

Thesis

A simple introduction to  
Structure  
in art & design education.

# "A simple introduction to structure in art and design education"

## Content

### Introduction:

- Chapter I Structures used in the past and in the present
- Chapter II Structures involving simple manmade shapes also structures involving natural forms.
- Chapter III Structures in general involving other elements.



## Introduction

In this paper I intend to outline the concept of structure in Art and design in relation to art education.

Structure is seen all around us. The process of structure may be made simple and may be carried out by students of all age groups.

Creating structures is a fascinating creative and interesting study for students to explore. Students see results quickly and are therefore urged on with enthusiasm. "All the basic elements of Art and design may be taught through construction." Elements like line, shape, form, colour, tone, texture and pattern to mention only a few.

As the exploration of many different materials may be made while constructing something, therefore, the student is also leaving absent the material in use and how the work, their potentials and how they react with other materials. Therefore structure has a large part to play in Art and Design education.

Structure: governs the way a form is built, or the way a number of forms are put together. It is overall spatial organisation, the skeleton beneath the fabric of shape, colour, and texture. The external appearance of a form can be rather complex, while its structure is relatively simple. Sometimes the internal structure of a form may not be immediately perceived. Once this is discovered the form can be better understood and appreciated.

The artist may consider any given shape, or colour of mass as a structural unit or "building block" with which to begin. The way we form and assemble these usual forces determines the degree of unity harmony, clarity, and vitality of the completed form. There are several primary means of achieving structural order. These we will discuss and demonstrate one by one.

- (1), Formal, (2) Semi-Formal (3) Informal, (4) Inactive, (5) Active, (6) Invisible
- (7) Visible (8) Repetition.

## Chapter I:

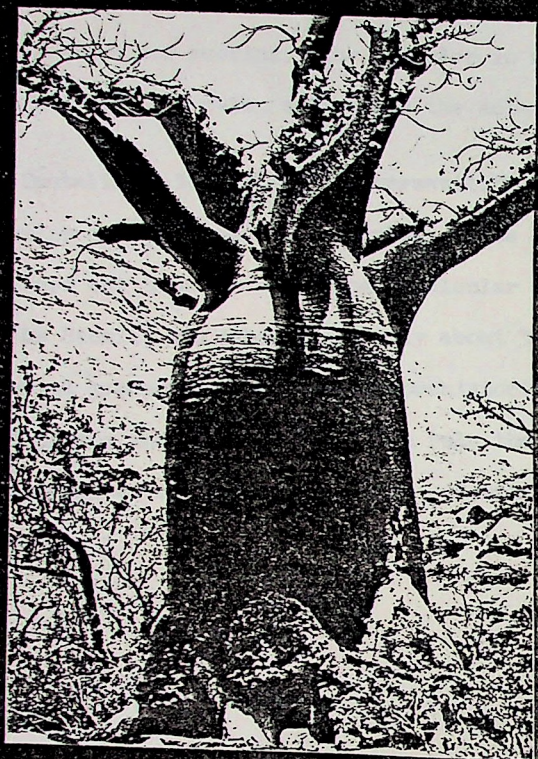
Structures used through material resources and manmade resources. The baobab tree of tropical Africa, sometimes reaches a diameter of 30 foot. Its wood being soft, trees are often hollowed out and used as dwellings.

### Grass Structures

In-digenous building methods often show great daring and elegance. The soaring framework for a men's clubhouse at Maipua, in the Gulf of New Guinea, is made of bamboo poles and will be covered with thatch. (Bamboo is not a tree but a grass that may attain a height of eighty feet).

Two stages and the final result of a construction method used in southern Iraq. The building material is giant reed, that grows along the lower Tigris and Euphrates, where it attains a height of twenty feet. It is bound into fascies, stuck into the ground and bent into parabolic arches.





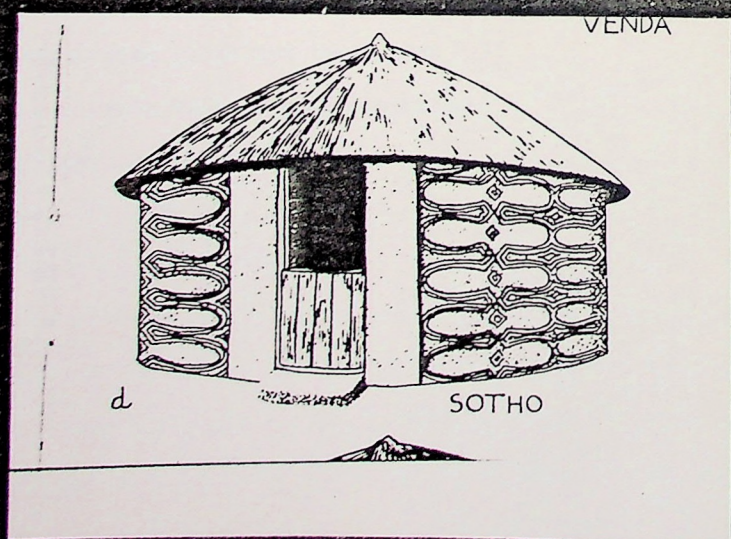


Chapter I

Mats woven from split reed serve for roofing. The interior is bare of furniture, carpets and a hearth for brewing coffee and the sole fixtures.

The Troglodytic town of Pantalica. Durability and versatility are characteristic of vernacular architecture. The chambers whose doors can be made out in the picture were cut into the nearly perpendicular declivities of the Anapo Valley by the Siculi, who inhabited Sicily about 3000 years ago. Originally serving as burial grounds for an adjacent prehistoric town, they were converted into dwellings during the Middle Ages. As a rule they form multistoried apartments connected by interior passages. Similar establishments are scattered all over Sicily.







When a work of art is praised for "having simplicity it is understood to organise a wealth of meaning and form in an all-over structure, that clearly defines the place and function of every detail in the whole ..... In an absolute sense, a thing is simple when it consists of a small number of structural features. In a relative sense, a thing has simplicity when it organises complex material with the smallest possible number of structural features" (Rudolf Arnheim, Art and Visual Perception).

### Materials

In the structure of anything, light flexible materials e.g. paper may be used as may heavy strong materials e.g. iron. A structure may be made from any material, therefore your choice of material is not limited. The place where the structure is made depends on the student. Benches can be used as can the floor, so therefore structures may be made without too many limitations.



## Structure in more reasant times

Megastructure - in their time were all large buildings but not all large buildings of their time were megastructure. Maki megastructuralists saw their task as being the proposal of "urban structure for the future". Rudolph's own meg, such as the Lower Manhattan expressionary development, justified by detailed analysis, to a well known but not architect - designed historical precedent. A megastructure was a building which looked liked a megastructure None existed before 1966. An over-scaled colossal multi-unit architectural mass. Megastructure as a "handy" mode of dealing with urban design problems. Elements of the Archigram cut out models ready for assembly, illustrating the seductive convenience of such models as a manageable way of handling problems that were difficult for the student, and their instructors to manipillite in conventional two dimensional representations - not to mention their function as educational toys.

### Suspended city project (

Through German, Otto produced the first pictorial images that fulfilled the French dream of an non-rectangular, three dimensional spider-webs city hung from a forest of Eiffel Towers.

The structural designs that occur in nature - in molecules, in crystals in living cells, in galaxies are the proper source of inspiration.

Nature at all levels builds responsive and adaptive structures that contrive material and energy resources through the use of modular components.

Skyscraper Style - by Cervin Robinson and Rosemarie Haag Bletter

Eric Merdelsohn, sketches for industrial buildings most of which contain streamlined forms from Sheldon Cheney.

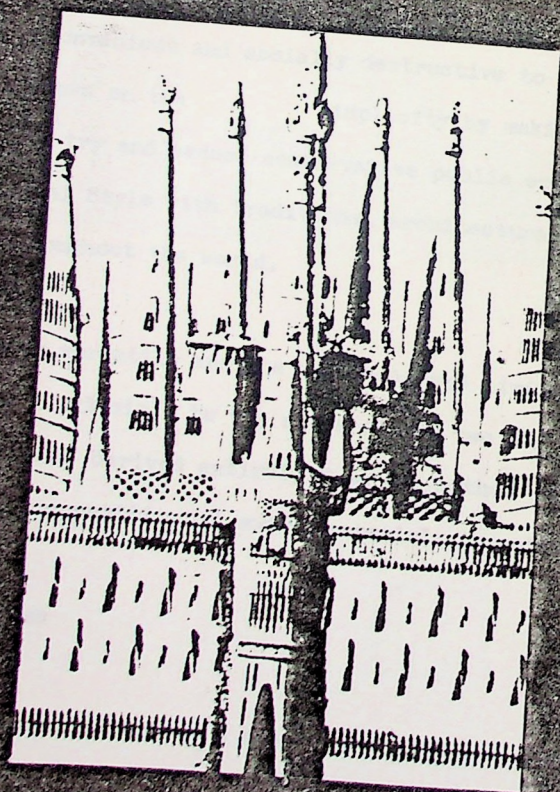
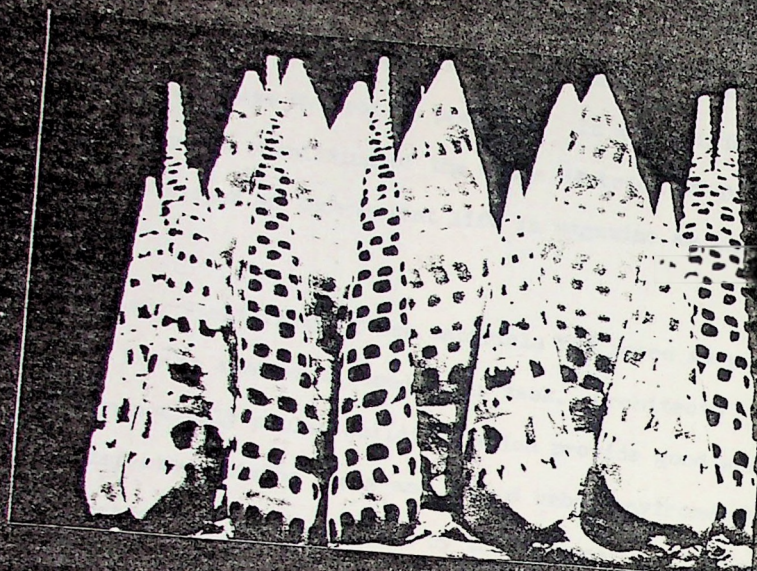
Art Museum project Antwerp 1955. The centre Pompidou is anticipated this time in the diagonally braced vertical frame of Jamagne's remarkably forward look project, which also anticipates most versions of the high technology capsule type of megastructure in which enclosed cells of great technical sophistication are bay at will in a simple carrying frame.



Tomorrow's City Hall project 1958. One of two prime sources for the diagonal frame so frequently proposed for megastructure and the first of Kahn's studies of the replanning of Philadelphia which collectively were to exercise great influence on the megastructure.

Atomium, Brussels 1958. The restaurants and viewing platforms in the upper spheres of this theme building were reached through the diagonal tubes,; a rare built version of the concept of circulation through diagonal structure that was to sustain many a megastructure proposal







Helicoids project (1961). Perhaps the best known most immediately recognizable of Japanese Metabolist projects. It was originally intended as a proposal for the rebuilding of the Ginza district of Tokyo but subsequently developed an independent life in magazine as the ultimate symbol of Metabolism.

The extraordinary flexibility of new materials has posed as much of a problem as it has in some ways eased their task. Architects - designers have to design not only public buildings which provide good working conditions but also satisfactory living areas and a good urban environment - taking into consideration the problems posed by the motorcar and the provision of transport facilities, and facing up to the restrictions and requirements of developers, planners, sociologists and politicians. It is inevitable that failures are more numerous, more obviously offensive and destructive to the environment, and more inconvenient and socially destructive to many more people. Attempts to improve on the simplicity by making it less simple or worse still, to try and seduce conservative public opinion by combining the International Style with traditional architectural forms, have now disfigured cities throughout the world.

Olympic Hall, Tokyo 1964.

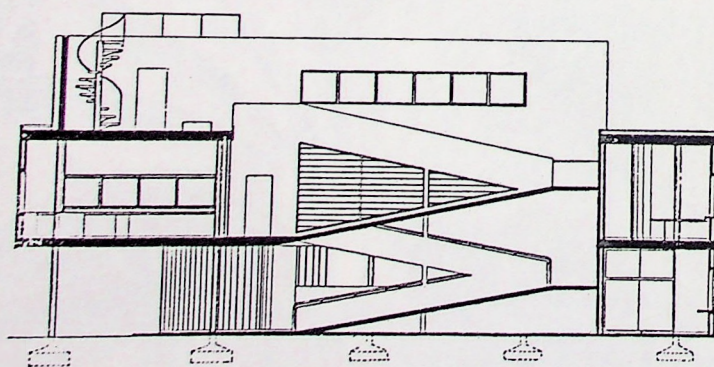
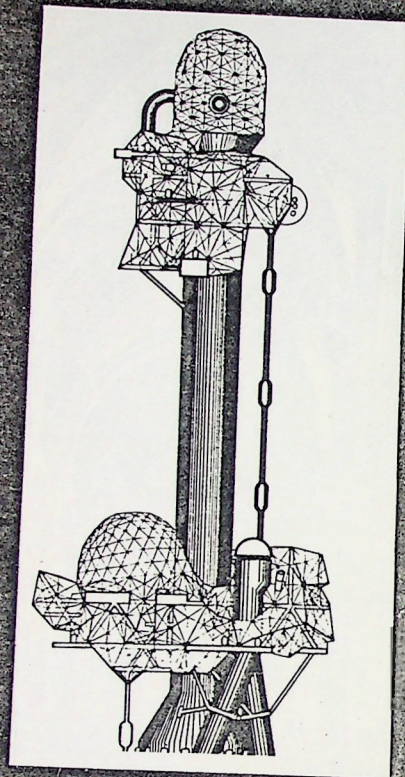
K. Tange probably the most versatile and the most talented living architect, has applied the suspension principle to the roofs of his two halls, to create buildings with original forms derived entirely from the method of construction not simply exploiting the versatility of modern materials to make novel shapes.

Palazetto Dello Sport - Rome

P.L. Nervi 1958

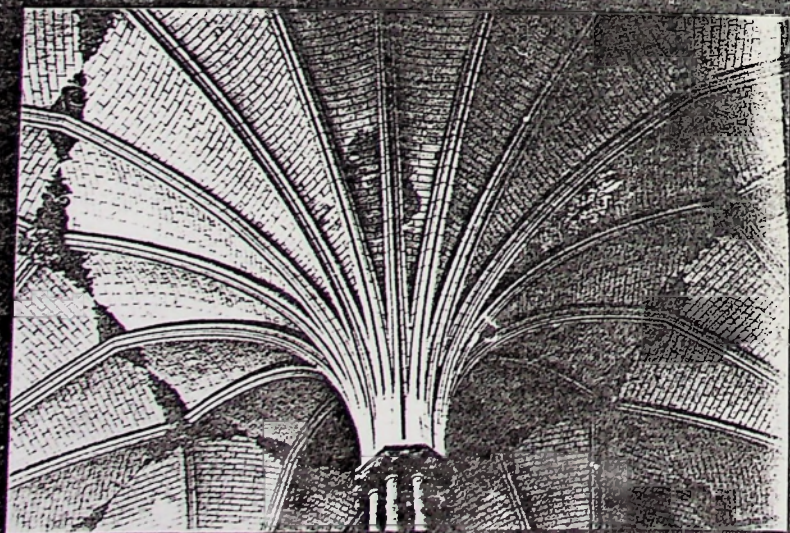
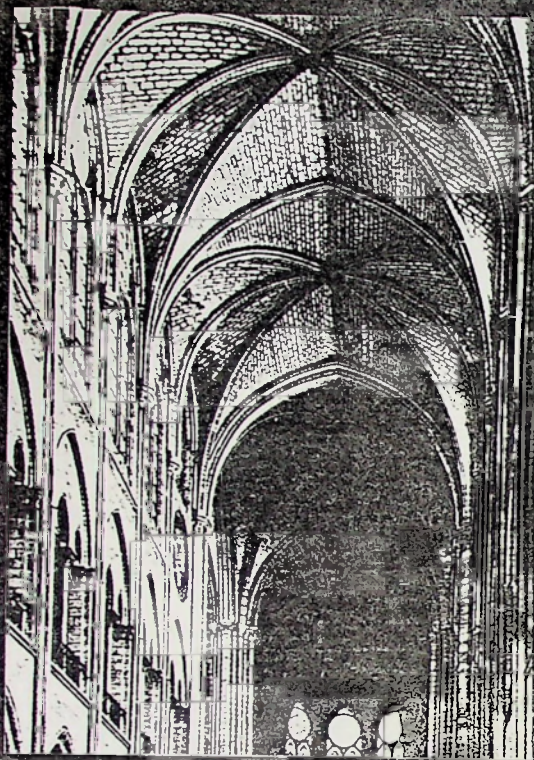
The building of Nervi invariably present a novel structural solution.



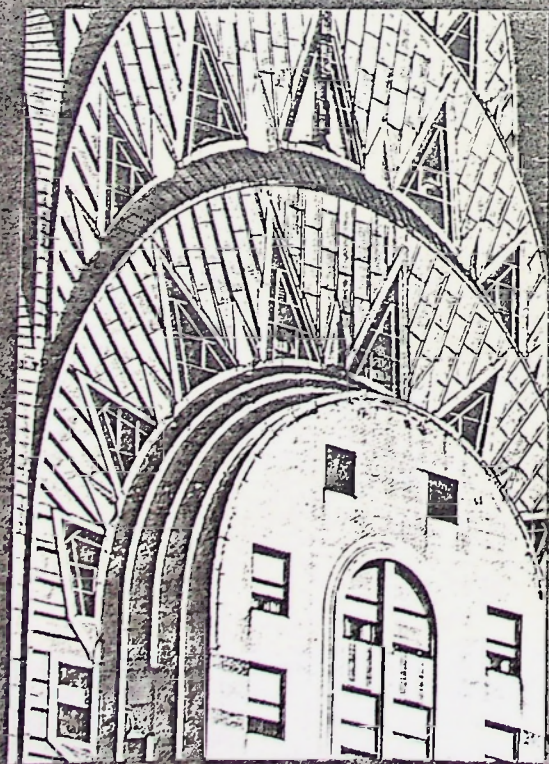
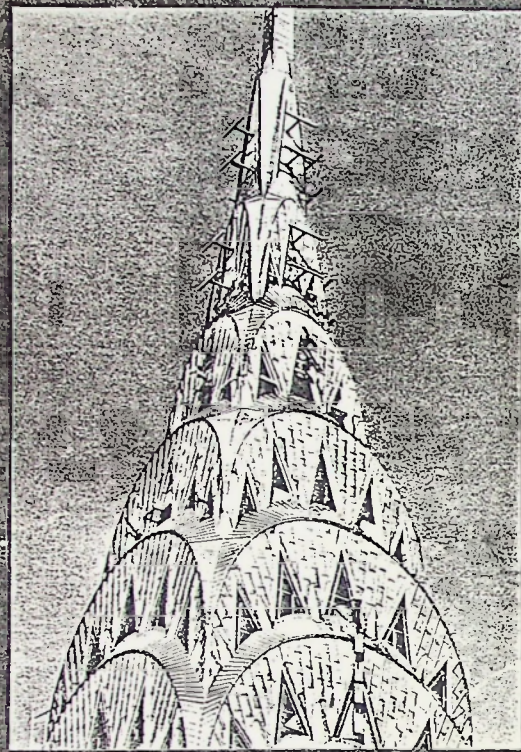


316. LE CORBUSIER and P. JEANNERET. Villa Savoye, 1928-30. Cross section. The hollowing out of the house from above and from below is accomplished with astorisk.

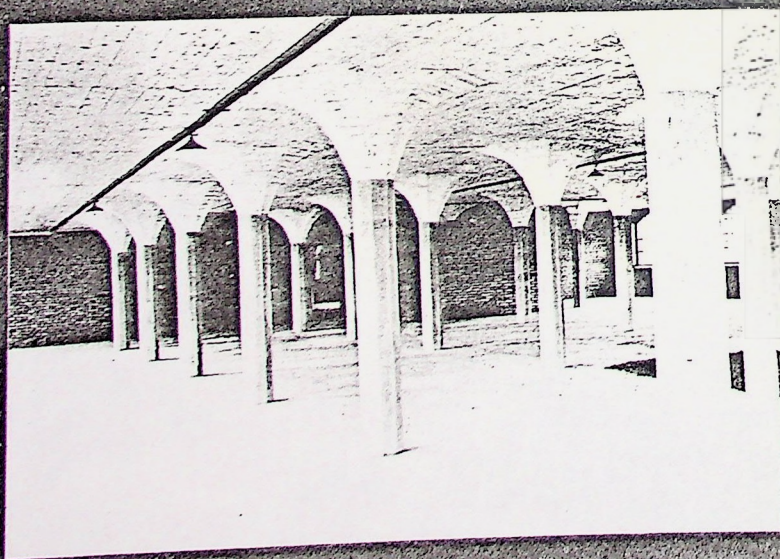
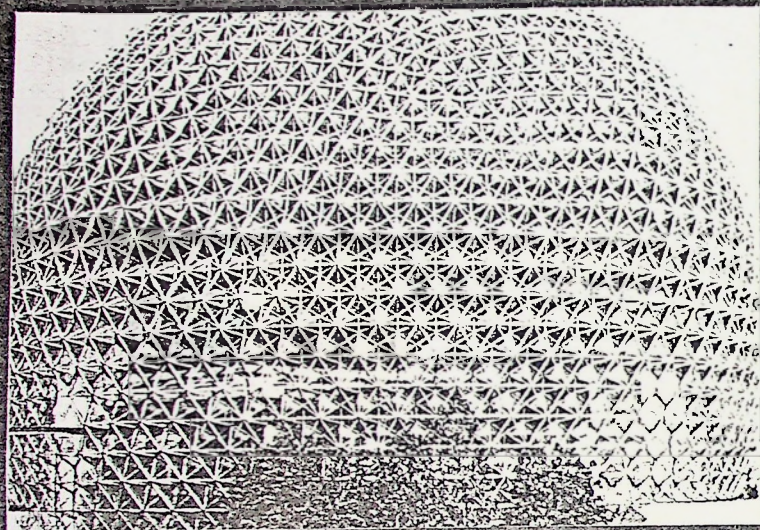




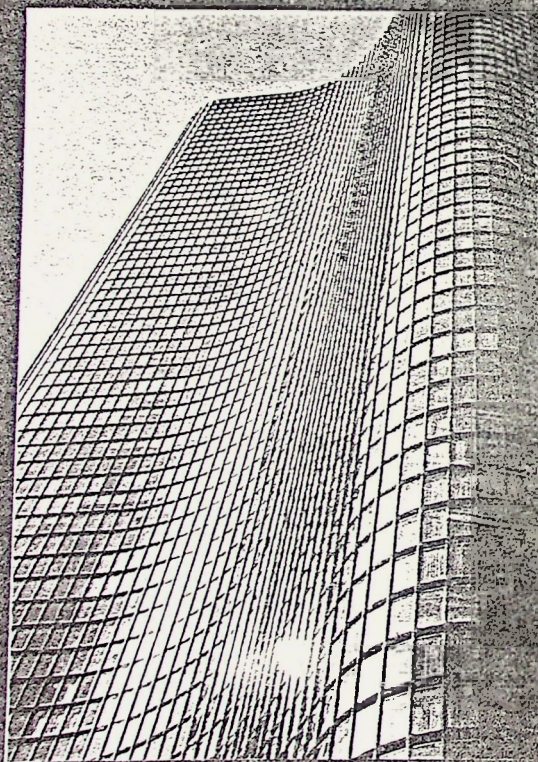














Chapter II

The cube, after some experimenting proved to be a suitable device to which I base my structure lessons on. The cube itself is a formal structure. The view of the cube chosen is one of many possible views that is why I made cubes and decided to use photographs. The photographs can be read as flat or implying as we can see a three-dimensional structure.



### 1. Formal Structure

Is a structure which is organised. The structural lines are constructed in a ridged manner and the shapes made are regular. Organisation contributes to the rhythm and the unity of the total organisation.

Class: To construct a structure using cubes made of wood not less than 2 ft. high to explain formal structure. Keep into consideration the rhythm of your structure.

### 2. Semi Formal Structure:

Is also quiet organised but irregular distances may exist. A tention may be created between shapes.

Class: To construct a semi-formal structure not less than 3ft. high use wooden cubes to make your structure. The structure should be enclosed in a space of 2ft. square, and must create a tention, which makes your structure more dynamic.

### 3. Informal Structure

The structure is informal and organisation is free and carefree.

Class: To construct an informal structure using one continuous piece of wire and any other shape other than the cube to make an object not less than 2 ft. high.

### 4. Repetition Structure

Repetition structure - forms are put together in regular sequence and pattern so that they all relate to one another in the same manner, vertically layers or horizontal layers.

Class: Design a form which interlocks and produce a structure not less than 3ft. high, with all the properties of repetition structure.

### 5. Inactive Structure

The shapes are static and the direction of shapes are not changeable.

Class: To construct a living quarters using balsa wood to accommodate a family of 6. Use the scale 1 : 100 to produce your object.

### 6. Active Structure

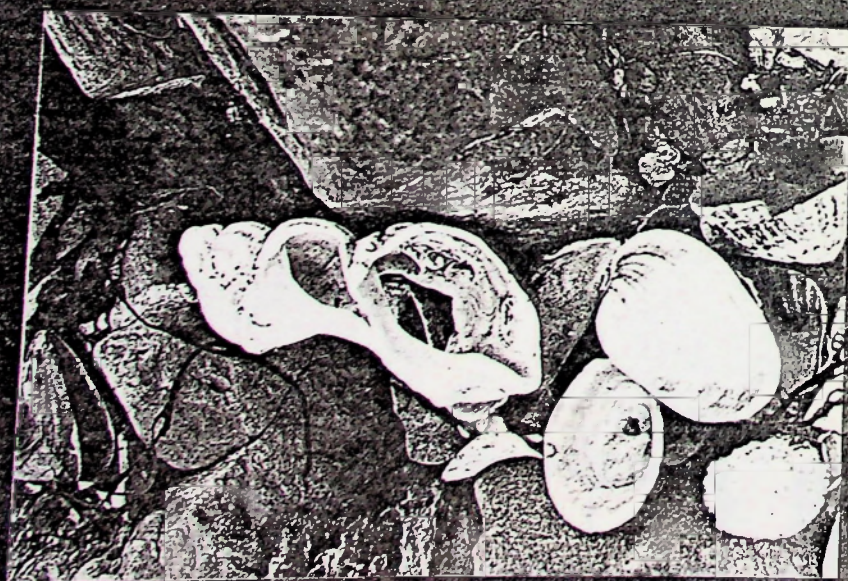
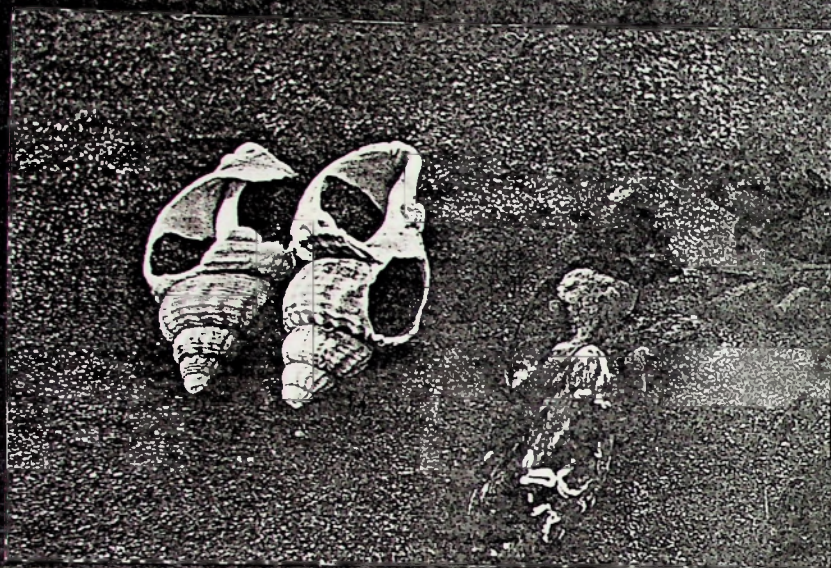


1. Formal Structure



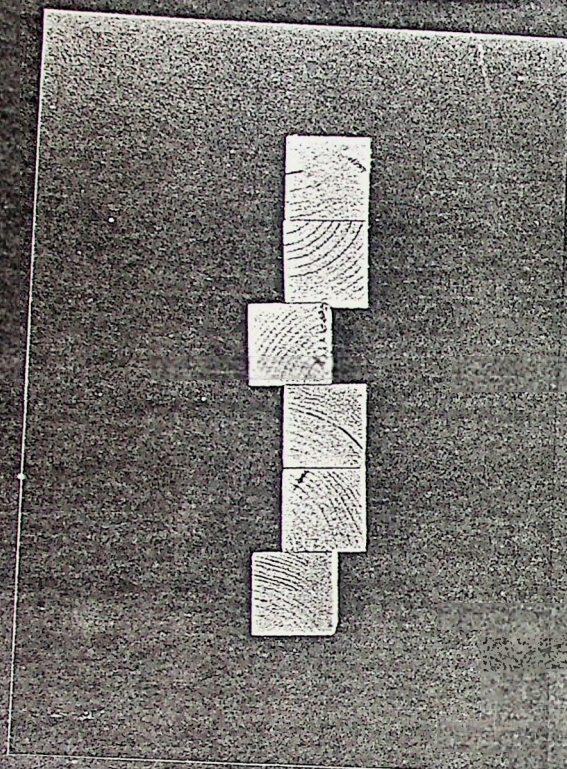


1. Formal Structure

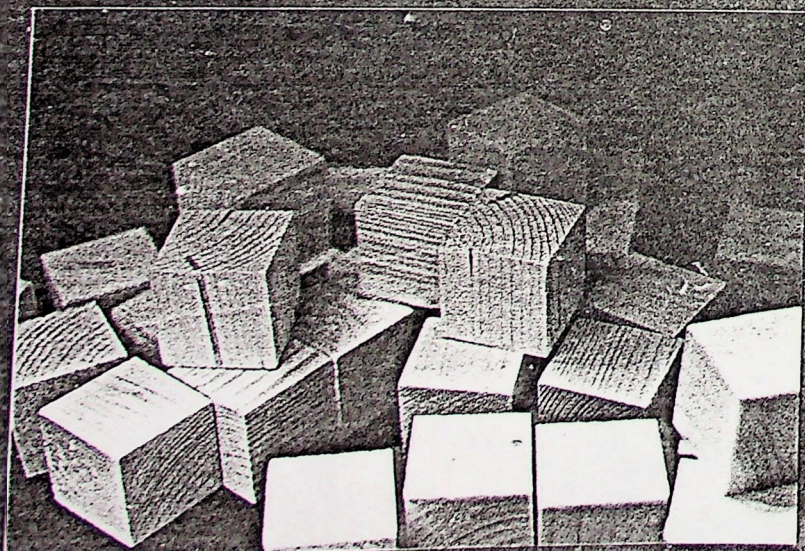




2. Semi Formal Structure:



3. Informal Structure



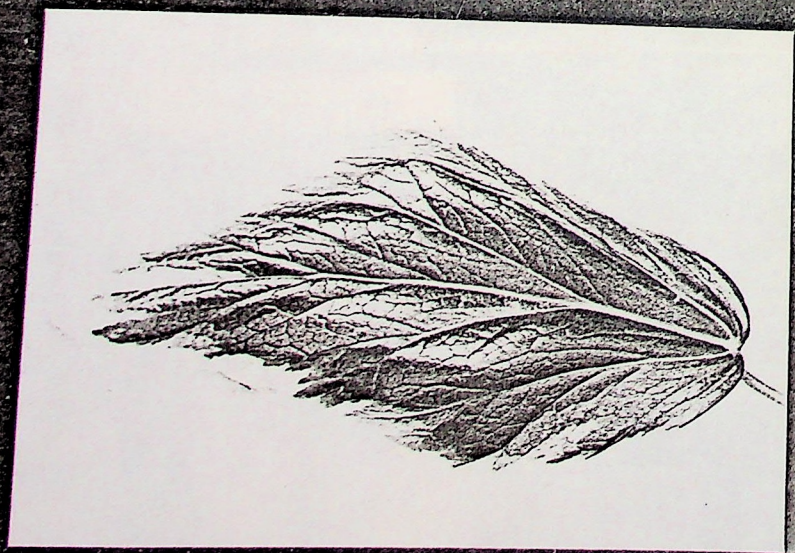
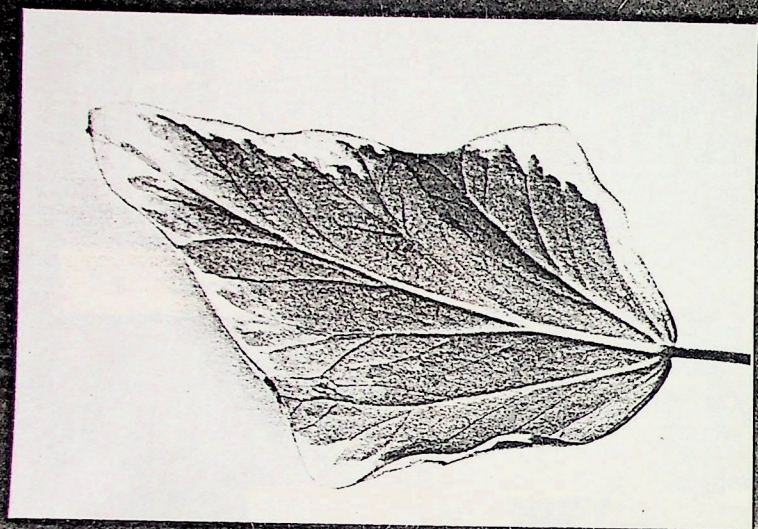


3. Informal Structure



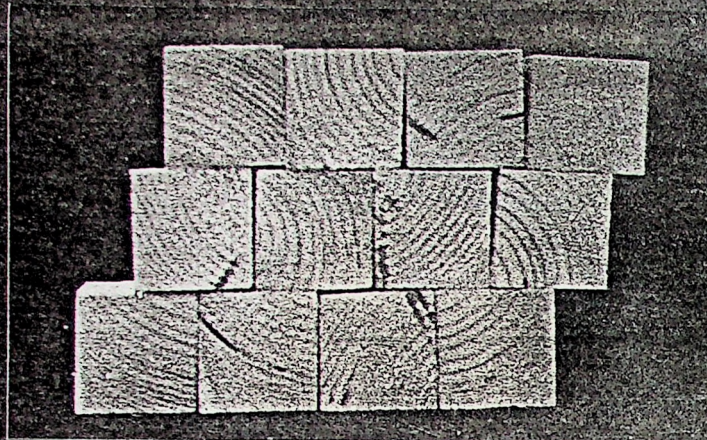


2. Semi Formal Structure:

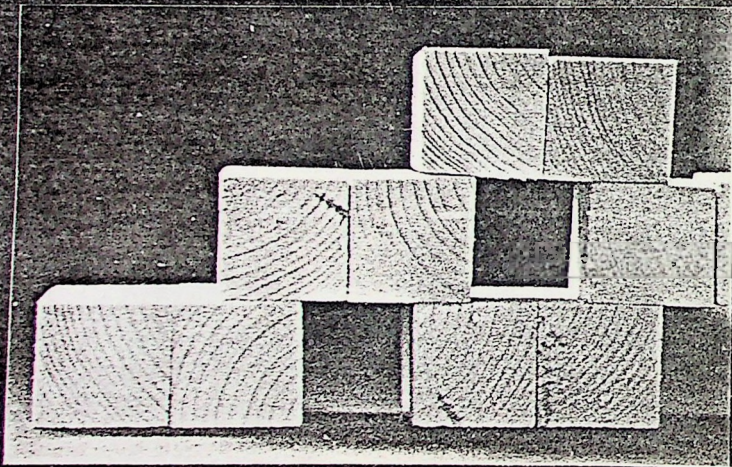




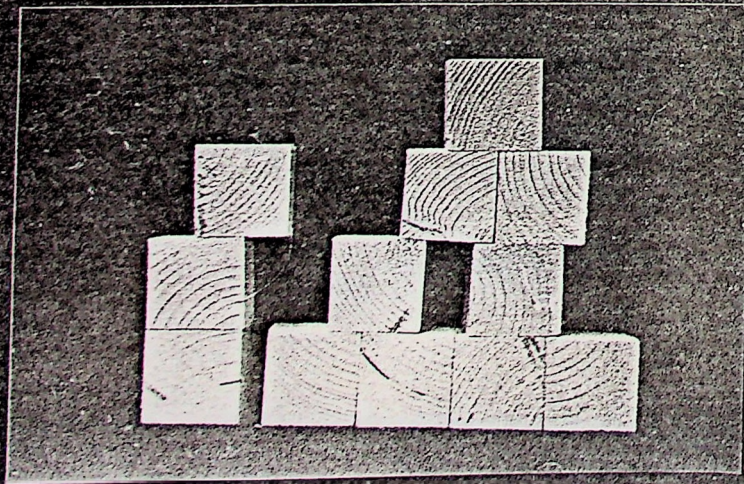
#### 4. Repetition Structure



#### 5. Inactive Structure

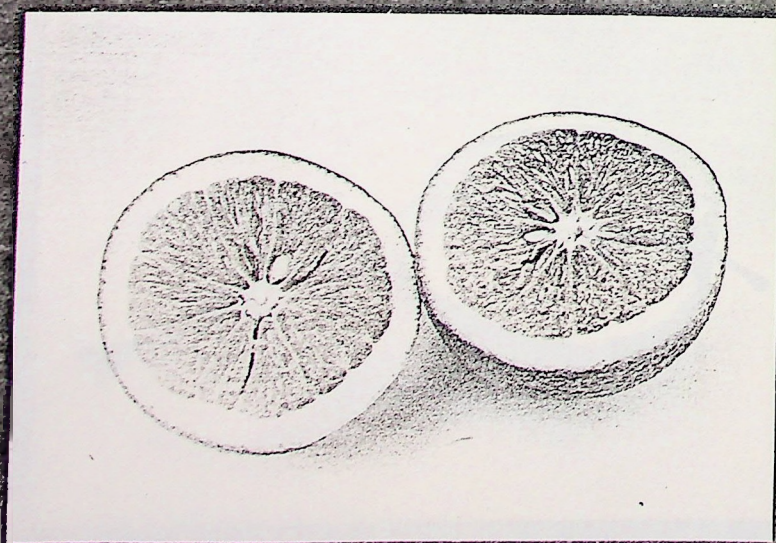
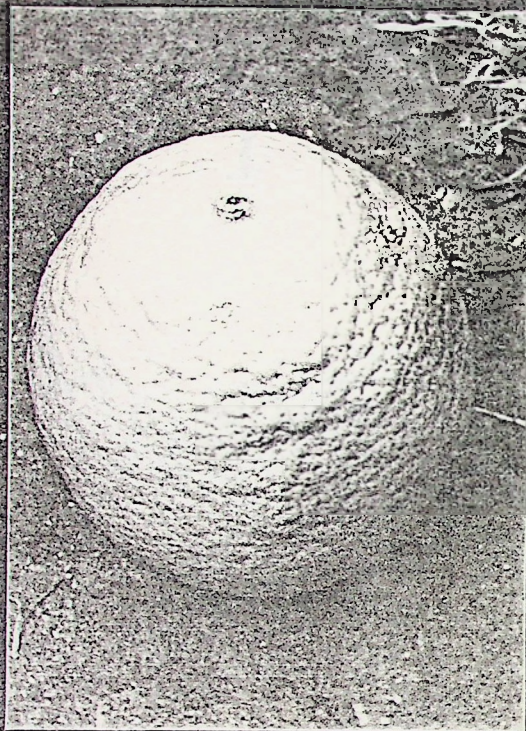


#### 6. Active Structure



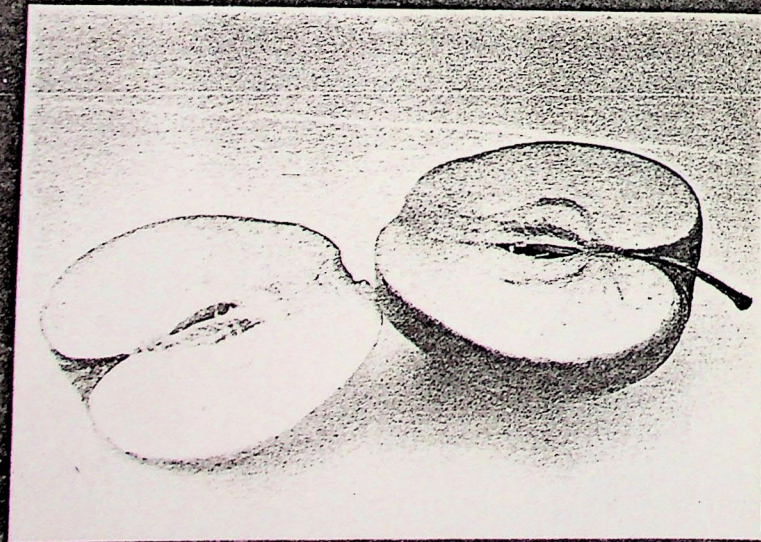
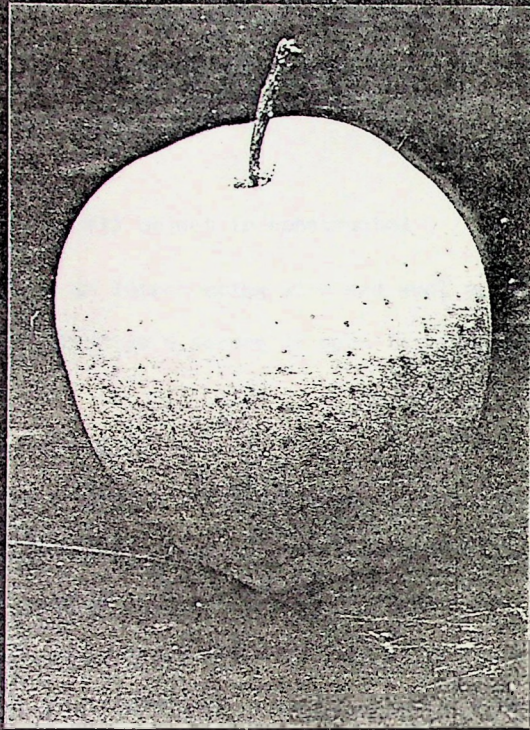


#### 4. Repetition Structure





5. Inactive Structure





Class: To construct a living quarters to accommodate 12 people  
Use the scale 1:200 and use wooden cubes and balsa wood  
to construct your area's

#### 7. Visible Structure

One you can see how the overall object is constructed

Class: To construct an insect using wire and wool or different  
threads to frighten a person if seen in reality.

#### 8. Invisible Structure

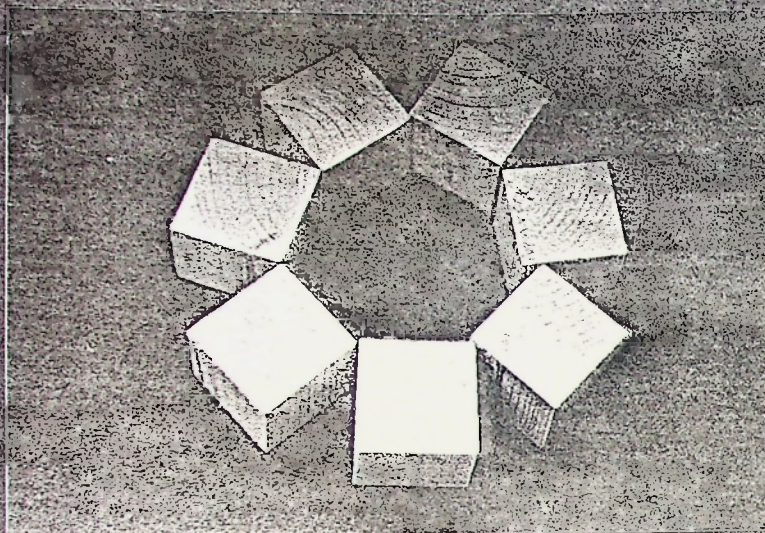
The core of the object may not be seen

Class: To make an invisible structure using wooden cubes to stand  
not less than 1 $\frac{1}{2}$ ft. high to hold a cement brick.

In the last four classes a purpose is asked for the structure as it would be wrong to presume that structures have no function. It is also used to make the class more difficult for the student as a progression is needed otherwise students would become bored with non-functional objects. It also helps the students think on a larger and on a more day to day basis.



7. Visible Structure

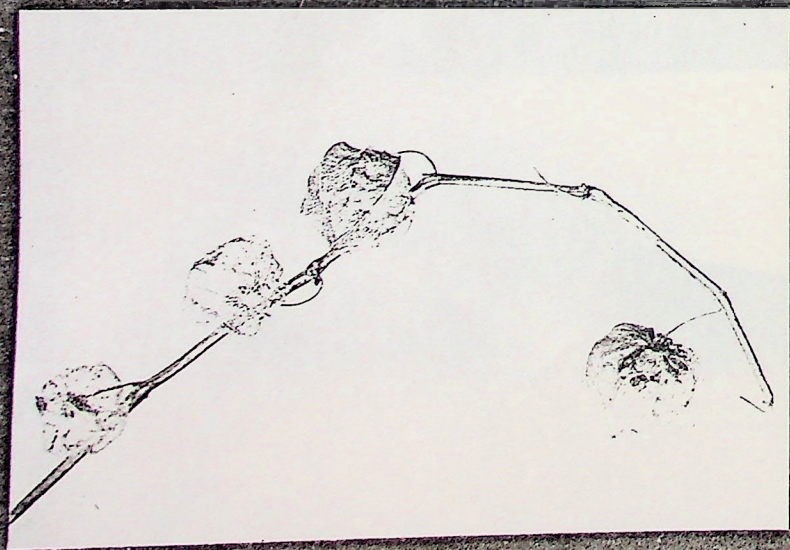


8. Invisible Structure



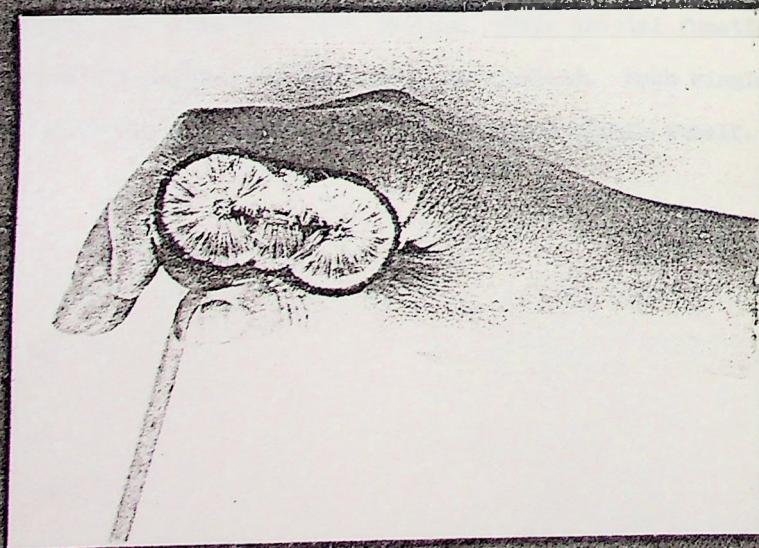


7. Visible Structure





8. Invisible Structure





I being interested in nature, became aware of structure how dominant it is to be seen in natural forms. After researching structure I became aware of many architects who got their new structural ideas from natural forms. I began to realise how close the link may become between a natural form and a form built by man. Natural forms found all around us, it is only natural that we should research their structure and base our designs on their natural structural qualities.

My idea being to create classes based on natural forms and see what ideas and structural forms may be obtained from these natural structures. These structures may be functional or non-functional.

All matter in nature - both living and non-living is composed of structural units, or "building blocks" which multiply and tend to form themselves into dynamically balanced and integrated systems. The cell is the building block of biological organisations, the crystal is the building block of inanimate matter. Cells grow from within, sub-dividing to multiply. Crystals grow from without assimilating materials from the outside. In the process of each growth each cell shapes itself and takes its right place within the whole. Though differentiated, the component parts perform, their special functions in co-operation with one another so that unity is attained. Each single form is a part of a larger pattern, and contains smaller patterns within itself.



### Formal Structure Shell

The natural form of the shell being formal as it is always organised. Looking at many different shells one finds that the shapes made within the shell are regular. There is a rhythm and unity to the form spoken off.

Class: Make drawings of a shell cut in half and use clay to explode part of the shell, build in 3D. Observe where the light is more dominant and give reasons why you think this is so.

### Semi Formal Structure (Cells with a leaf)

The natural form found within a leaf are quite organised but irregular distances do exist.

Class: Take rubbings from different types of leaves and use one colour to compose an informal pattern.

### Informal Structure (Trees)

The structure of many different trees are different and branches grow in an informal manner and grow freely.

Class: Take part of a tree draw what you find most interesting on that particular part. Make a distortion from the drawn made, this will make the shape appear to have been pushed pulled, stretched, compressed, twisted, warped or bent by some mechanical force that has caused it to change relations within its own dimensions. We see the distorted shape as a divergence from the norm.

### Repetition Structure (Orange)

The orange is an object with repetition structure within, segments are put together in regular sequence and pattern so they all relate to one another in the same manner.



Class: Collect a number of objects which have a repetitional structure within and change the repetitional order use only two colours to change the appearance.

#### Inactive Structure (An Apple)

The shapes found within an apple are static and the direction does not change.

Class: Draw the object full, halved, quartered, and make a very static pattern from the shapes found in the apple drawn<sup>1</sup>).

#### Active Structure (Cells)

Cells structure are not static and the directions in which they grow are changeable. Movement a dominant element when we consider cells. Movements are made when the cells are being divided, this process may be long, short, wide, narrow, growing, diminishing, swinging, restricted. The shape of the movement may be straight, curved direct, meandering, zigzagging, spiraling, rolling, interweaving. The direction of movement may be right left, forward backward, up, down, standing, towards away from or around the centre, along an axle or any combination of these. The number of movements may be one, a few, many, one combined with many. The intervals of space between movements may be large, small, numerous, few. The density of movement may be close sparse, changing.

Class: Construct the movements of cells using card cut in strips and one colour to explain the growth of a cell.

#### Visible Structure

The dried plant may be seen - through as a result the structure is very visible. It is quite obvious how the plant is constructed.

Class: In this class I wish to discuss balance.

Balance may occur between many different systems or patterns of order. There may be a single focal centre of strength accompanied by progressively less focal centres. There may be extreme contrast between very strong focal centres and minor weak centres. Focal may be distributed between a few very strong



focal centres or a number of weak ones.

Design a 3D object in card to explain the purpose of balance. The object must be less than 2 ft in height and need not serve a purpose if scaled up.

Invisible Structure (Bog rush)

This structure is combined so tightly that the core is invisible.

Class: To make a structure using air board (packed) and air board (un-packed) to explain that there is something of vital importance going on inside the structure you make.



### Chapter III

Classes using both man made shapes and natural shapes are very visible. Students would be able to make up simple kits of man made shapes, likewise students can find first class information of any natural forms as they are found so frequently in our lives.

Each student would be able to provide himself with such a Kit and when the different types of structure were been explained. Work sheets could be given out to explore the type of structure in question. Suggestion may be made as to what would happen if we were to take away one Brick. What kind of structure would we have. Likewise if we were to change only the direction of a brick.

Talking about any natural structure examples may be seen in our surroundings and students may be given the opportunity to go out and study the local environment as a wealthy store of information is only there to be exploited. In talking about any of these forms or natural forms class may be given on colour, texture, and any of the other art elements one wishes to mention. These elements may be combined with all the different types of structures mentioned before in this paper.

Other different elements I wish to discuss in general relate to structure

- (1) Rhythn
- (2) Tension
- (3) Balance
- (4) Proportion
- (5) Texture
- (6) Movement
- (7) Materials



### Rhythm:

Rhythm effects a linking - together of things in common. Where we see things in common forms, movements, colours, our sense of order increases, thus rhythmic recurrence helps to unify an organisation.

Rhythmic movement occurs when similar elements are repeated at regular or recognisably related intervals. Simple rhythms can be produced by any repeated similarity of shape, position, density, colour, movement or other visual factors.

Both similarities and differences - uniformity and variation, sameness and uniqueness - are necessary of the sense of unity.

Within each structure whatever the subject talked about is a structural feature, it dominates and determines the particular character of the whole.

The simplicity and complexity of an organisation are dependent not on the number of elements or changes but on the number of changes of structural features.

### Tension:

Tension is the sensation of tentative equipoise between attracting forces that are being pulled in opposing directions. It occurs between any visual forces that are opposed in such a way that we feel a strain or deviation from a stronger state, which, at the same time, tends to hold the forces to the norm. We feel a heightened excitement in the areas of stress or tension between opposing forces and for this reason they are areas of strong attraction. A design can be made more dynamic by the use of tension.

### Balance:

From the moment a second force is introduced into a space, what happens between the forces - how they interact with one another or balance - becomes an important consideration.

As new forces are added, the elements to be balanced are compounded. In visual structures of great complexity the weighing of factors that are involved becomes



largely dependent on intuition and sensitivity.

The intention or purpose of the artist determines the state of balance that is considered final.

We have a sense of unbalance in a design when it seems necessary to shift or change certain parts in some way - for example, to change the size, position or shape of a part, or to add a different force that will cause a shift of weight, intensity, or direction.

Balance is affected by the direction of movement. For example a form moving in one direction may be balanced by a form moving in the opposite direction. Balance is also affected by the strength ( weight, velocity or intensity of a form).

Balance may occur between many different systems or pattern of order. There may be a single focal centre of strength that is centered and balanced within the whole, or a primary focal centre of strength accompanied by progressively less forceful centres. There may be extreme contrast between very strong focal centres and minor weak centres. The centres may be evenly or unevenly dispersed, and distributed over a part of the surface or over all of the surface. Certain spatial positions have a special influence on balance. The vertical is stronger than the horizontal. The left is stronger than the right, we tend to look at the left side of a plane just assuming that it has greater importance.

#### Proportion:

Proportion involves a comparative relation between parts and the whole. Proportion may be arrived at intuitively or by means of a mathematical ratio, progression or other calculation.

Although mathematics and nature hold infinite possibilities for us, the artist usually has to depend on his intuitive sense of proportion - his feelings for the "rightness" of the relations that are involved.

Aproportion seems right when we feel neither too much nor too little of any element or characteristic. The right proportion changes with the situation, for proportion is dynamic not static. Differences are required to produce



different emotional qualities and right proportion depends upon our intention  
Speaking about proportion it is useful to consider such question as the following:

How much mass to how much space?

How much dark to how much light?

How much roughness of texture to how much smoothness?

How much advancing to how much reading?

How much tension to how much repose?

How much, complexity to how much simplicity?

### Texture:

The texture of a substance can only be determined by touch. Visual perception of surface qualities leaves a certain degree of doubt. In the classroom students can experience something of the richness and variety of textures by comparing different object i.e. like comparing the texture of the grain in the wood and the texture of the veins found in leaves.

There are many different surface qualities in the environment. Students will have a store of experiences which can be supplemented and used in the classroom. Record of surfaces of some items can be obtained by taking rubbings. Students can create their own surfaces from which to take rubbings. Different materials may be collected and students will gain a knowledge of materials they wish to work with. Printing may also be involved when speaking about textures and it is a process which is very flexible.

Apply a texture to a surface or a structure is definitely food for thought as the structure may or may not need the texture applied at all.

### Movement:

Movement involves time. A greater sense of movement is achieved as soon as a mark is made away from the horizontal or vertical position. The diagonal shape or line is the black sheep of the family. A diagonal or sloping line suggests



10

movement also curves and sinuous lines too. Likewise when talking about a structure we find likes or shapes that suggest movement. Students may record these movements, "action painting" "Relief panels" etc.

After speaking about the kinds of structures mentioned it is only how I; realise how much these structures connect. How it becomes quiet difficult to speak about one structure at a time so thinking about the different structures it becomes quiet difficult to speak about one structure at a time. There is a bigger connection than I realised when I just started this paper. Therefore structures may be talked about in connection with each other. One particular structure may be talked about in connection with another particular one and different classes may be given on this basis.



## B I B L I O G R A P H Y

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Space Time and Architecture - S. Giedion

Design for the Real World - Victor Papanek

Thames and Hudson Ltd 1972

About Design - Ken Baynes

An Outline of World Architecture - Michael Raeburn

Shelter, Sign and Symbol - Paul Oliver

Architecture in Wood - Hans Jurgen Hansen

Illusion in nature and art - Edited by Gregory and Gombrick

Teaching Art Basics - Roy Sparkes

The instrument of Thought -

Diagram -