may have to view it from different angles and distances, and piece the information together in our minds for a complete grasp of its three-dimensional reality. It is through the human mind that the three-dimensional world gains its significance.

**Two-dimensional Design**

Two-dimensional design refers to the creation of a two-dimensional world with conscious efforts of organization of the various elements. Casual marking such as doodling on a flat surface may have chaotic results. This may be far from two-dimensional design, the main objective of which is to establish visual harmony and order, or to generate purposeful visual excitement.

Two-dimensional design is not within the scope of the present book, but some of its principles will be mentioned when relevant to our discussion.

**Three-dimensional Design**

Similar to two-dimensional design, three-dimensional design also aims at establishing visual harmony and order, or generating purposeful visual excitement, except that it is concerned with the three-dimensional world. It is more complicated than two-dimensional design because various views must be considered simultaneously from different angles, and much of the complex spatial relationships cannot be easily visualized on paper. Yet it is less complicated than two-dimensional design because it deals with tangible forms and materials in actual space, so that all the problems involving illusory representation of three-dimensional forms on paper (or any kind of flat surface) can be avoided.

Some people are inclined to think sculpturally but many others tend to think pictorially. These people may have some difficulties in three-dimensional design. Often they are so involved with the frontal view of a design they neglect other views. They may find internal structures of three-dimensional forms beyond comprehension, or be easily attracted by surface color and texture when volume and space are more important.

Between two-dimensional thinking and three-dimensional thinking, there is a difference in attitude. A three-dimensional designer should be capable

**CHAPTER 1: INTRODUCTION**

**The Two-dimensional World**

What is a two-dimensional world? The two dimensions are length and breadth. They co-establish a planar surface, on which flat visible marks can be displayed, that has no depth except for an illusory kind. The marks have no thickness and can be either abstract or representational. The surface and the marks taken together reveal a two-dimensional world which differs completely from the world of our day-to-day experience.

The two-dimensional world is essentially a human creation. Drawing, painting, printing, dyeing, or even writing are activities which directly lead to the formation of the two-dimensional world.

Sometimes we may see three-dimensional things two-dimensionally, such as a view we enjoy just because of its sheer pictorial beauty. Today, with the progress of technology, a camera readily transforms everything in front of its lens into a flat picture, and television instantly transmits moving images to a defined surface. Textural marks on smooth natural materials such as stone, wood, etc., also suggest two-dimensional imagery. It is, however, through the human eye that the two-dimensional world gains its significance.

**The Three-dimensional World**

We live, in fact, in the three-dimensional world. What we see in front of us is not a flat picture with length and breadth only, but an expanse with physical depth, the third dimension. The ground underneath our feet stretches all the way to the distant horizon. We can look straight ahead, look back, look to the left, look to the right, look up, and look down. What we see is a continuum of space in which we are enveloped. There are many objects nearby which we can touch, and objects farther away which are also tangible if we try to reach for them.

Any object that is small, lightweight, and close to us can be picked up and turned around in our hands. Each movement of the object displays a different shape because the relationship between the object and our eyes has changed. If we walk straight ahead into a scene (this is not possible in the two-dimensional world), not only will the objects in the distance gradually become bigger, but their shapes will also change, for we will see more of certain surfaces and less of others.

Our understanding of a three-dimensional object can never be complete at a glance. A view from one fixed angle and distance may be deceptive. A circular shape first seen from some distance away may on closer examination turn out to be a sphere, a cone, a cylinder, or any shape which has a round base. To understand a three-dimensional object, we
The Three Basic Views

Any three-dimensional form can be placed inside an imaginary cube with which three basic views can be established. (Fig. 4)

By projecting the form onto the top, front, and side planes of an imaginary cube, we can have:

(a) a plane view — view of the form as seen from the top; (Fig. 5)
(b) a front view — view of the form as seen from the front; (Fig. 6)
(c) a side view — view of the form as seen from the side. (Fig. 7)

Each view is a flat diagram, and these views together (occasionally supplemented by auxiliary and/or sectional views) provide the most accurate description of a three-dimensional form, although one needs to have some background knowledge of engineering drawing to be able to reconstruct the original form from these views.

The Three Primary Directions

To start thinking three-dimensionally we must, first of all, know about the three primary directions. As mentioned earlier, the three dimensions are length, breadth, and depth. In order to obtain the three dimensions of any object, we must take measurements in the vertical, horizontal, and transverse directions.

Thus the three primary directions consist of a vertical direction which goes up and down, a horizontal direction which goes left and right, and a transverse direction which goes forwards and backwards. (Fig. 1)

For each direction we can institute a flat plane. In this way we can have a vertical plane, a horizontal plane, and a transverse plane. (Fig. 2)

Doubling such planes, the vertical plane now becomes the front and rear planes, the horizontal plane the top and bottom planes, and the transverse plane the left and right planes. With these, a cube can be constructed. (Fig. 3)
fines the border of a plane, and marks the place where two planes join or intersect each other. (Fig. 9)

(c) plane—the path of a line in motion (in a direction other than its own intrinsic direction) becomes a plane. A conceptual plane has length and breadth but no depth. It is bound by lines. It defines the external limits of a volume. (Fig. 10)

(d) volume—the path of a plane in motion (in a direction other than its own intrinsic direction) becomes a volume. A conceptual volume has length, breadth, and depth, but no weight. It defines the amount of space contained or displaced by the volume. (Fig. 11)

It is important to note that many of our three-dimensional ideas are first visualized on a flat piece of paper. We usually use a fine line to indicate the border of a plane or volume. This line is visual as it appears on the two-dimensional surface, but is conceptual when its only use is as a means of representing a three-dimensional form.

Visual Elements

Three-dimensional forms are seen differently from different angles and distances and under different lighting conditions. Therefore, we must consider the following visual elements to be independent of such variable situations:

(a) shape—shape is the outward appearance of a design

Elements of Three-dimensional Design

In two-dimensional design, there are three sets of elements:

(a) the conceptual elements—point, line, plane, and volume;
(b) the visual elements—shape, size, color, and texture;
(c) the relational elements—position, direction, space, and gravity.

Conceptual elements do not exist physically, but are perceived as being present. Visual elements, of course, can be seen, and constitute the final appearance of a design. Relational elements govern the overall structure and internal correspondences of the visual elements.

All these elements are as essential for three-dimensional design, although we will define them in a slightly different way, and add a set of constructional elements for practical reasons. The constructional elements are, in fact, concrete realizations of the conceptual elements and will be indispensable in our future discussions.

Conceptual Elements

A three-dimensional design can be conceived in the mind before it takes on physical shape. The design is thus defined by the following conceptual elements:

(a) point—a conceptual point indicates position in space. It has no length, breadth, or depth. It marks the two ends of a line, the single place where lines intersect, and the meeting of lines at a corner of a plane or the angle of a solid form. (Fig. 8)
(b) line—as a point moves, its path becomes a line. A conceptual line has length but no breadth or depth. It has position and direction. It de-
Relational Elements

Relational elements are more complicated in three-dimensional design than in two-dimensional design. Whereas in two-dimensional design a frame of reference is used, in three-dimensional design we can use an imaginary cube to establish the relationships.

(a) position—position must be ascertained by more than one of the three basic views. We have to know how a point is related to the front/rear, top/bottom, and side planes of the imaginary cube. (Fig. 16)

(b) direction—direction, too, should be seen from more than one view. A line could be parallel to the front/rear planes but oblique to all other planes of the imaginary cube. (Fig. 17)

(c) space—space here is, of course, actual and not illusory. It can be seen as positively occupied, unoccupied, or internally hollowed. (Fig. 18)

(d) gravity—gravity is real and has a constant effect on the stability of the design. We cannot have forms in mid-air without supporting, hanging, or anchoring them in some way. Some materials are heavy and some are light. The material used determines the weight of the form as well as its capacity to bear gravitational loads of other forms on top of it. All three-dimensional structures are subject to the laws of gravity and this means certain arrangements and positioning are just not possible. (Fig. 19)

and the main identification of its type. A three-dimensional form can be rendered on a flat surface by multiple two-dimensional shapes, and we must be aware of this to be able to visually relate all such different aspects to the same form. (Fig. 12)

(b) size—size is not just greatness or smallness, length or brevity, which can only be established by way of comparison. Size is also concrete measurement, and can be measured on any three-dimensional form in terms of length, breadth, and depth (or height, width, and thickness) from which its volume can be calculated. (Fig. 13)

(c) color—color, or light and dark value, is what most clearly distinguishes a form from its environment, and it can be natural or artificial. When it is natural, the original color of the material is presented. When it is artificial, the original color of the material is covered up by a coat of paint, or transformed by treating with some other method. (Fig. 14)

(d) texture—texture refers to the surface characteristics of the material used in the design. It may be naturally unadorned or specially treated. It may be smooth, rough, matt, or glossy as determined by the designer. It may be small-scale texture that accents two-dimensional surface decoration or bold texture that accentuates three-dimensional tactility. (Fig. 15)
Form and Structure

Form is a term easily confused with shape. Earlier it was pointed out that a three-dimensional form can have multiple two-dimensional shapes when rendered on a flat surface (see Fig. 12). This means that shape is really only one aspect of form. When a form is rotated in space, each step of rotation reveals a slightly different shape, because a different aspect is seen by our eyes.

Form, then, is the total visual appearance of a design, although shape is its main identifying factor. We also identify form by size, color, and texture. In other words, all the visual elements are referred to collectively as form.

Structure governs the way a form is built, or the way a number of forms are put together. It is overall spatial organization, the skeleton beneath the fabric of shape, color, 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.

Unit Forms

Smaller forms which are repeated, with or without variations, to produce a larger form are referred to as unit forms. Sometimes these repeated units are called modules. A unit form may be made of even smaller components, which can be called sub-unit forms.

A larger unit may be made of two or more unit forms in a constant relationship that appears frequently in a design. They are called super-unit forms.

Repetition and Gradation

Unit forms can be used in exact repetition or in gradation. Gradation means that the unit forms are identical in shape, size, color, and texture. Shape is the most important visual element of unit forms, so that we can have unit forms repeated in shape but not in size. Color and texture can vary if desired, but they are not within the scope of this book.

Gradation means transformation or change in a gradual, orderly manner. Here the sequential arrangement is very important, otherwise the order of gradation cannot be recognized. We can have gradation in shape, with the shape changing slightly from one unit to the next, or gradation in size, with the units repeated or graduated in shape.

Construtional Elements

Construtional elements have strong structural qualities and are particularly important for the understanding of geometric solids. These elements are used to indicate the geometric components of three-dimensional design:

(a) vertex—when several planes come to one conceptual point, we have a vertex. Vertices can be projected outward or inward. (Fig. 20)
(b) edge—when two nonparallel planes are joined together along one conceptual line, an edge is produced. Again edges may be projected outward or inward. (Fig. 21)
(c) face—a conceptual plane which is physically present becomes a surface. Faces are external surfaces which enclose a volume. (Fig. 22)

Ideally all vertices should be sharp and pointed, all edges should be sharp and straight, and all faces should be smooth and flat. In reality this depends on the materials and techniques, and certain minor irregularities are normally unavoidable.

Construtional elements can help to precisely define volumetric forms. For example, a cube has eight vertices, twelve edges, and six faces.
Dissection of a Cube

To illustrate a bit further, we can dissect a cube into a number of thin planes of the same thickness.

The simplest way is to dissect along the length, breadth, or depth, in parallel layers. As a result, a number of serial planes are obtained which are repeats in both shape and size (Fig. 30).

The same cube can also be dissected diagonally. There are many ways to do this. Our diagram here shows a kind of diagonal dissection resulting in serial planes with gradation of shape. Size is gradational too. The height remains constant, but the breadth increases or decreases gradually. (Fig. 31)

It should be pointed out that in dissection along the length, breadth, or depth, all serial planes have squared edges. (Fig. 32)

In diagonal dissection, all serial planes have bevelled edges. (Fig. 33)

The edges may not be of much significance if the planes are extremely thin, but if they are thick, influences of the edges on the design should not be overlooked.

In arranging serial planes, the relational elements should be taken into consideration. The two main relational elements which must not be neglected are position and direction.

CHAPTER 2: SERIAL PLANES

Points determine a line. Lines determine a plane. Planes determine a volume.

A line can be represented by a series of points. (Fig. 23)

A plane can be represented by a series of lines. (Fig. 24)

A volume can be represented by a series of planes. (Fig. 25)

When a volume is represented by a series of planes, each plane is a cross-section of the volume.

Serial Planes

Thus, to construct a volumetric form, we can think in terms of its cross-sections, or how the form can be sliced up at regular intervals, which will result in serial planes.

Each serial plane can be considered as a unit form which may be used either in repetition or in gradation.

As mentioned, repetition refers to repeating both shape and size of the unit forms. (Fig. 26)

Gradation refers to gradual variation of the unit form, and it can be used in three different ways:

(a) gradation of size but repetition of shape; (Fig. 27)

(b) gradation of shape but repetition of size; (Fig. 28)

(c) gradation of both shape and size. (Fig. 29)
Directional Variations

Direction of the planes can be varied in three different ways:

(a) rotation on a vertical axis; (Fig. 39)
(b) rotation on a horizontal axis; (Fig. 40)
(c) rotation on its own plane. (Fig. 41)

Rotation on a vertical axis requires a diversion of the planes from parallel arrangement. Position is definitely affected, because every directional change simultaneously demands positional change.

The planes in this case can be arranged in radiation, forming a circular shape. (Fig. 42)

Or they can form a shape with curves left and right. (Fig. 43)

Rotation on a horizontal axis cannot be done if the planes are fixed on a horizontal baseboard. If they are fixed on a vertical baseboard, their rotation on a horizontal axis would be essentially the same as the rotation on a vertical axis described above.

Rotation on its own plane means that the corners or edges of each plane are moved from one position to another without affecting the basic direction of the plane itself. This results in a spirally twisted shape. (Fig. 44)

The planes can be physically curled or bent if desired. (Fig. 45)

Positional Variations

Position has to do with, first of all, spacing of the planes. If no directional variations are introduced, all the serial planes will be parallel to one another, each following the next successively, with equal spacing between them.

Let us assume that all the planes are squares of the same size. If one plane follows another in a straight manner, then the two vertical edges of the planes trace two parallel straight lines, with a width the same as the breadth of the planes. (Fig. 34)

Spacing between the planes can be made narrow or wide, with different effects. Narrow spacing gives the form a greater feeling of solidity, whereas wide spacing weakens the suggestion of volume. (Fig. 35)

Without changing the spacing between the planes, the position of each plane can be shifted gradually towards one side or back and forth. This causes the volumetric shape to undergo various distortions. (Fig. 36)

Again without changing the spacing between the planes, the position of each plane can be shifted gradually upwards or downwards. This can be easily done if the planes are hung or supported in midair. (Fig. 37)

If the planes are placed on a baseboard, we can reduce the height of the planes to suggest the effect of their gradual sinking in just by positional variation in a vertical manner. (Fig. 38)
Figures 51 to 66 all illustrate the same design problem in projects by different students.

**Figure 51**—this is constructed of horizontal serial planes which are repeated both in shape and size. The planes are all parallel to one another with equal spacing in between, and they are anchored to two vertical planes.

**Figure 52**—here a number of repetitive vertical planes are placed around a common vertical axis. The result is a cylindrical shape.

**Figure 53**—the arrangement is similar to Figure 52. Here the serial planes increase gradually in height from the foreground to the background. The volumetric feeling of the form is not very strong because the spacing between planes is rather wide along the circumference of the shape.

**Construction Techniques**

Any kind of sheet material can be used for making serial planes. Acrylic sheets are excellent when a transparent effect is desired. Plywood boards can be used for construction in a very large scale. Most of the models shown in this chapter have been made of thick cardboard, which can be handled easily. The thickness of the cardboard ensures firm adhesion to the baseboard if there is one.

For cardboard construction, adhesives that give a quick, strong bond are the best. The serial planes should stand in a vertical position on the horizontal baseboard for maximum fineness and stability. Tilted planes are possible only when the materials and the bond are both extremely strong, and the joining edge of each plane is precisely bevelled. (Fig. 46)

For reinforcement purposes, additional plane(s) can be used next to the top or side edges of the planes. This is recommended only when those edges of the planes play a rather insignificant role in the final shape of the design. (Fig. 47)

Horizontally arranged serial planes demand a very strong bond if only one vertical board is used for attachment. (Fig. 48)

Normally two or more vertical boards should be used for horizontal serial planes. (Fig. 49)

A vertical supporting core can be used for horizontal serial planes of a free-standing shape if desired. (Fig. 50)
Figure 54—At a glance, it seems that all the serial planes are identical both in shape and size. A closer study reveals that they have a subtle gradation of shape. While the upper part of the structure is straight all across, the lower part subtly bends inward in a V-shape.

Figure 55—with a straight plane standing in the middle of the structure, all other planes are bent in increasingly sharper angles. The volumetric form suggested here is an emerging spherical shape.

Figure 56—This shows the effective use of gradation of shape. Each plane is obtained by the combination of a positive rectangular shape and a negative circular shape. The former has a constant width but the latter grows bigger and bigger and moves gradually downward and forward. The straight edges of the rectangular shape remain straight at the front but those at the rear change gradually into sweeping curves to echo the negative circular shapes.
Figure 60—gradation of shape is used here in a rather complicated way. The form rises from the baseboard in high relief, but it splits up in the center to reveal another form within the deep concavity.

Figure 61—this is a free-standing form with a projecting semi-sphere in the front and another in the back. Both semi-spheres have a concave portion, inside of which a smaller semi-sphere is nested. The effect is similar to Figure 60.

Figure 62—the play of concavity and convexity here is the same as in Figure 60.

Figure 63—here the semi-spherical shape has been cut into two parts, and the shape of each part is further modified. A prominent negative shape now becomes the focal point of the design.

Figure 57—this is a triangular structure which is the result of gradation of both shape and size of the serial planes. The short, wide V-shaped planes at the two sides become tall and narrow towards the middle by gradation of size and shape.

Figure 58—circular planes of exactly the same size and shape have been used in this structure. The sinking-in effect of the planes on the backboard is due to positional variation. The two loops which make the general shape very much like the numeral 8 are the result of directional variation.

Figure 59—the use of gradation of shape is quite obvious here, and gives the feeling of planes emerging from or sinking into the baseboard.
Figure 64—in this form, gradation of shape is used in combination with directional variation. Note the introduction of a negative shape which runs like a tunnel at the lower part of the design.

Figure 65—all the planes in this structure are repetitive in shape and size, but are arranged in a slightly zigzag manner by positional variation. This zigzag arrangement echoes the shapes of the planes themselves. The result is an interesting shape with faceted faces and identical front, rear, left, and right views.

Figure 66—this not only has identical views from four sides, but from top and bottom also. Each of the six views displays the letter X in the same shape and size. To construct this, negative shapes are introduced into square serial planes which are all repetitive in size. Some are repetitive in shape and some are graduated in shape.
Spatial Cells and Unit Forms

To explore the various possibilities of making wall structures, we can first bend a strip of thin cardboard or glue four pieces of thick cardboard together to form a cube without the front and rear planes. (Fig. 71)

This is our simplest spatial cell. We can see through it and place a unit form inside. The unit form can be as simple as a flat plane used repetitively or with slight variations. (Fig. 72)

As a planar shape, the unit form can be positive or negative. (Fig. 73)

It can be a combination of two positive shapes or one positive and one negative. (Fig. 74)

Unit forms can be used in gradation of shape if desired. (Fig. 75)

Gradation of size can be effected by:
(a) enlarging or reducing proportionately; (Fig. 76)
(b) charging of width only; (Fig. 77)
(c) charging of height only; (Fig. 78)

If the unit form is a combination of two smaller shapes, size of one can be kept constant while size of the other varies. (Fig. 79)

Or both shapes can vary in different ways. (Fig. 80)

CHAPTER 3: WALL STRUCTURES

Cube, Column, and Wall

Starting with a cube, we can place a second cube above and a third cube below it. (Fig. 87)

Now we have a column of three cubes that can be extended in either direction to include any desired number of cubes. (Fig. 88)

The column can also be repeated left and right. When a number of columns are erected, one adjacent to another, we have a wall. (Fig. 89)

The wall structure is basically two-dimensional. The cube has been repeated in two directions, first in the vertical direction and then in the horizontal direction.

Each cube is a spatial cell in the wall structure. These spatial cells are arranged two-dimensionally on a frontal plane. (Fig. 90)

All formal two-dimensional structures can become wall structures with the addition of some depth, and their structural sub-divisions can be made into spatial cells. (Fig. 91)
Directional Variations of Unit Forms

Inside each spatial cell, the unit form can be rotated in any direction desired. During each stage of rotation, it will be seen differently from the front.

Let us observe the effects of rotating a square shape. In Figures 85 to 88, the first vertical column represents the front views, the second vertical column the side views, and the third vertical column the plane views.

Rotation on the shape’s own plane does not change the shape at all in the front view. The side view of the shape is always a line. The plane view of the shape is also always a line. (Fig. 85)

Rotation along a vertical axis makes the square shape, in the front view, which becomes a narrower and narrower oblong that decreases finally to a line. In the side view it is first a line which gradually becomes a square. In the plane view, the shape remains a line of constant length that varies in direction. (Fig. 86)

Rotation along a horizontal axis is very similar to rotation along a vertical axis. The shape remains a line of constant length, not in the plane view, but in the side view. (Fig. 87)

Rotation along a diagonal axis leads to more complicated results. In the front view, the square is transformed into a diagonal line after a series of graduated parallelograms. Different shapes of parallelograms are also seen in the side and plane views. (Fig. 88)

Positional Variations of Unit Forms

Variations of positioning of the unit forms can be accomplished by:

(a) moving the shape forward or backward; (Fig. 81)
(b) moving the shape up or down; (Fig. 82)
(c) moving the shape left or right; (Fig. 83)
(d) reducing the height or width of the shape to suggest the feeling of its sinking into one of the encasing planes. (Fig. 84)
Modifications of Spatial Cells

Greater three-dimensional quality can be achieved by the modification of spatial cells.

Enclosing planes of the spatial cells can be trimmed so that some of the front edges are not perpendicular to the base or side planes (Fig. 96).

The straight edges of the spatial cells can be changed to curvilinear edges. (Fig. 97)

The enclosing planes of the spatial cells can be constructed so they are not at right angles to one another. (Fig. 98)

The spatial cells can be so designed that they are part of the unit form structure. (Fig. 99)

The spatial cells can become the unit forms, or we can have unit forms to erect a wall structure without the use of spatial cells. (Fig. 100)

Unit Forms as Distorted Planes

If greater three-dimensional effects are desirable, unit forms can depart from the characteristics of a flat plane. Two or more flat planes can be used for the construction of one unit form, or a simple flat plane can be treated in the following ways to become a unit form:

(a) by curling; (Fig. 89)
(b) by bending along one or more straight lines; (Fig. 90)
(c) by bending along one or more curved lines; (Fig. 91)
(d) by cutting and curling; (Fig. 92)
(e) by cutting and bending. (Fig. 93)

Wall Structures Not Remaining Flat

When one spatial cell is placed on another, the flat frontality of the wall structure can be made slightly more three-dimensional by positional variation. (Fig. 84)

A similar effect can be obtained by varying the depths of the spatial cells. (Fig. 95)

Directional variation in the arrangement of the spatial cells is possible but must be done with care, as too much rotation may make the side planes of the spatial cells too prominent.
Figure 103—spatial cells here are specially constructed in a way very much like Figure 99. Triangular negative shapes are made on the curled planes. The result gives a tactile feeling of texture after the spatial cells have been repeated many times.

Figure 104—interpenetrating spatial cells are here arranged with some positional variation. The interpenetrated areas have been distorted by cutting and bending, but no separate unit forms are introduced in the spatial cells.

Figures 101 to 113 are examples of student projects solving the design problem of creating wall structures.

Figure 101—spatial cells here are arranged with slight positional variation. The linear unit forms are, in fact, part of the enclosing planes of the spatial cells which have been treated in a way similar to Figure 93.

Figure 102—unit forms are cut-out shapes from the enclosing planes of the spatial cells. They are interlocked in an interesting way. Spatial cells are made of cardboard cubes with top and bottom planes missing, and therefore they become parallelograms in the plane view when the side edges are pulled by the interlocking unit forms.
**Figure 107**—unit forms are placed in each spatial cell with slight projection from the front plane of the wall structure.

**Figure 108**—spatial cell and unit form are one and the same in this design. Triangular planes instead of square planes have been used in the construction.

**Figure 105**—similar to Figure 101, unit forms here are strips cut and folded inward from the side planes of spatial cells. Some parts of the side planes have been removed. The whole design has a transparent effect with delicate linear elements.

**Figure 106**—spatial cells have been so greatly transformed that they become unit forms that are very linear in character. The depth of the design is shallow, but it contains a large number of tilted planes in various directions.
Figure 111—each spatial cell is triangular. The unit form inside it is a piece of curled plane joining two edges of the spatial cell.

Figure 112—a strip of thin cardboard is folded three times to form a spatial cell which is also the unit form. In folding, the beginning and the ending of the strip do not overlap, but instead the right edge of the beginning of the strip touches the left edge of the ending of the strip. This causes a slight twist of the planes in the resulting form.

Figure 113—the spatial cells are cubical and arranged one directly above or adjacent to the next. The unit forms are made of curled strips of thin cardboard.

Figure 109—again, the spatial cells also serve as the unit forms. The arrangement shows a gradation of cylindrical shapes. As contact between curved surfaces is rather restricted, the whole wall structure is quite flexible and can be curled at will.

Figure 110—the faceted surface of this structure has a relief effect. This is achieved by cutting, scoring and folding of flat continuous planes.