this dynamic variable is seen as the more appropriate dynamic variable.

From the previous argument, a relatively suitable built environmental space might be set up by the six hypotheses and the relevant hypotheses can be reinterpreted by the defined dynamics. It is assumed that space one is a relatively suitable space among the eight spaces and its convergent variable is assumed to be at the 6-7 level (between very strong and extremely strong) and the level of clarity of the center around 2.5-3 (between quite clear and very clear). It implies that the level of the convergent dynamics and clarity of the center increase in a direct rate and the more suitable a space is, the stronger the level of the convergent dynamics and clarity of center are. The assumptions of the three independent variables are rejected. This means that these variables have been inappropriately assumed. Space eight is most preferred by the average respondents and there is an obvious contradiction between the level of the convergent dynamics at 4-4.5 (strong) and clarity of the center of the spaces at 2.4 (quite clear). It is, therefore, inferred that the level of clarity of the spatial center does not necessarily mean that the space is more suitable. Thus, the null hypothesis is accepted. Consequently, hypothesis six is rejected.

6.3 CONCLUSION

Hypotheses two, three and five seem to be accepted and hypotheses one, four and six are rejected.

There is no conclusive evidence as to which the preferable space is in terms of the level of the convergent dynamics and clarity of the center of the spaces.

It was found that the unpredictable factors are too complicated to be used in the designing of a relatively suitable built environmental space, in terms of the dynamics as used in this study

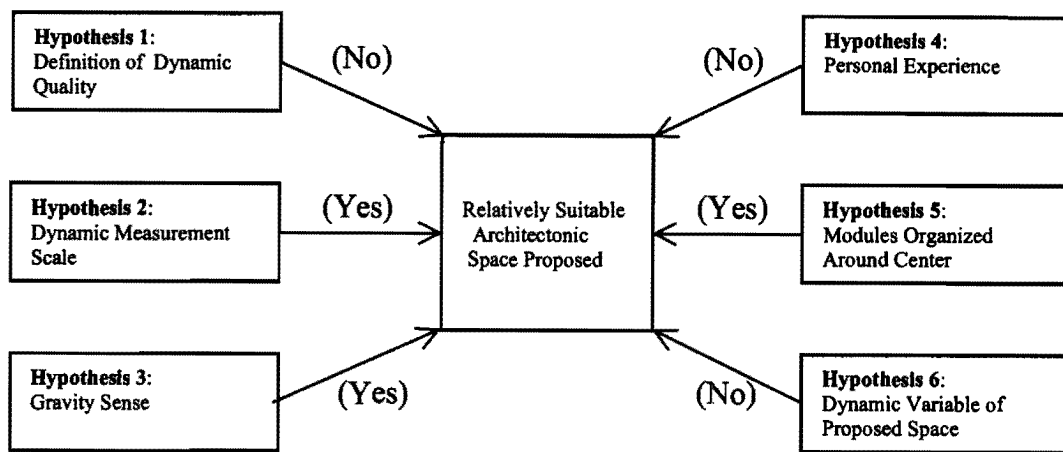


Figure 6.1

6.4 RECOMMENDATION

From this study it seems that the interests of architectural professionals do not coincide with that of the average person. It suggests, with the convergent dynamics, that there is a gap between the average person and architectural students. In this respect, the architectural students seem to have a greater ability to perceive the levels of the convergent dynamics than that of the average respondents. The perception of the center of the space is identified quite differently in terms of the mean. Architectural professional training has, indeed, assisted them to be keener when identifying the center than that of the average person. This perceptual ability along with the clarity of the center seems to be less keen as ones age increases. With this realization, if an architect designs an exterior space in terms of the dynamics, in satisfying his clients he should consciously soften his professional sense, generally. Moreover, his design may be more appreciated by young females. Furthermore, his design may be far less appreciated by those people older than forty-five. In summarizing this point of view, it seems to be a good idea to plan a design strategy in terms of different people's groupings.

Although there is no conclusive evidence to indicate a close relationship between the most preferable architectonic space and the level of the convergent dynamics and the clarity of the center, space eight is the most preferable space by the average respondents, and these variables are quite close to those of space seven. The variables for both the average respondents and the architectural students have statistical significant. This space

is therefore recommended as an ideal design stance to consciously satisfy clients. It is also recommended that further investigation in this regard may need to be conducted.

6.5 ADDITION

Although there is no strong evidence there are indications that need to be studied further. The researcher feels that there were factors that came into play that were outside the parameters of this study but could be investigated in further studies.

As far as this study is concerned the researcher feels that it was an extremely difficult task to attempt to isolate the factors but for the purposes of this study there was no choice but to identify one or two factors and work with them. It is also expedient to attempt to verify the general feeling there is about dynamics. This study has also highlighted some interesting results in term of how the client sees the environment and this has some practical use.

APPENDIX 1

A DEMONSTRATION: VALUE AND EXERCISES VALUE

The limitless numerical values:

Table 3.1 VALUES EXPRESSED IN METRES

RED SERIES: RO		BLUE SERIES: BL	
cm	m	cm	m
95,280.7	959.80		
58,886.7	588.86	117,773.5	1,177.73
36,394.0	363.94	72,788.0	727.88
22,492.7	224.92	44,985.5	449.85
13,901.3	139.01	27,802.5	278.02
8,591.4	85.91	17,182.9	171.82
5,309.8	53.10	10,619.6	106.19
3,281.6	32.81	6,563.3	65.63
2,028.2	20.28	4,056.3	40.56
1,253.5	12.53	2,506.9	25.07
774.7	7.74	1,549.4	15.49
478.8	4.79	957.6	9.57
295.9	2.96	591.8	5.92
182.9	1.83	365.8	3.66
113.0	1.13	226.0	2.26
69.8	0.70	139.7	1.40
43.2	0.43	86.3	0.86
26.7	0.26	53.4	0.53
16.5	0.16	33.0	0.33
10.2	0.10	20.4	0.20
6.3	0.06	12.6	0.12
3.9	0.04	7.8	0.08
2.4	0.02	4.8	0.04
1.5	0.01	3.0	0.03
0.9		1.8	0.01
0.6		1.1	
etc.		etc.	

APPENDIX 2

THE SURVEY PERFORMANCE

INSTRUCTION

Before proceeding, please spend some time reading through this brief description of this survey.

This survey is about the concentrated emotion evoked by a number of architectonic spaces. These will be presented from different perspectives and shown to you.

This survey consists of two major steps. Firstly, you should carefully look through all these perspectives and bear these eight spatial imaginations*** in mind. Secondly, a number of questions will be asked and answers should please be completed in the tables provided. The answers to these questions are based on the comparisons of these spaces. The scale of comparison of the concentrated emotion of these spaces is presented in Figure 1 below.

- (1) Please start by completing Table 4.5.
- (2) Please make sure you understand exactly what is expected and how you should proceed.
- (3) If there are any questions, please ask the interviewer.
- (4) The answer to the questions must be based on the comparison of the concentrated emotion of these spaces.
- (5) Only use the scale provided.

ARCHITECTURAL PERSPECTIVES

Eight perspectives will be presented to you, the respondent. In order for each of these spaces to be more comprehensible, two perspectives of each space will be shown: one is perceived at a viewing height slightly higher than the normal height and the other at a much higher viewing height. You are asked to imagine yourself wandering in the space and to follow from one space to the next, consecutively. There is a human-scaled figure showing you wandering around.

The perspectives are attached:

QUESTIONS

After carefully looking through each of these architectural spaces, please proceed to the next question. The answers can be completed by simply ticking one of the spaces in the table (Table 4.6, 4.7, 4.8). Please bear in mind that the ranking must be based on the comparison of these spaces.

- (1) Do you feel any convergent visual dynamics from these architectonic spaces? Y/N
- (2) If yes, please carry on with Table 4.6 by referring to the measurement scale in Figure 1.
- (3) Which one out of these eight architectonic spaces do you find the most suitable? Please indicate this in Table 4.7.
- (4) Do you feel is a center in these architectonic spaces? Y/ N
- (5) If so, which center do you most identify with? Please complete Table 4.8.

TABLE

The questions will be answered by filling in these tables. Please do so by crossing the relevant space in each table.

Table 4.5 needs to be completed in the very beginning of this survey and Table 4.6, 4.7, and 4.8 only after viewing the spaces and in the process of answering the questions.

Table 4.5 General Personal Information

Socio-demographic Characteristics						
Age			Gender		Occupation	
5 - 24	25 - 44	45 - 64	Female	Male	General	Profession

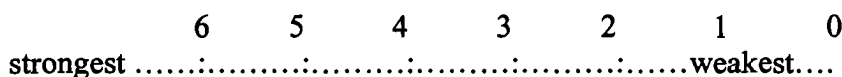
Table 4.6 Ranking of Convergent Dynamics Felt

Ranks No.	Ranking of Eccentric Dynamics							
	None	Weakest (1)	Weaker (2)	Weak (3)	Less strong (4)	Strong (5)	More strong (6)	Extremely strong (7)
Space 1								
Space 2								
Space 3								
Space 4								
Space 5								
Space 6								
Space 7								
Space 8								

* The ranking could be referred to the measurement scale following (figure 1)

Measurement Scale

The levels of the concentrated dynamics evoked is scaled from the weakest to the strongest by means of digital numbers 1 to 6, respectively. '0' represents no such emotion felt at all.



Concentrated Dynamic scale

(figure 1)

Table 4.7 Select the Most Preferable Space

	Space 1	Spacer 2	Space 3	Space 4	Space 5	Spacer 6	Space 7	Space 8
The most suitable emotion								

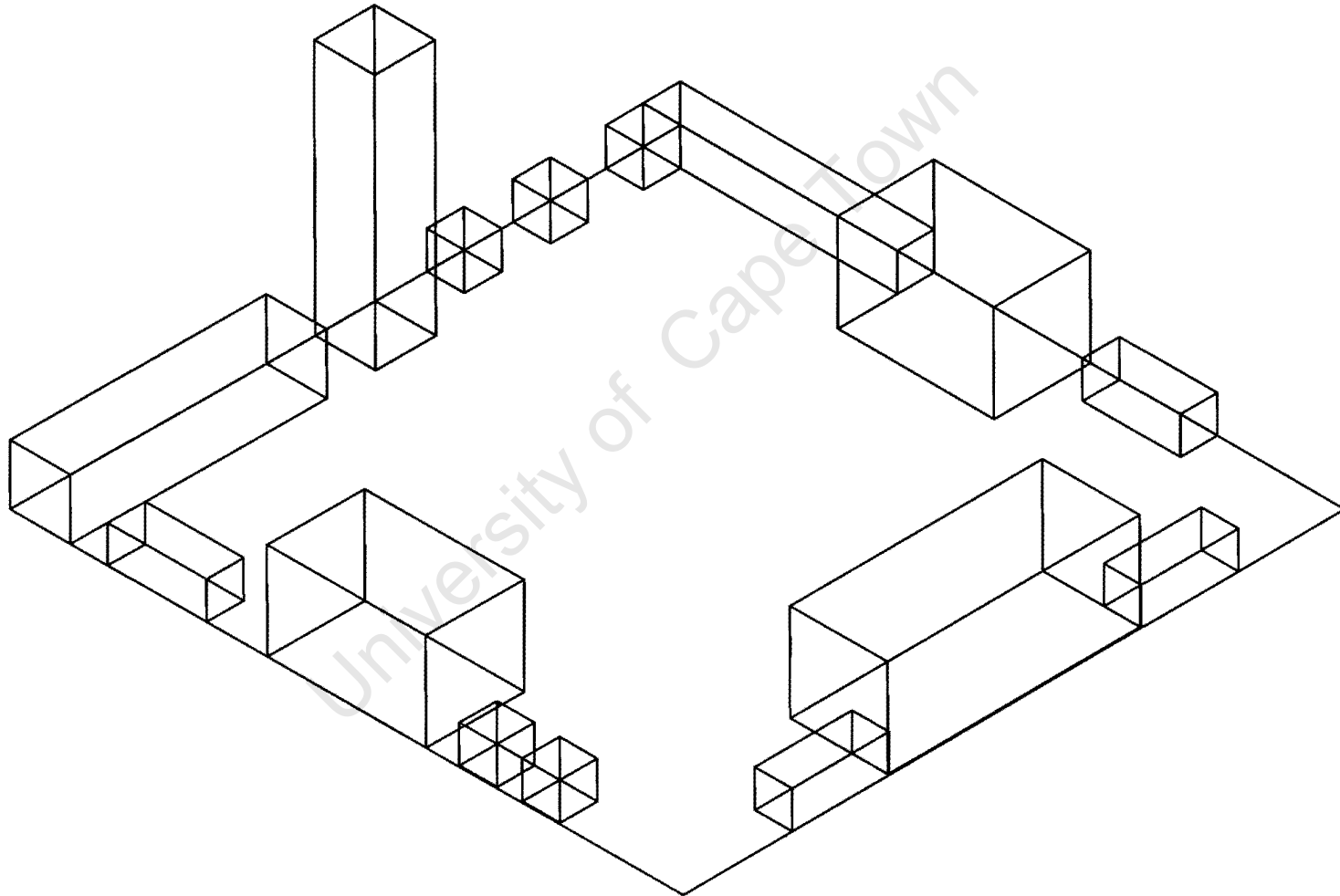
Table 4.8 Indicate the Clarity of the Center of these Spaces

	Space 1	Spacer 2	Space 3	Space 4	Space 5	Spacer 6	Space 7	Space 8
Very Clear								
Clear								
Less Clear								

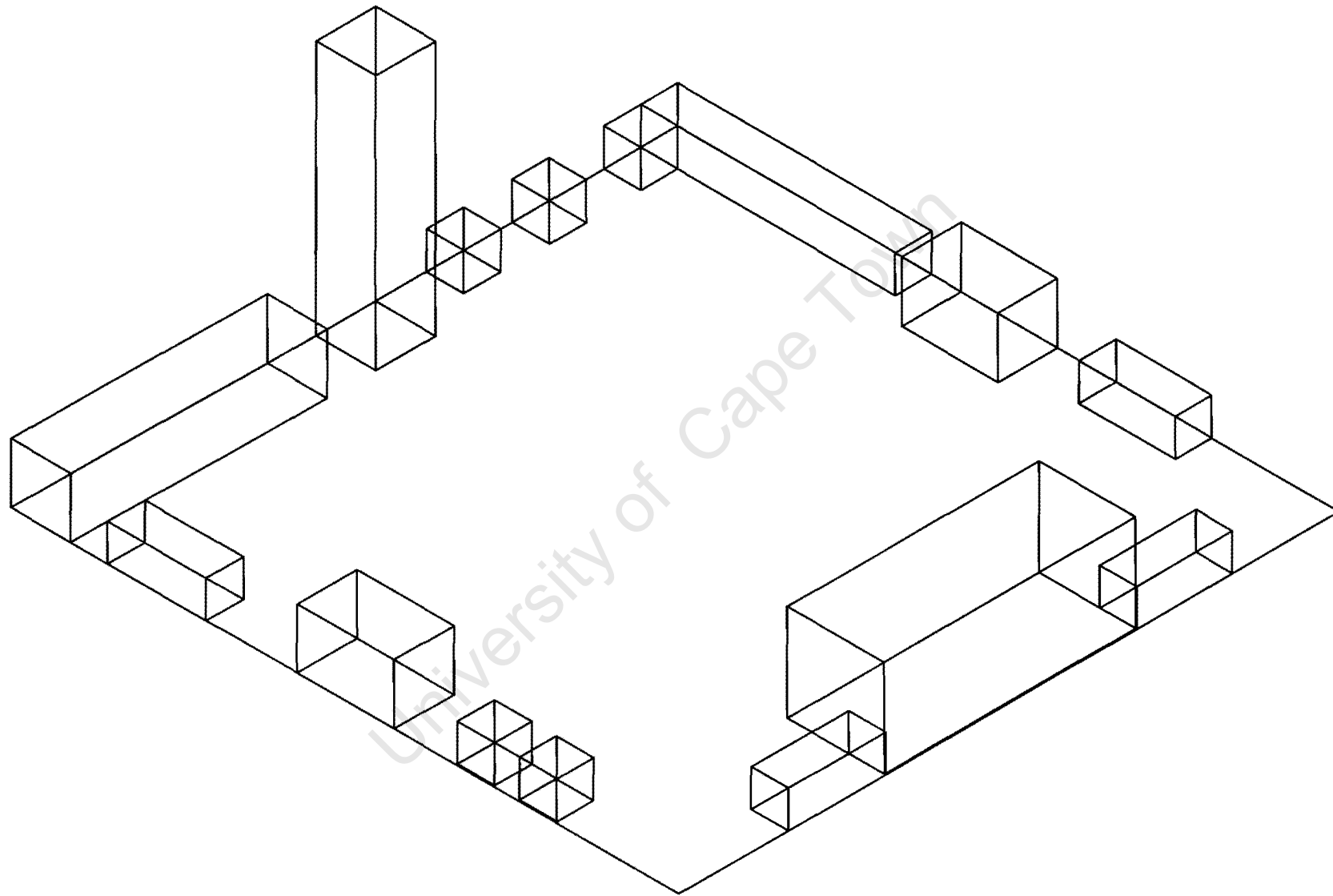
Thank you for your time.

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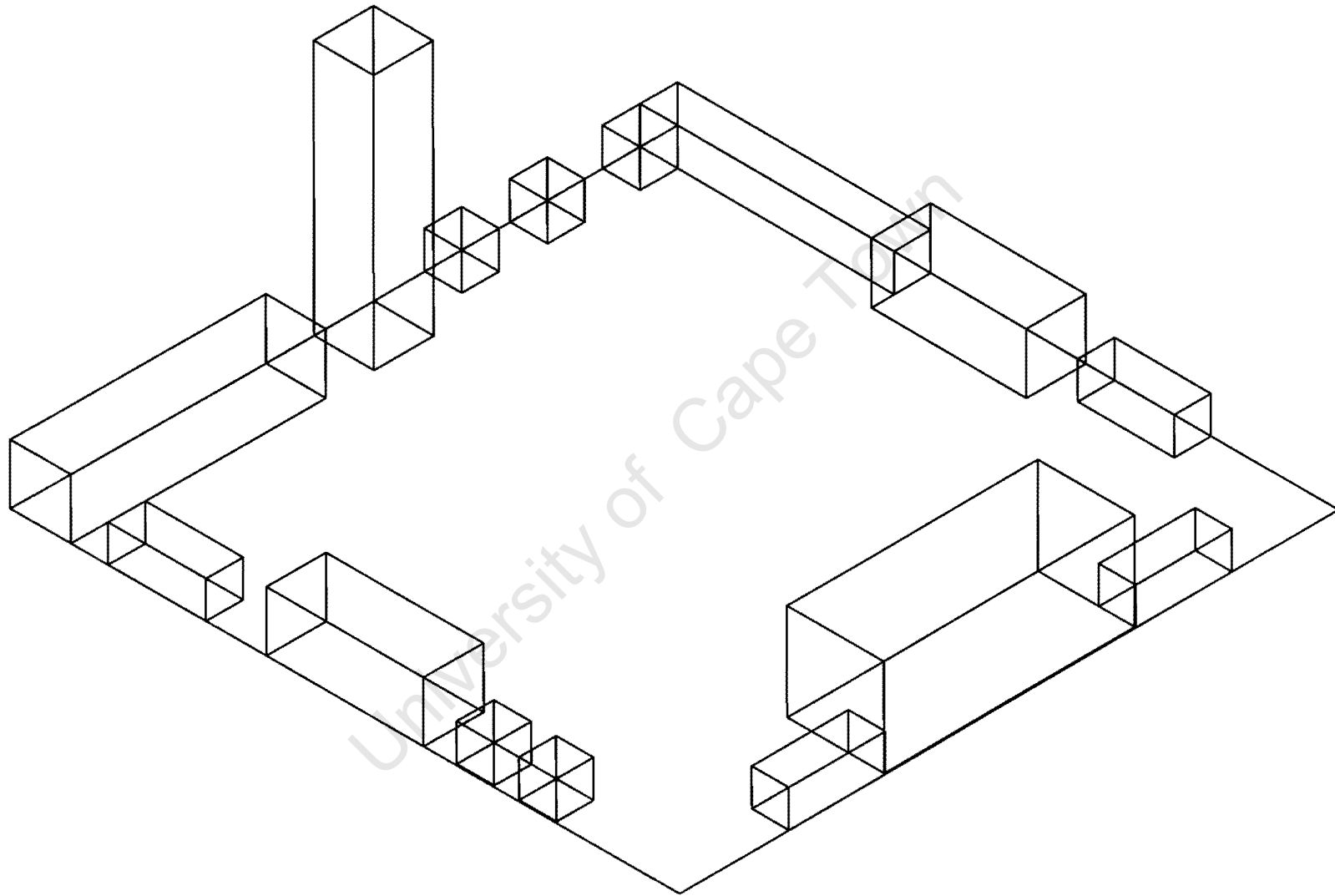
APPENDIX THREE (SPACE ONE-SPACE EIGHT)



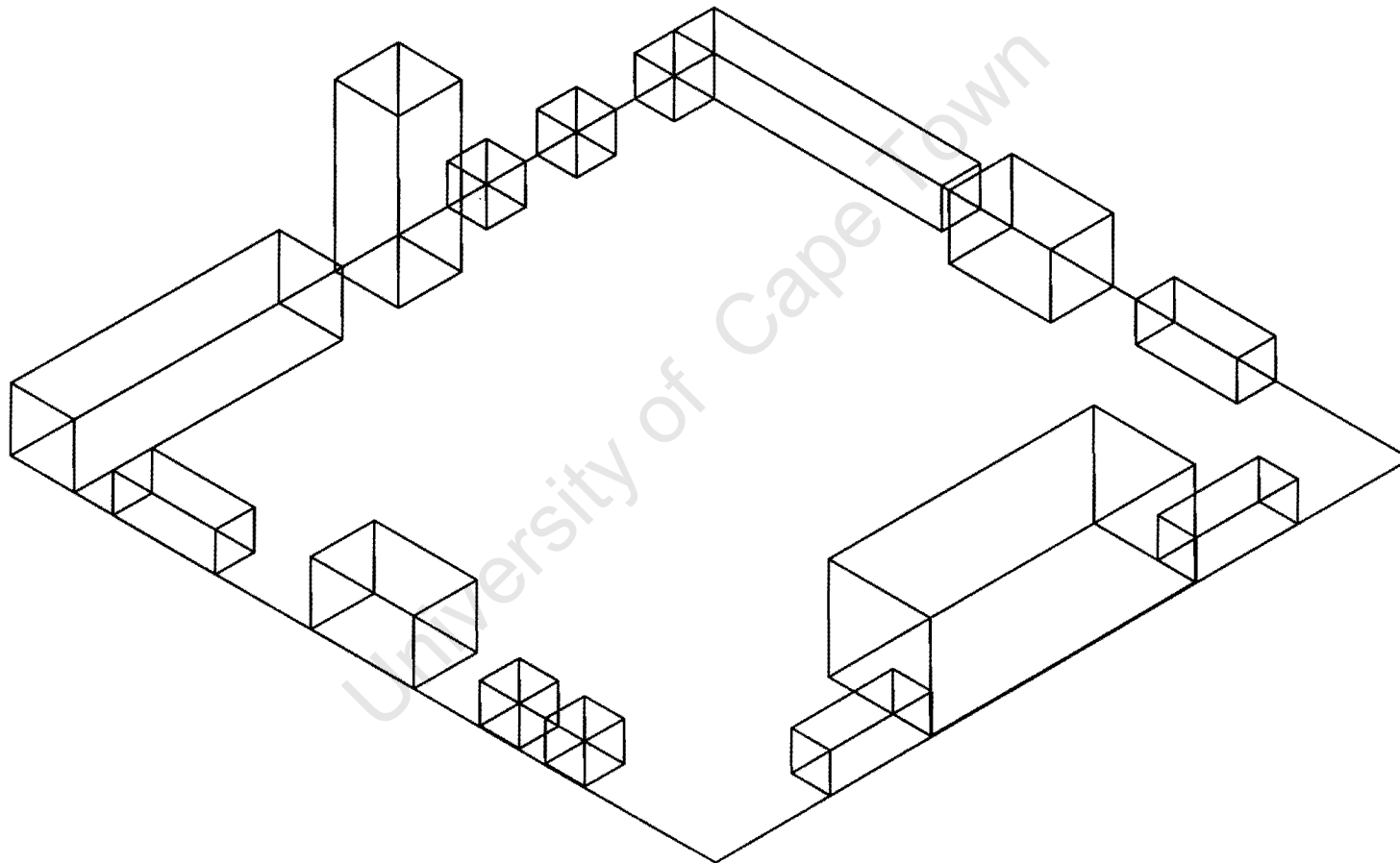
Aero-perspective for Architectonic Space (1)



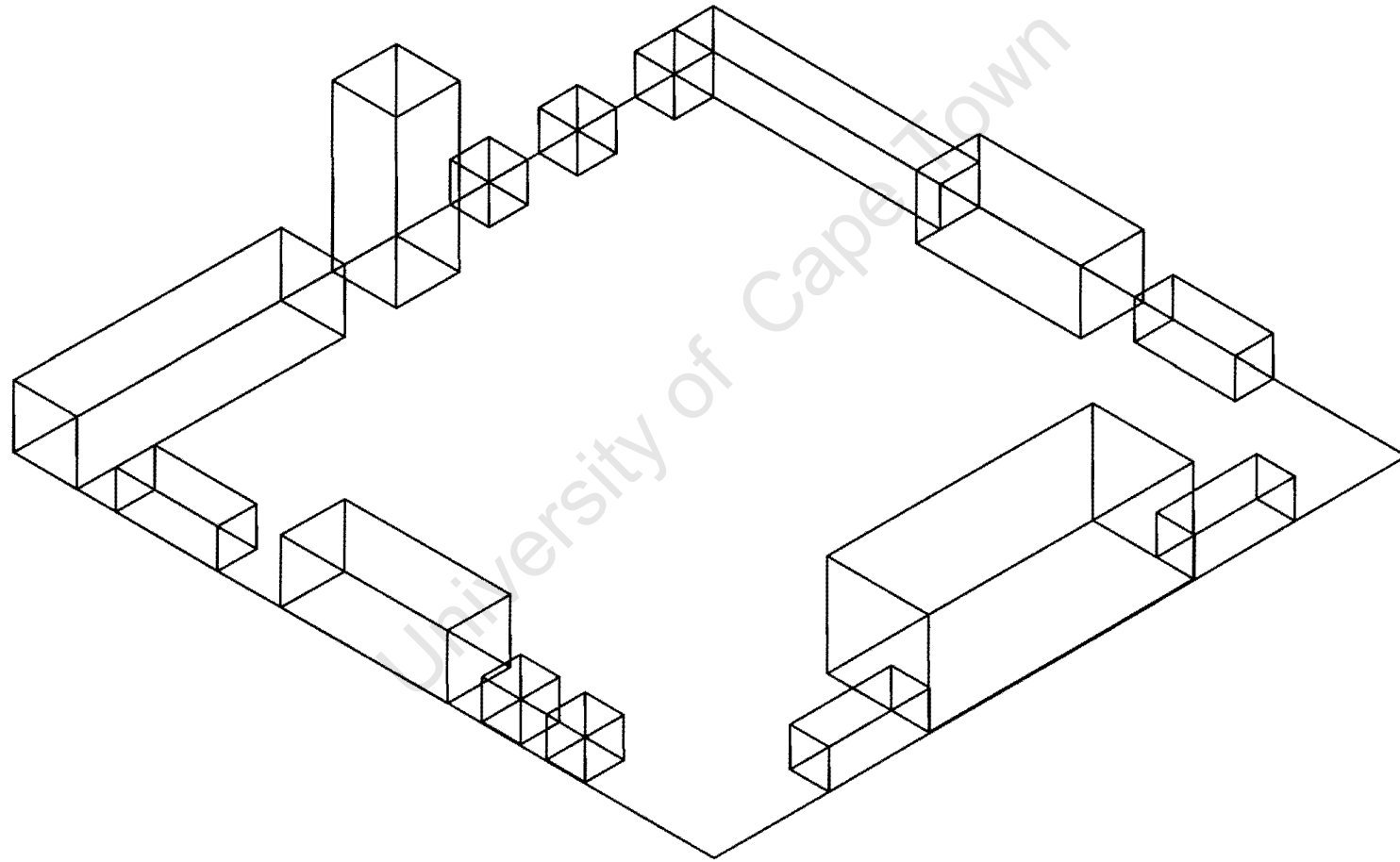
Aero-perspective for Architectonic Space (2)



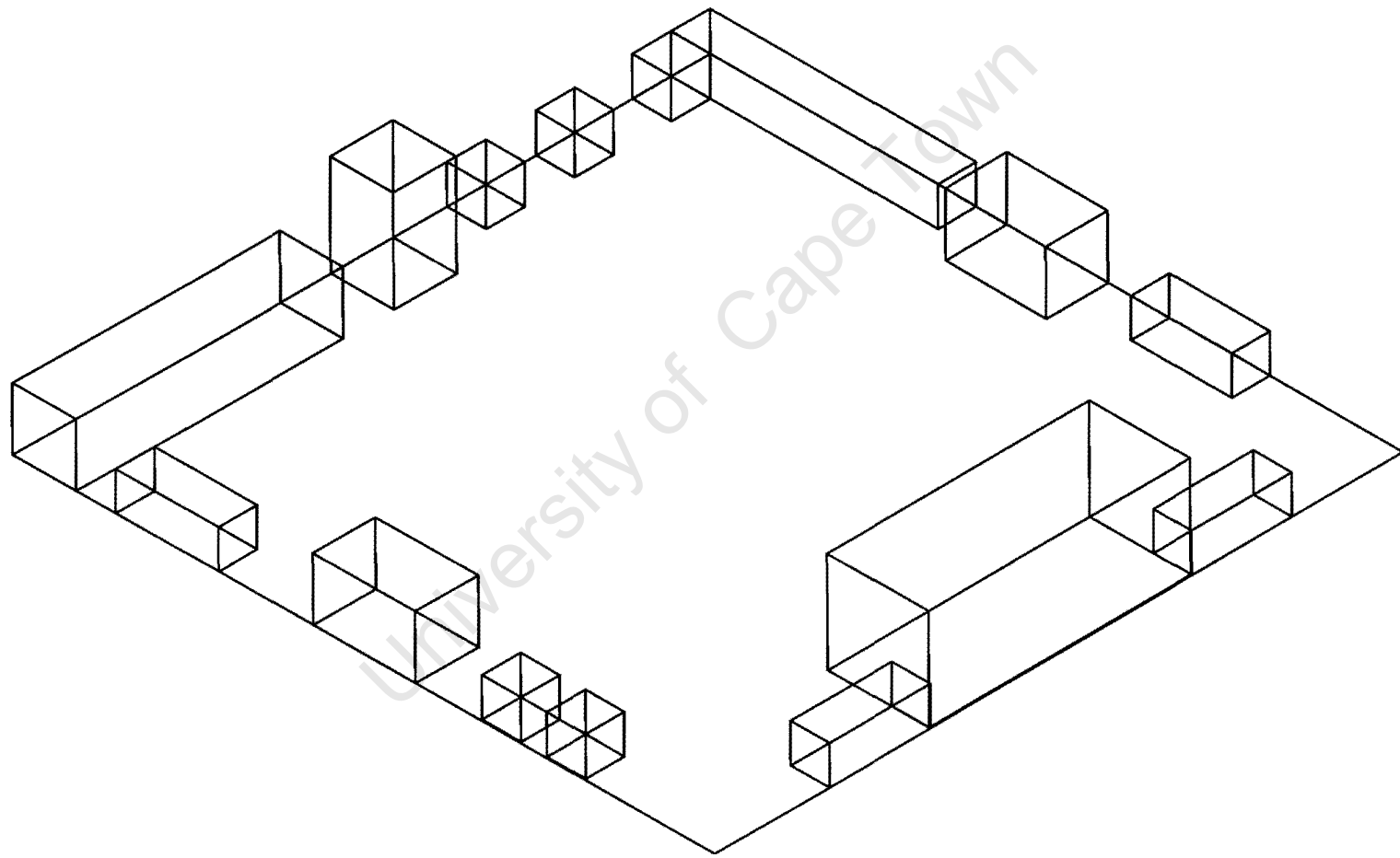
Aero-perspective for Architectonic Space (3)



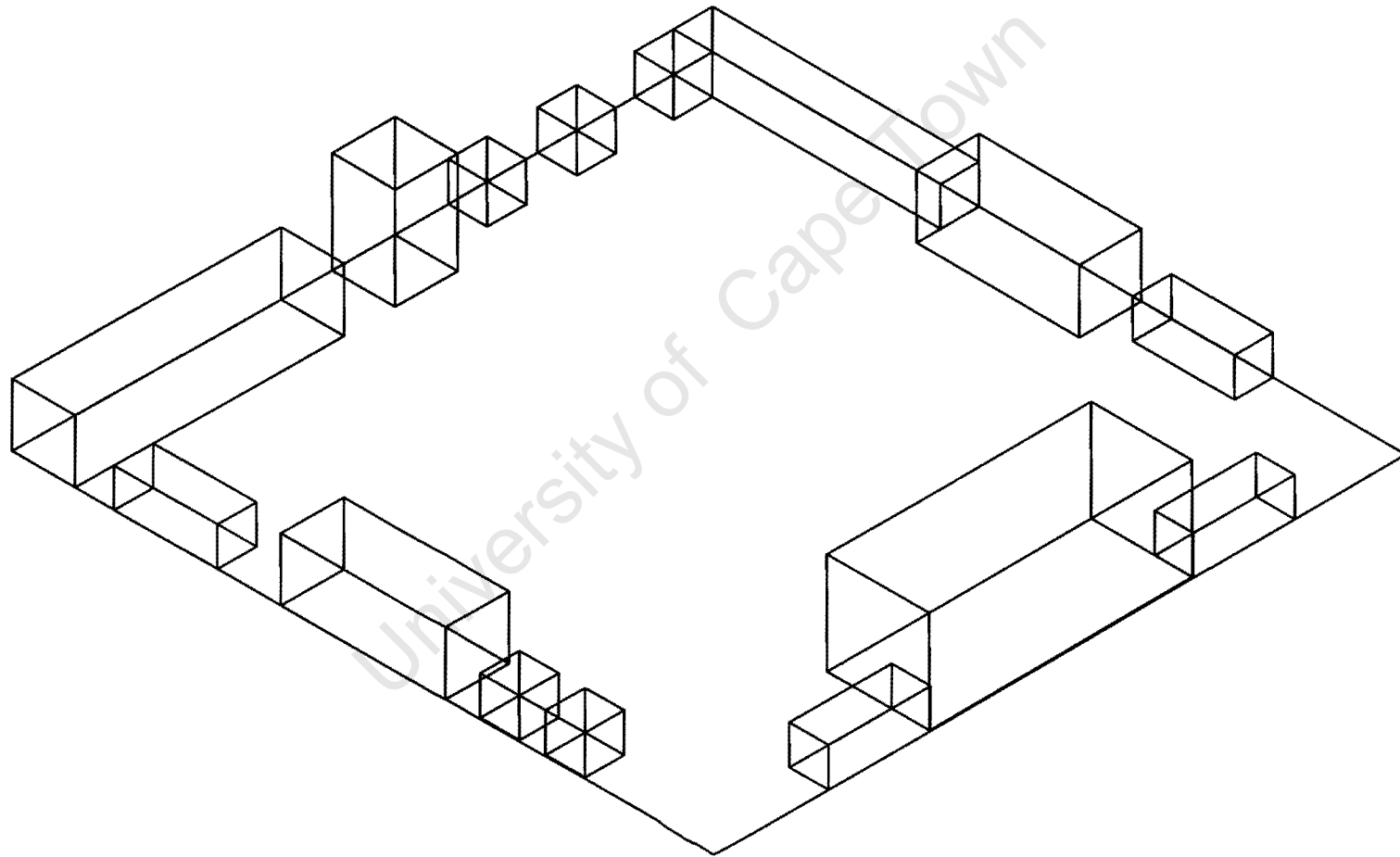
Aero-perspective for Architectonic Space (4)



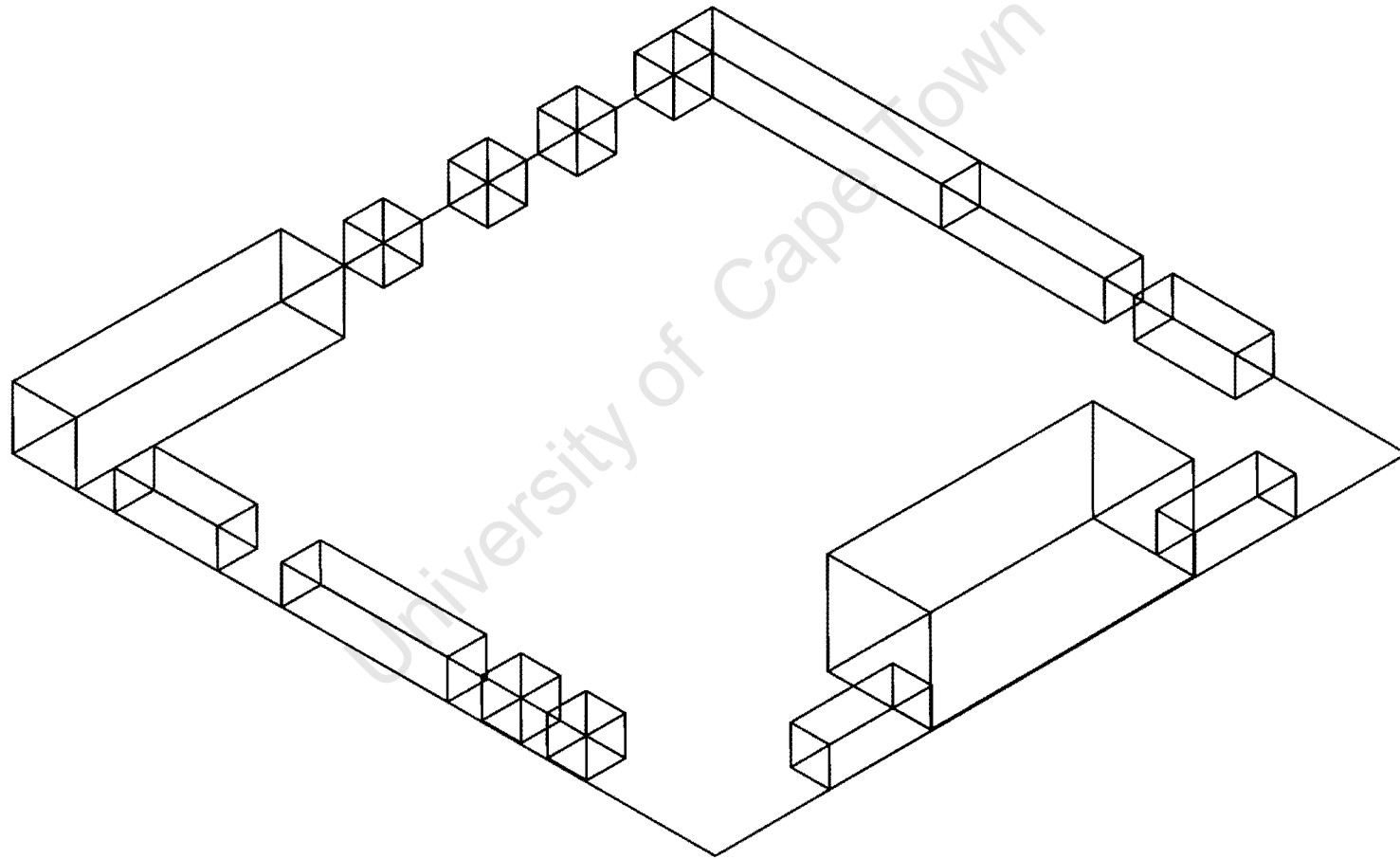
Aero-perspective for Architectonic Space (5)



Aero-perspective for Architectonic Space (6)



Aero-perspective for Architectonic Space (7)



Aero-perspective for Architectonic Space (8)

APPENDIX 4 (Independent Variable)

Table 5.2-1 Ranking of Convergent Dynamics Felt by Males aged 5-24

Ranks No.	Ranking of Convergent Dynamics								Number of People	Percentage(%)
	0	(1)	(2)	(3)	(4)	(5)	(6)	(7)		
Space 1		1		1	1	1		2		
Space 2				2			2			
Space 3		1	1	1		1	1			
Space 4			1		2		1			
Space 5	1			1	1	1	1			
Space 6	1		1			1	1			
Space 7		1			1		2			
Space 8	1			2		1		1		
Total									6	100

Table 5.2-2 Ranking of Convergent Dynamics Felt by Females aged 5-24

Ranks No.	Ranking of Convergent Dynamics								Number of People	Percentage(%)
	0	(1)	(2)	(3)	(4)	(5)	(6)	(7)		
Space 1	2	1				1		1		
Space 2	1			1	1	1				
Space 3				2		2				
Space 4				2	2					
Space 5				2	1		2			
Space 6		1	1	1		1				
Space 7				2			1	1		
Space 8				1		1		1		
Total									5	100

Table 5.2-3 Ranking of Convergent Dynamics Felt by Males aged 25-44

Ranks No.	Ranking of Convergent Dynamics								Number of People	Percentage(%)
	0	(1)	(2)	(3)	(4)	(5)	(6)	(7)		
Space 1						1	2			
Space 2					1	2	1			
Space 3					2		1	1		
Space 4					1		1	1		
Space 5					1	2		1		
Space 6				1		2		1		
Space 7			1		1	1	1			
Space 8		1		1	1			1		
Total									4	100

Table 5.2-4 Ranking of Convergent Dynamics Felt by Females aged 25-44

Ranks No.	Ranking of Convergent Dynamics								Number of People	Percentage(%)
	0	(1)	(2)	(3)	(4)	(5)	(6)	(7)		
Space 1	1	1		2			3	1		
Space 2		1		2	1		1	2		
Space 3		1	1	3		2	1			
Space 4			1	3	3			1		
Space 5				1	3	1	2	1		
Space 6			2		2	3	1	1		
Space 7		2			1	3	1			
Space 8	2	1	1		1		1	2		
Total									8	100

Table 5.2-5 Ranking of Convergent Dynamics Felt by Males aged 45-64

Ranks No.	Ranking of Convergent Dynamics								Number of People	Percentage(%)
	0	(1)	(2)	(3)	(4)	(5)	(6)	(7)		
Space 1	1						1	1		
Space 2		1					2			
Space 3			1			2				
Space 4				1	1	1				
Space 5			1		1	1				
Space 6				1	1	1				
Space 7		1			1		1			
Space 8	1			1				1		
Total									3	100

Table 5.2-6 Ranking of Convergent Dynamics Felt by Females aged 45-64

Ranks No.	Ranking of Convergent Dynamics								Number of People	Percentage(%)
	0	(1)	(2)	(3)	(4)	(5)	(6)	(7)		
Space 1			1			2		1		
Space 2		1			1	1				
Space 3				1	1	2				
Space 4					3		1			
Space 5				1	2	1				
Space 6			1	2	1					
Space 7		1		2						
Space 8		3						1		
Total									4	100

Table 5.3-1 The Most Preferable Space by Male respondents aged 5-24

Number of Space	Frequency distribution	Percentage (%)
Space 1	1	17
Space 2	2	33
Space 3	2	33
Space 4		
Space 5		
Space 6		
Space 7	1	17
Space 8		
Total	6	100

Table 5.3-2 The Most Preferable Space by Female respondents aged 5-24

Number of Space	Frequency distribution	Percentage (%)
Space 1	1	20
Space 2		
Space 3		
Space 4		
Space 5	2	40
Space 6	1	20
Space 7		
Space 8	1	20
Total	5	100

Table 5.3-3 The Most Preferable Space by Male respondents aged 25-44

Number of Space	Frequency distribution	Percentage (%)
Space 1		
Space 2	1	25
Space 3	1	25
Space 4		
Space 5		
Space 6	1	25
Space 7		
Space 8	1	25
Total	4	100

Table 5.3-4 The Most Preferable Space by Female respondents aged 25-44

Number of Space	Number of People (persons)	Percentage (%)
Space 1	2	25
Space 2	1	12.5
Space 3	1	12.5
Space 4		
Space 5	1	12.5
Space 6	1	12.5
Space 7		
Space 8	2	25
Total	8	100

Table 5.3-5 The Most Preferable Space by Male respondents aged 45-64

Number of Space	Frequency distribution	Percentage (%)
Space 1	2	67
Space 2		
Space 3		
Space 4		
Space 5		
Space 6		
Space 7		
Space 8	1	33
Total	3	100

Table 5.3-6 The Most Preferable Space by Female respondents aged 45-64

Number of Space	Frequency distribution	Percentage (%)
Space 1		
Space 2	1	25
Space 3		
Space 4		
Space 5		
Space 6		
Space 7		
Space 8	3	75
Total	4	100

Table 5.4-1 Clarity of Center Felt by Male Respondents between 5 and 24 years

Number of Space	Very Clear (3)	Clear (2)	Least Clear (1)	Number of People	Percentage (%)
Space 1		1	1		
Space 2	1		1		
Space 3	2				
Space 4	1				
Space 5		2	1		
Space 6		1	2		
Space 7	2	1	1		
Space 8	2	1	1		
Total				6	100

Table 5.4-2 Clarity of Center Felt by Female Respondents between 5 and 24 years

Number of Space	Very Clear (3)	Clear (2)	Least Clear (1)	Number of People	Percentage (%)
Space 1	3				
Space 2	1	1			
Space 3			3		
Space 4		2			
Space 5	1	2			
Space 6					
Space 7					
Space 8			1		
Total				5	100

Table 5.4-3 Clarity of Center Felt by Male Respondents between 25 and 44 years

Number of Space	Very Clear (3)	Clear (2)	Least Clear (1)	Number of People	Percentage (%)
Space 1	2	1			
Space 2	2	2			
Space 3		1	2		
Space 4		1	1		
Space 5	1	1			
Space 6	3				
Space 7	2	1			
Space 8	1	1	2		
Total				4	100

Table 5.4-4 Clarity of Center Felt by Female Respondents from 25 to 44 years

Number of Space	Very Clear (3)	Clear (2)	Least Clear (1)	Number of People	Percentage (%)
Space 1	2	2	1		
Space 2	2	3			
Space 3	2	3	1		
Space 4		4			
Space 5	1	3			
Space 6	2	1			
Space 7	2	1	1		
Space 8	2	1	1		
Total				8	100

Table 5.4-5 Clarity of Center Felt by Male Respondents between 45 and 64 years

Number of Space	Very Clear (3)	Clear (2)	Least Clear (1)	Number of People	Percentage (%)
Space 1	2		1		
Space 2		3			
Space 3	1	1			
Space 4		2			
Space 5		2			
Space 6		1	1		
Space 7		1	1		
Space 8	1		2		
Total				3	100

Table 5.4-6 Clarity of Center Felt by Female Respondents between 45 and 64 years

Number of Space	Very Clear (3)	Clear (2)	Least Clear (1)	Number of People	Percentage (%)
Space 1		1	1		
Space 2		1			
Space 3		1	1		
Space 4	1	2			
Space 5		2			
Space 6	1	2			
Space 7		1			
Space 8	2		1		
Total				4	100

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APPENDIX 5 (Chi-square calculation)

Table 5.8-1 Space One

	0	1	2	3	4	5	6	7	Total
Average Respondent	4	3	1	3	1	5	6	6	29
Architectural Student	0	0	0	1	0	4	2	3	10
Total	4	3	1	4	1	9	8	9	39

Degrees of freedom: 7
 Chi-square = 5.05431034482759
 For significance at the 0.05 level, chi-square should be greater than or equal to 14.07.
 The distribution is not significant.
 p is less than or equal to 1.

Table 5.8-2 Space Two

	0	1	2	3	4	5	6	7	Total
Average Respondent	1	3	0	5	4	4	6	2	25
Architectural Student	0	0	3	1	2	2	0	2	10
Total	1	3	3	6	6	6	6	4	35

Degrees of freedom: 7
 Chi-square = 12.95
 For significance at the 0.05 level, chi-square should be greater than or equal to 14.07.
 The distribution is not significant.
 p is less than or equal to 0.1.

Table 5.8-3 Space Five

	0	1	2	3	4	5	6	7	Total
Average Respondent	1	0	1	5	10	7	5	2	31
Architectural Student	0	1	0	1	4	1	1	1	9
Total	1	1	1	6	14	8	6	2	40

Degrees of freedom: 7
 Chi-square = 5.2159075139102
 For significance at the 0.05 level, chi-square should be greater than or equal to 14.07.
 The distribution is not significant.
 p is less than or equal to 1.

Table 5.8-4 Space Six

	0	1	2	3	4	5	6	7	Total
Average Respondent	1	1	5	5	4	8	2	2	28
Architectural Student	0	0	3	3	4	0	0	0	10
Total	1	1	8	8	8	8	2	2	38

Degrees of freedom: 7
 Chi-square = 8.34642857142857
 For significance at the 0.05 level, chi-square should be greater than or equal to 14.07.
 The distribution is not significant.
 p is less than or equal to 1.

Table 5.8-5 Space Seven

	0	1	2	3	4	5	6	7	Total
Average Respondent	0	5	1	5	4	4	6	7	32
Architectural Student	1	0	2	4	1	0	1	0	9
Total	1	5	3	9	5	4	7	7	41

Degrees of freedom: 7
 Chi-square = 14.46569664903
 p is less than or equal to 0.05.
 The distribution is **significant**.

Table 5.8-6 Space Eight

	0	1	2	3	4	5	6	7	Total
Average Respondent	4	5	1	5	2	2	1	7	27
Architectural Student	0	7	0	1	1	0	0	1	10
Total	4	12	1	6	3	2	1	8	37

Degrees of freedom: 7
 Chi-square = 10.1692901234568
 For significance at the 0.05 level, chi-square should be greater than or equal to 14.07.
 The distribution is not significant.
 p is less than or equal to 0.20.

Table 5.9-1 Space One

		Total
Non-arch Respondent	6	6
Architectural Student	1	1
Total	7	7

Degrees of freedom: 0
 Chi-square = 0
 For significance at the 0.5 level, chi-square should be greater than or equal to 0.05.
 The distribution is not significant.
 p is less than or equal to 1.

Table 5.9-2 Space Two

		Total
Non-arch Respondent	4	4
Architectural Student	1	1
Total	5	5

Degrees of freedom: 0
 Chi-square = 0
 For significance at the 0.5 level, chi-square should be greater than or equal to 0.05.
 The distribution is not significant.
 p is less than or equal to 1.

Table 5.9-3 Space Five

		Total
Non-arch Respondent	3	3
Architectural Student	5	5
Total	8	8

Degrees of freedom: 0
 Chi-square = 0
 For significance at the 0.5 level, chi-square should be greater than or equal to 0.05.
 The distribution is not significant.
 p is less than or equal to 1.

Table 5.9-4 Space Six

		Total
Non-arch Respondent	3	3
Architectural Student	1	1
Total	4	4

Degrees of freedom: 0
 Chi-square = 0
 For significance at the 0.5 level, chi-square should be greater than or equal to 0.05.
 The distribution is not significant.
 p is less than or equal to 1.

Table 5.9-5 Space Seven

		Total
Non-arch Respondent	1	1
Architectural Student	1	1
Total	2	2

Degrees of freedom: 0
 Chi-square = 0
 For significance at the 0.5 level, chi-square should be greater than or equal to 0.05.
 The distribution is not significant.
 p is less than or equal to 1.

Table 5.12-1 Space One

	1 (least clear)	2 (median clear)	3 (very clear)	Total
Non-arch Respondent	4	5	9	18
Architectural Student	1	1	7	9
Total	5	6	16	27

Degree of freedom: 2
 Chi-square = 1.93125
 For significance at the 0.5 level, chi-square should be greater than or equal to 5.99.
 The distribution is not significant.
 p is less than or equal to 1.

Table 5.12-2 Space Two

	1 (least clear)	2 (median clear)	3 (very clear)	Total
Non-arch Respondent	1	9	6	16
Architectural Student	6	3	0	9
Total	7	12	6	25

Degree of freedom: 2
 Chi-square = 11.5141369047619
 p is less than or equal to 0.01.
 The distribution is **significant**.

Table 5.12-3 Space Three

	1 (least clear)	2 (median clear)	3 (very clear)	Total
Non-arch Respondent	7	6	5	18
Architectural Student	4	3	1	8
Total	11	9	6	26

Degree of freedom: 2
 Chi-square = 0.749579124579124
 For significance at the 0.5 level, chi-square should be greater than or equal to 5.99.
 The distribution is not significant.
 p is less than or equal to 1.

Table 5.12-4 Space Four

	1 (least clear)	2 (median clear)	3 (very clear)	Total
Non-arch Respondent	1	11	2	14
Architectural Student	4	5	0	9
Total	5	16	2	23

Degree of freedom: 2
 Chi-square = 5.20922619047619
 For significance at the 0.5 level, chi-square should be greater than or equal to 5.99.
 The distribution is not significant.
 p is less than or equal to 1.

Table 5.12-5 Space Five

	1 (least clear)	2 (median clear)	3 (very clear)	Total
Non-arch Respondent	1	12	3	16
Architectural Student	1	7	1	9
Total	2	19	4	25

Degree of freedom: 2
 Chi-square = 0.386056286549708
 For significance at the 0.5 level, chi-square should be greater than or equal to 5.99.
 The distribution is not significant.
 p is less than or equal to 1.

Table 5.12-6 Space Six

	1 (least clear)	2 (median clear)	3 (very clear)	Total
Non-arch Respondent	3	5	6	14
Architectural Student	4	3	1	8
Total	7	8	7	22

Degree of freedom: 2
 Chi-square = 2.78507653061224
 For significance at the 0.5 level, chi-square should be greater than or equal to 5.99.
 The distribution is not significant.
 p is less than or equal to 1.

Table 5.12-7 Space Seven

	1 (least clear)	2 (median clear)	3 (very clear)	Total
Non-arch Respondent	3	5	6	14
Architectural Student	6	4	0	10
Total	9	9	6	24

Degree of freedom: 2
 Chi-square = 6.62857142857143
 p is less than or equal to 0.05.
 The distribution is **significant**.

Table 5.12-8 Space Eight

	1 (least clear)	2 (median clear)	3 (very clear)	Total
Non-arch Respondent	8	3	8	19
Architectural Student	7	0	1	8
Total	15	3	9	27

Degree of freedom: 2
 Chi-square = 4.8157894736842
 For significance at the 0.5 level, chi-square should be greater than or equal to 5.99.
 The distribution is not significant.
 p is less than or equal to 0.10.

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