

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 mathematical semi-regular plane tessellations and structures consisting of repetitive shapes with regular gaps. (Fig. 23)

Unit Forms and Structural Subdivisions

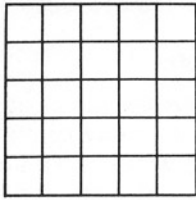
In an inactive (and invisible) structure, unit forms are either positioned in the center of structural subdivisions, or at intersections of structural lines. They can fit exactly, be smaller or bigger than the subdivisions. If bigger, adjacent unit forms will touch, overlap, penetrate, unite, subtract, or intersect one another. Sometimes they can be so big that one can cross over several others simultaneously.

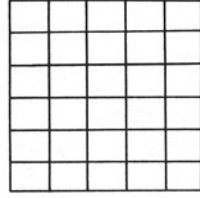
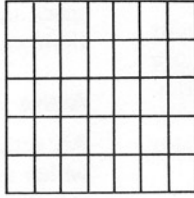
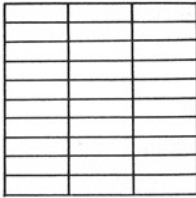
In an active (visible or invisible) structure, each unit form is confined to its own spatial subdivision, but it is not necessarily placed right in the center of the subdivision. It can just fit, be smaller or bigger than the subdivision, but it is seldom so big that it extends too much beyond the area of the subdivision. Variations of position and direction can occur.

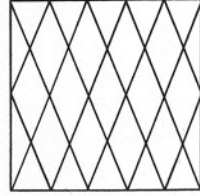
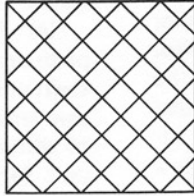
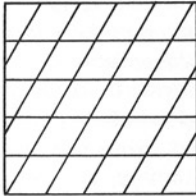
Super-unit-forms are related to the structural subdivisions in the same way, except that we may contain them in super-structural-subdivisions which consist of several regular subdivisions joined together.

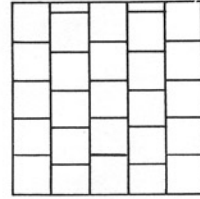
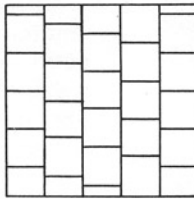
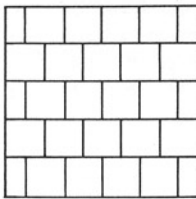
Repetition of Position

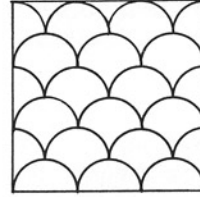
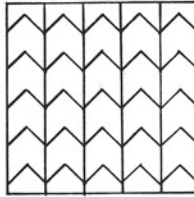
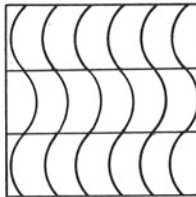
This has been mentioned in the preceding chapter. Repetition of position means that the



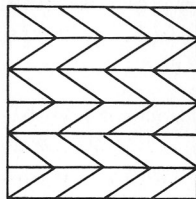
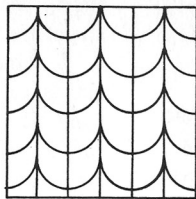
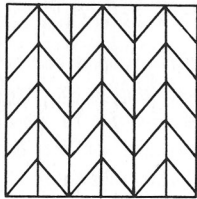
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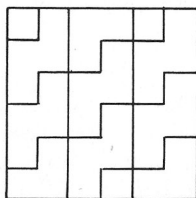
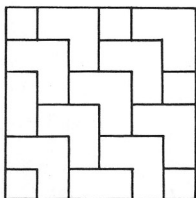
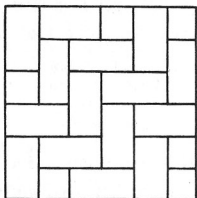
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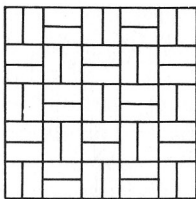
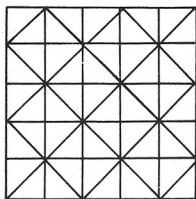
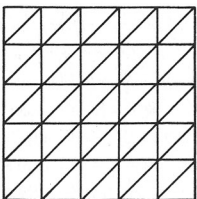
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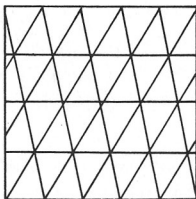
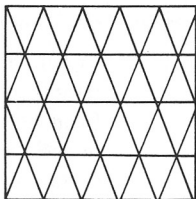
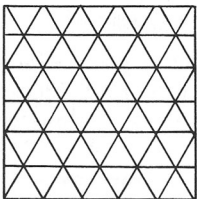
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