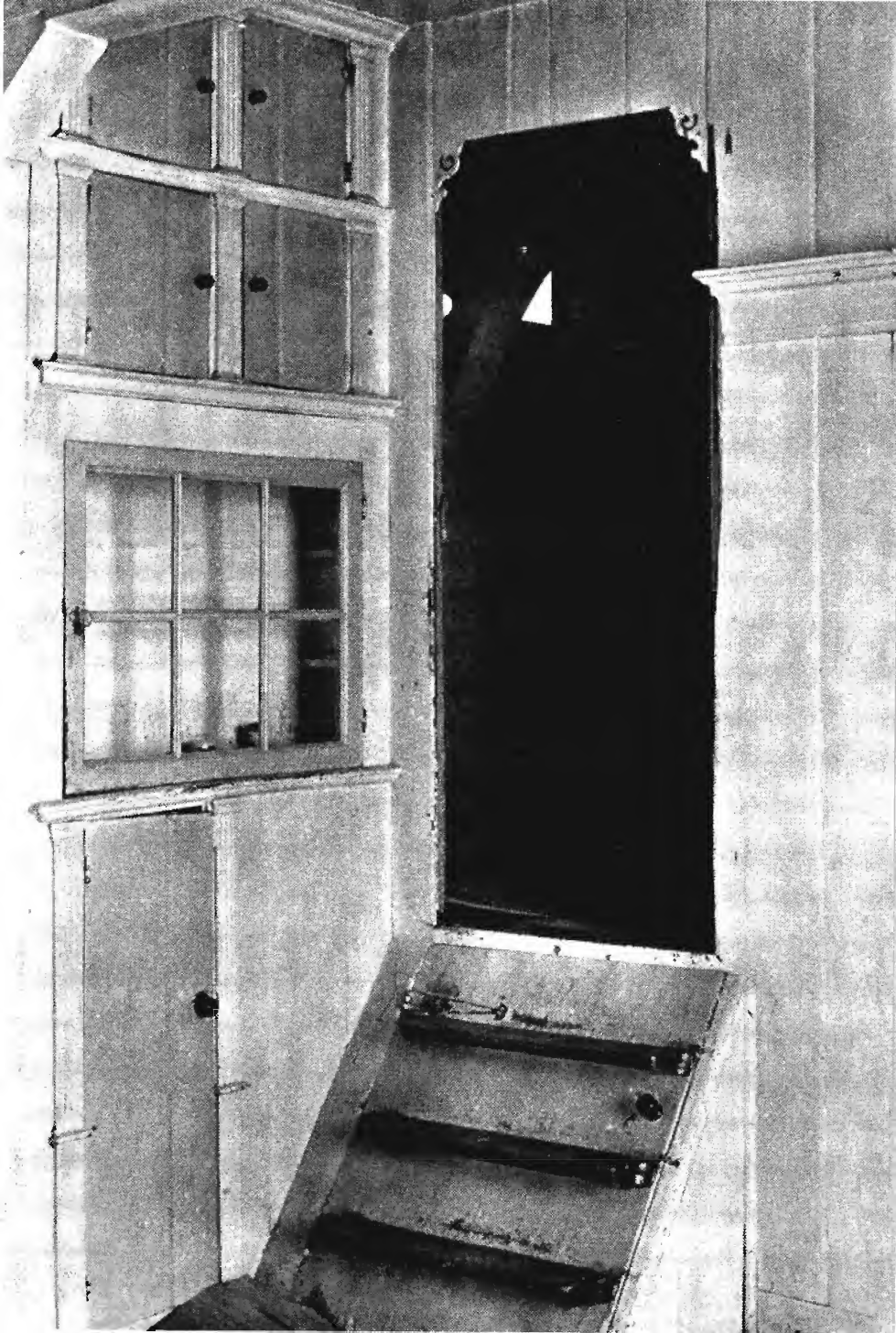
CHAPTER 23

THE PROCESS OF CONSTRUCTION

Once the buildings are conceived like this, they can be built, directly, from a few simple marks made in the ground—again within a common language, but directly, and without the use of drawings.



Suppose now, that you have the layout of a building done, according to the processes described in the last two chapters. It happens, as we have seen, with very great ease.

Now we come to the actual building of the building.

Again, just as before, the process is sequential. Only now the patterns operate not on a mental image, but on the building itself, as it is being built. Each pattern defines an operation, which helps to differentiate, and to complete, the building as it grows: and when the last patterns are introduced into the growing fabric, the building is complete.

Again, the patterns operate upon the whole: they are not parts, which can be added—but relationships, which get imposed upon the previous ones, in order to make more detail, more structure, and more substance—so the substance of the building emerges gradually, but always as a whole, at each stage of its growth.

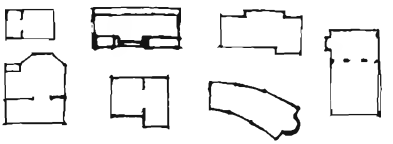
Suppose, to start with, that we have used a pattern language to lay out a rough scheme of spaces for a building.

And suppose that we have captured this rough scheme on paper, with a rough pencil sketch, or on the ground, with stakes, or sticks and stones.

In order for the building to be alive, its construction details must be unique and fitted to their individual circumstances as carefully as the larger parts.

This means that, like the larger parts, the details must be very carefully shaped according to their position in the larger whole; and, although similar parts will have a similar shape, no two of them will ever be exactly identical.

Look, for instance, at these drawings. According to the room you start with, the exact spacing of the columns, and hence the exact size of panels which form the walls, are different in each case.

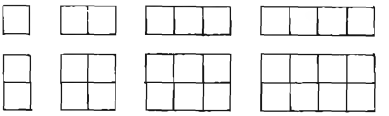


The rooms become alive because the details of the column spacing fit the whole. Any kind of irregularity in the room can be accommodated without trouble by the building process. The exact size and spacing of the building details, governed by the process, adapts itself to the nature of the room.

The details of a building cannot be made alive when they are made from modular parts.

Suppose, for example, that the building system contains a panel which is four feet wide, which fits together with other panels on a four-foot grid. None of the many rooms which I have described could be built, exactly as they are, with these four-foot panels.

To build these rooms out of modular four-foot panels, each of the rooms would have to be made into a perfect square, sixteen feet by sixteen feet.



The modular panels tyrannize the geometry of the room.

If the builder wants to build the room from modular four-foot panels, he must change the size of the rooms, and change their shape, to fit his panels.

In such a building system, it is impossible for a person to create a plan which reflects the larger subtleties of site or plan. Each plan will always be chopped and disfigured to make it fit the building details.

And the beautiful variety in which a hundred or a thousand rooms can all be roughly fifteen by sixteen, yet no two alike, is destroyed, and replaced by an endless repetition in which hundreds and thousands of rooms are exactly and identically the same.

And, for the same reason, the details of a building cannot be made alive when they are drawn at a drawing board.

The details of a building cannot be alive when they are specified in the form of working drawings, because these drawings always assume, for the sake of simplicity, that the various manifestations of a given part are all identical.

The person who draws a working drawing cannot

draw each window, or each brick, differently, because he has no basis for knowing the subtle differences which will be required. These only become clear when the actual building process is already under way. So he draws them the same, because he has no reason, sitting at the drawing board, to make them different. But if the builder builds according to a detailed drawing, and is constrained by his contract to make the building exactly like the drawing, he then makes the detail identical, to follow the drawing—and in the actual building this becomes dead and artificial.

To make the building live, its patterns must be generated on the site, so that each one takes its own shape according to its context.

Consider, for instance, patterns like COLUMNS AT THE CORNERS or FINAL COLUMN DISTRIBUTION, which give the proper column spacing so that columns act as stiffening for walls, in the most efficient way.

To create these patterns correctly the builder makes a room by placing columns at the four corners, and then places extra columns along each wall, at equal spacings, to make column intervals somewhere between 4 and 6 feet, according to the length of the wall, then finally places a beam along each wall, over the columns.

This process is an active representation of the patterns. Each time the process is used, it will create a slightly different configuration, according to the plan of the room.

Each room will have in it the skeleton of columns and beams which embody the same patterns. Yet, no two rooms will have exactly the same panel sizes.

It is essential, therefore, that the builder build only from rough drawings: and that he carry out the detailed patterns from the drawings according to the processes given by the pattern language in his mind.

This is commonplace in nature. When the spider builds its web, the process is standardized; but the parts which are created are all different. Each web is beautiful, unique, perfectly adapted to its situation. Yet it is created by a standard process: and there is just one process. It is very simple. Yet this simple process interacts in an infinite variety of ways with different circumstances to produce different particular webs.

And just so in the building process which I shall now describe. The individual processes are standardized, and very simple. But the actual parts which are produced are infinitely various—they are infinitely different manifestations of the patterns which the processes define.

The process for making vaults is standard—but the individual vaults which it produces are unique.

What is standard is the process of weaving the basket, placing the strips of wood, covering with cloth, stiffening the cloth with resin, covering the resined cloth with light-

weight concrete . . . . But the actual product, which this process produces, is different each time, according to the local circumstances.

And the process for making columns is standard—but again the individual columns which it produces are unique.

Nailing the boards, placing in position, nailing on the beam, filling with concrete—these are standard operations. But each column that is made this way is different—it is made by a different person, and reflects that fact. Perhaps one is carved, another colored in an individual fashion—and each is in a different position, has different connections to its surroundings, and is therefore different because of that.

For concreteness' sake, I shall now give a sequence of construction processes which will produce a building in this manner.

Of course, the sequence of these processes is just an example: it depends on a particular combination of materials. But some similar sequence, with just the same increasing definition, starting rough, and getting more precise as the building gets finished, is necessary.

First, stake out the corners of the ground-floor rooms and spaces.

To make sure these stakes are right, it is often helpful to

use large stakes, bamboos, or old bits of wood, so that several people can visualize the exact form and size of the rooms, their relation to one another, and their relation to the outdoors around them.

Wherever there are outdoor spaces near the building—terraces, paths, entrances, balconies, arcades, trellises, garden walls . . . stake them out as well, so that you can feel the indoors and the outdoors together.

It is very likely—almost certain—that you will modify the building as you have so far conceived it. The stakes are so vivid that you will almost certainly begin to see all kinds of subtlety, which you could not imagine before, now that the stakes and rooms are actual, right out there on the ground.

Modify the position of the stakes, a foot here, a foot there, until they are as perfectly placed as you can imagine; and until the layout of the rooms seems just exactly right.

Erect the corner columns, and place stiffening columns as nearly as possible at equal spacings, within the framework given by the corner columns.

For buildings of different heights, and on different stories, also according to the building height, these intermediate columns need different spacing, because the forces coming down are different. But on any one floor, their spacing will be roughly constant.

However, on any one floor the spacing is only roughly constant. The different rooms have walls of different lengths. Because they are not modular, the spacing of the

intermediate columns is relaxed and natural; it will vary with the exact spacing of the corner columns.

Tie the columns together, with perimeter beams.

These beams then form the upper edge of every room. They make it possible to visualize the space of the rooms, very clearly; make it possible to put the window frames and door frames in position: and most important, they provide the tension ring around each room, which forms the basis for the springing of the individual vaults.

Make the beams lowest around alcoves; higher around ordinary rooms, and highest of all round the big and public rooms.

This will start the process of creating ceiling height variety. The alcoves can have beams as low as 5 feet or 5 feet 6 inches; the ordinary rooms as low as 6 feet or 6 feet 6 inches; the larger rooms perhaps 7 feet, 8 feet, or 9 feet.

In every case, the belly of the vault will add a foot or two, or even more to the perimeter beam height; accordingly, the extent of the addition will depend on the span of the vault.

Put in the window frames and door frames.

You already have some rough idea of where you want to put the doors and windows, from the conception of the building you have worked out in your mind.

But now the framing of the rooms is up, you can see

just exactly where the openings should go. By mocking them up, with bits of rough wood, you can modify them, and adjust them, until they create the perfect relationship between the inside and the outside, give the right views, the right amount of light in the right places, the right sill heights, the right heights for the doors, and the proper breakdown of the larger openings into smaller ones.

Now weave the baskets which will form the basis for the vaults above each room.

Each room, no matter what its shape, can be roofed with a simple vault, whose formwork can be woven out of thin strips of flexible wood, perhaps a foot apart. This basket can adapt to all the small irregularities of the room, and can even go round corners if it has to.

And shape the belly of the vault; it can be shaped to give each room just the ceiling height it needs. For structural reasons the vault needs to be roughly one sixth of the span of the vault. But this sixth is quite variable, and you may now adjust the exact curve of the vault to make the room feel right for just exactly what you will be doing there.

Put in the walls between the columns and the window frames.

These walls can be made of any simple sheet material: tiles, wood planks, hollow blocks, lightweight sheets and boards, cut and placed so they fill the gaps between the columns and the window frames.

Make half vaults for the stairs, so that each stair goes up at just the proper angle in the bays reserved them.

The stairs can be conceived as lying over vaults. The steps will be filled in, over a vault, or pair of vaults, or series of vaulted arches. These vaulted arches now give the position of the stair.

Trowel the concrete for the vaults onto the basket forms, and fill the walls to make them solid.

Using perhaps a lightweight fill, or ultralightweight concrete, trowel a one-inch vault onto the basket forms, after they have been covered with a simple cloth and stiffened; and do the same to fill the walls and columns in one continuous mass, so that the building becomes three dimensionally rigid.

Now start the second story, by the same procedure as the first.

Place columns in between the columns which are already there, and place the bottom of these columns on the vault, where they will be filled by the fill which forms the floor.

Fill the floor, to make it horizontal.

Make up the form boards on the outside of the building, to contain a horizontal floor, poured in above the vaults: and fill the space with voids—jugs, bottles, anything

which will form roughly spherical bubbles in the concrete, and reduce its mass without reducing strength.

Complete the second story, just as you have built the first, then do the same for the third if there is one.

Make the terraces and seats and balconies around the building.

Treat them as part of the building, and yet part of the earth.

Use terracotta tiles set simply in the earth, with small plants growing in between them. Set the tiles in mud, keep it as wet as possible, so that it grips the tiles quite firmly, and yet makes the possibility of movement over time, and allows plants to grow between them.

Plant a few small flowering plants, between the tiles, while you are setting them in mud, so that after a few months, the flowers are yellow, purple . . .

Build individual doors and windows, as cheaply as you can, but each one shaped, and subdivided right according to the frame.

Because of the procedure you have followed in laying out the window frames and door frames, all the openings in the building are of slightly different sizes now.

This is essential, and it means that you cannot use standard doors or windows.

Now nail together simple doors and windows. They can be made of simple planks just nailed and glued to-

gether, with small strips to form the subdivision of the window panes, routed out to make a rebate for the window glass.

Carve decorations in the panels round the doors, and in the other places where you want some emphasis or gaiety.

You can carve simple scrolls and lines and hearts and dots into the boards which form the outside of the walls. Later, when the building is almost finished, you can fill these scrolls with plaster.

Paint the walls white; leave the columns visible.

Plaster in between the splines of basketwork which formed the basis for the vaults, and are still visible below the vault in every room.

Plaster in the ornaments which you have carved.

Plaster into the holes in those panels where you have cut holes for ornaments.

Oil the wood; wax the floor.

Then, finally, the finished building will have a rhythm of the same patterns repeated hundreds and thousands of times, but different every time that they occur.

There are not only roughly equal columns, column spacings, arcades, windows, doorways, dormers, roofs, and terraces. These are the larger patterns which repeat. But there is also a wealth of mouldings, tiles, drips, gutters,

panels, brickwork, edges, door sills, ornaments, small strips, small squares, small cornerstones, column heads, column feet, rings cut in columns, braces, bracing details, nail-heads, handles, spacers, sparsely placed, just where they have to be, but visible, so that the building is completed by these smallest structures, and formed by the rhythm of their almost regular irregularities.

The picture on the last two pages shows an example of a building built like this.

This picture is a photograph of a model. The building is a four-story apartment building, for twenty-seven families, in which the members of each family have designed their own apartments, using a common pattern language, and the building is then intended to be built, floor by floor, using the system of columns and beams and vaults which I have just described.

Although the model is very rough, it is already possible to see the way that the discipline of the construction process interacts with the informality of plan, to produce a building which goes much further towards the quality without a name, than either of the actual buildings shown in chapters 21 and 22.

A building built like this will always be a little looser and a little more fluid than a machine-made building.

Its doors and columns, windows, shelves, wall panels, ceilings, terraces, and balustrades are shaped exactly to take

their part in the larger whole: they fit it perfectly. And because they fit it perfectly, they are therefore a little rougher in appearance than the slick machine-smooth quality of buildings made of factory materials.

But the beauty of the building lies in the fact that it is whole.

The essential thing is this. Each process (given by a pattern) takes the configuration which has been produced by the previous processes, and adapts itself to them. No matter where the columns are, the process of weaving a vault can form the vault *according to* the position of the columns. No matter where the edges of a window are, the process of making a window forms the window and its panes *according to* the size and shape of the window frame.

And it is this which makes the building whole.

The building, like the countless buildings of traditional society, has the simplicity of a rough pencil drawing. Done in a few minutes, the drawing captures the whole—the essence and the feeling of a horse in motion, a woman bending—because its parts are free within the rhythm of the whole.

And just so with the building now. It has a certain roughness. But it is full of feeling, and it forms a whole.