

CHAPTER 4: STRUCTURE

Most designs have a structure. Structure is to govern the positioning of forms in a design. Why is one group of unit forms displayed in a row and equidistant from one another? Why does another group of unit forms suggest a circular pattern? Structure is the underlying discipline for such arrangements.

Structure generally imposes order and pre-determines internal relationships of forms in a design. We may have created a design without consciously thinking of structure, but structure is always present when there is organization.

Structure can be formal, semi-formal, or informal. It can be active or inactive. It can also be visible or invisible.

Formal Structure

A formal structure consists of structural lines which are constructed in a rigid, mathematical manner. The structural lines are to guide the entire formation of the design. Space is divided into a number of subdivisions equally or rhythmically, and forms are organized with a strong sense of regularity.

The various types of formal structure are repetition, gradation, and radiation. Repetition structures will be discussed later in this chapter. The other two types of formal structure will be dealt with in Chapters 6 and 7.

Semi-formal Structure

A semi-formal structure is usually quite regular, but slight irregularity exists. It may or may not consist of structural lines to

determine the arrangement of unit forms. Semi-formal structures will be discussed in Chapters 5, 8, and 10.

Informal Structure

An informal structure does not normally have structural lines. Organization is generally free and indefinite. We will come to this type of structure when we discuss contrast in Chapter 9. It will also be touched upon in Chapter 10.

Inactive Structure

All types of structure can be active or inactive.

An inactive structure consists of structural lines which are purely conceptual. Such structural lines are constructed in a design to guide the placement of forms or unit forms, but they never interfere with their shapes nor divide the space up into distinct areas where color variations can be introduced. (Fig. 19a)

Active Structure

An active structure consists of structural lines which are also conceptual. However, the active structural lines can divide the space up into individual subdivisions which interact with unit forms they contain in various ways:

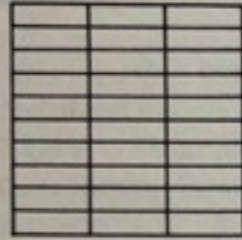
(a) The structural subdivisions provide complete spatial independence for the unit forms. Each unit form exists in isolation, as if it had its own small frame of reference. It can have a ground of different color from that of its neighboring unit forms. Alternate, systematic, or random play of positive and negative forms can be introduced effectively. (Fig. 19b)

(b) Within the structural subdivision, each unit form can move to assume various off-center positions. It can even slide partially beyond the area defined by the structural

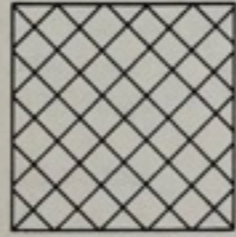


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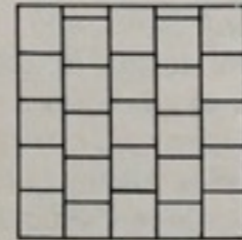
a



b



c



d



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subdivision. When this happens, the portion of the unit form that is outside the confines as clearly marked by the active structural lines may be cut off. Thus, the shape of the unit form is affected. (Fig. 19c)

(c) When the unit form intrudes into the dominion of an adjacent structural subdivision, this situation can be regarded as the encounter of two forms (the unit form and its adjacent structural subdivision), and interpenetration, union, subtraction, or intersection can take place as desired. (Fig. 19d)

(d) Space isolated by a unit form in a structural subdivision can be united with any unit form or structural subdivision nearby. (Fig. 19e)

Invisible Structure

In most cases, structures are invisible, whether formal, semi-formal, informal, active, or inactive. In invisible structures, structural lines are conceptual, even though they may slice a piece off from a unit form. Such lines are active but not visible lines of measurable thickness.

Visible Structure

Sometimes a designer may prefer a visible structure. This means that the structural lines exist as actual and visible lines of desired thickness. Such lines should be treated as a special kind of unit form because they possess all the visible elements and can interact with the unit forms and the space contained by each of the structural subdivisions. (Fig. 20a)

Visible structural lines can be positive or negative. When negative, they are united with negative space or negative unit forms, and they can cross over positive space or positive unit forms. Negative structural lines

are considered as visible because they have a definite thickness which can be seen and measured. (Fig. 20b)

Positive and negative visible structural lines can be used in combination in a design. For example, all horizontal structural lines can be positive, and all vertical structural lines negative. (Fig. 20c)

Visible and invisible structural lines can also be used together. This means we can have only the verticals or the horizontals visible. Or visible and invisible structural lines can be used alternately or systematically, so that the visible structural lines mark off divisions, each of which actually contains more than one regular structural subdivision. (Fig. 20d)

Repetition Structure

When unit forms are positioned regularly, with an equal amount of space surrounding each of them, they may be said to be in a "repetition structure."

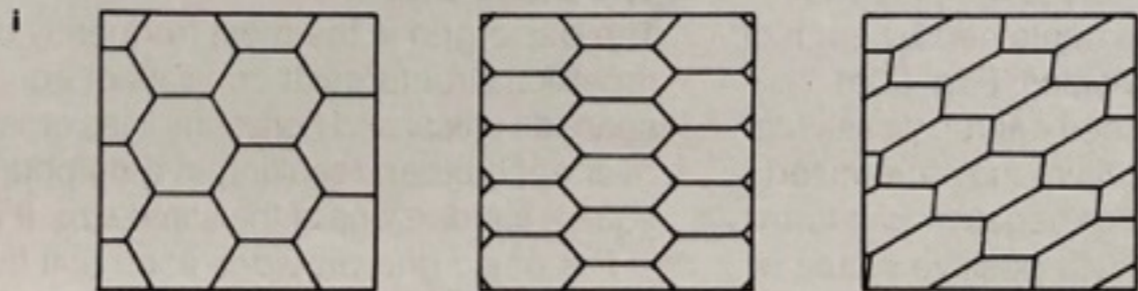
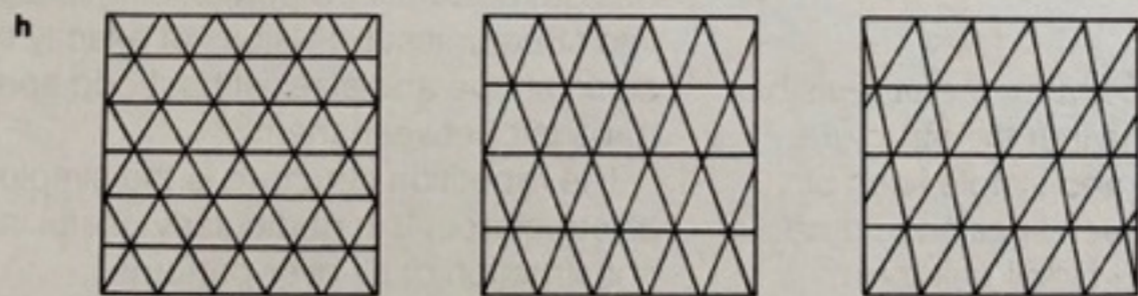
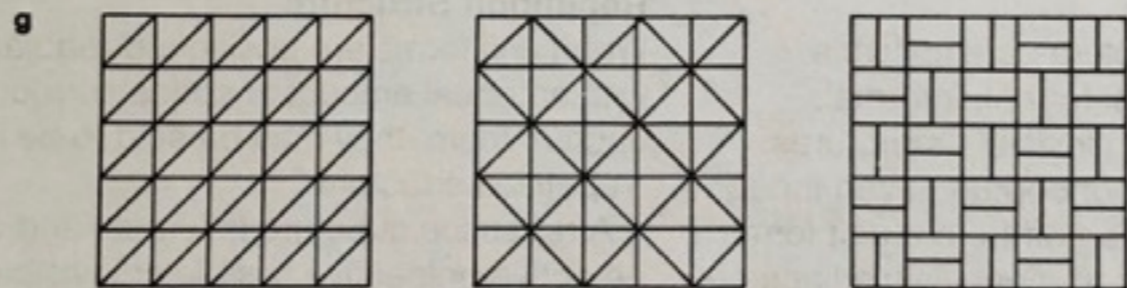
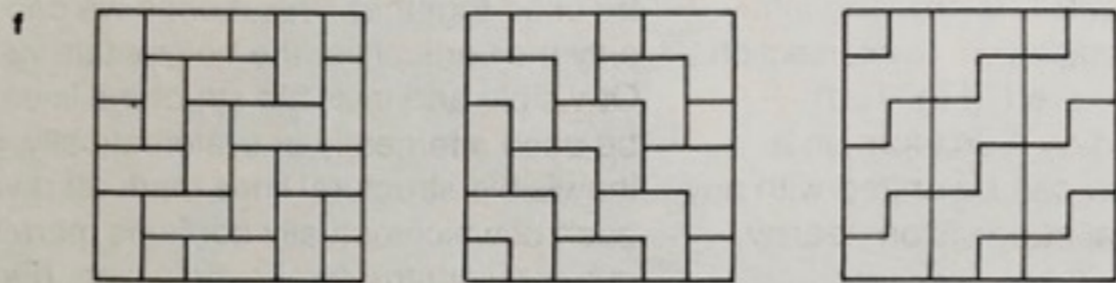
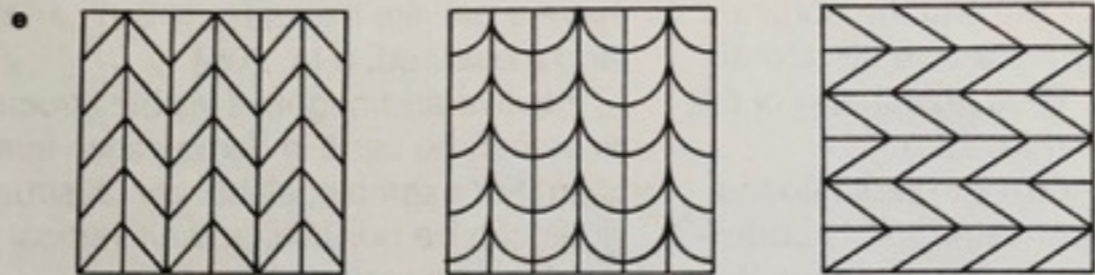
A repetition structure is formal, and can be active or inactive, visible or invisible. In this type of structure, the entire area of the design (or a desired portion of it) is divided into structural subdivisions of exactly the same shape and size, without odd spatial gaps left between them.

The repetition structure is the simplest of all structures. It is particularly useful in the construction of all-over patterns.

The Basic Grid

The basic grid is the most frequently used in repetition structures. It consists of equally spaced vertical and horizontal lines crossing over each other, resulting in a number of square subdivisions of the same size. (Fig. 21)

The basic grid provides each unit form the same amount of space above, below, left, and



right. Except for the direction generated by the unit forms themselves, the vertical and horizontal directions are well-balanced, with no obvious dominance of one direction over the other.

Variations of the Basic Grid

There are many other types of repetition structures, usually derived from the basic grid. Such variations of the basic grid are suggested as follows:

(a) **Change of proportion** — The square subdivisions of the basic grid can be changed into rectangular ones. The balance of the vertical and the horizontal directions is thus transformed, and one direction gains greater emphasis. (Fig. 22a)

(b) **Change of direction** — All the vertical or horizontal lines, or both, can be tilted to any angle. Such diversion from the original vertical-horizontal stability can provoke a sense of movement. (Fig. 22b)

(c) **Sliding** — Each row of structural subdivisions can slide in either direction regularly or irregularly. In this case, one subdivision may not be directly above or next to another subdivision in an adjacent row. (Fig. 22c)

(d) **Curving and/or bending** — The entire set of vertical or horizontal lines, or both, can be curved and/or bent regularly, resulting in structural subdivisions still of the same shape and size. (Fig. 22d)

(e) **Reflecting** — A row of structural subdivisions as in (b) or (d) (provided that the two outer edges of the row are still straight and parallel to each other) can be reflected and repeated alternately or regularly. (Fig. 22e)

(f) **Combining** — Structural subdivisions in a repetition structure can be combined to form bigger or perhaps more complex shapes. The new, bigger subdivisions

should, of course, be of the same shape and size, and fit together perfectly without gaps in the design. (Fig. 22f)

(g) **Further dividing** — Structural subdivisions in a repetition structure can be further divided into small or perhaps more complex shapes. The new, smaller subdivisions should, again, be of the same shape and size. (Fig. 22g)

(h) **The triangular grid** — Tilting of the direction of structural lines and further dividing the subdivisions thus formed, we can obtain a triangular grid. Three well-balanced directions are usually distinguished in this triangular grid, although one or two of the directions may appear to be more prominent. (Fig. 22h)

(i) **The hexagonal grid** — Combining six adjacent spatial units of a triangular grid produces a hexagonal grid. It can be elongated, compressed, or distorted. (Fig. 22i)

It is necessary to note that inactive (and invisible) structures should be rather simple, because the shape of the subdivisions remains unseen. Active (both visible or invisible) structures can be more complex. Since the shape of the subdivisions is to affect the design, care should be taken in relating them to the unit forms.

Multiple Repetition Structures

When the structure consists of more than one kind of structural subdivisions which repeat both in shape and size, it is no longer a repetition structure but a "multiple repetition structure."

A multiple repetition structure is still a formal structure. The various kinds (usually two, but there can be more) of structural subdivisions are woven together in a regular pattern. Examples of this type of structure are

The active or visible structural lines provide sufficient discipline of repetition so that the freedom of positioning the unit forms, plus directional variations, may be fully explored.

Superimposition of Repetition Structures

One repetition structure, along with the unit forms it carries, can be superimposed upon another repetition structure. The two structures and their unit forms can be the same or different from each other. Interaction of the two structures may produce unexpected results. (Fig. 24)

Notes on the Exercises

Figures 25a, b, c, d, e, and f exemplify the use of repetitive unit forms in an inactive (and invisible) repetition structure. The unit form here is a smaller circle enclosed by a bigger circle. The relationship of the smaller circle and the bigger circle has to remain consistent within each design.

The use of active (and invisible) repetition structures is demonstrated in figures 26a, b, c, d, e, and f. The unit form here is similar to the one used in our problem for inactive repetition structure, except that the ring-like shape is broken, suggesting a form very much like the letter C.

Comparing the results of the two problems, we should easily notice that straight lines are present in the designs with active structures but absent in those with inactive structures. The straight, active structural lines not only affect the shape of unit forms and space surrounding them, but also change the nature of the design.

