but still perfectly simple-hearted. Each essential thing is given not one element of structure more than it requires. Complex shapes appear only when they come about naturally, from the interaction of the elements. The author of the plan was too childish to add any extra structure; it would have seemed like showing off.

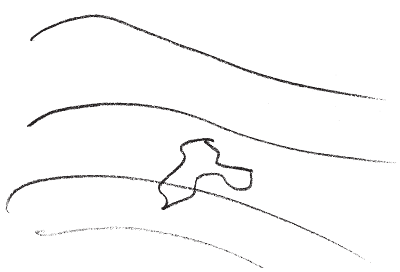
The process which produced this plan was certainly practical, but leavened by great simplicity *of heart*. It consisted — I believe — of taking every step in the sequence of structure-preserving transformations in the simplest way possible. When new centers could be made symmetrical, they were. When they had to be asymmetrical, they were made so. As the monk of the St. Gall plan followed this process in his drawing, he gradually got something which became more and more complex (in a comfortable, organic way) but was still gentle and simple in heart.

4 / DOING THE SIMPLEST THING: THE BASIS OF ALL STRUCTURE-PRESERVING TRANSFORMATIONS

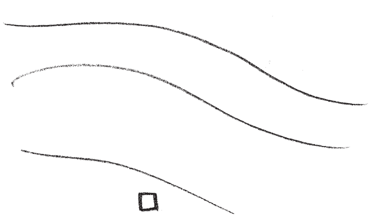
Let us get a more concrete vision of these ideas. To do so, we go back to the fundamental process, and to the concept of structure-preserving transformations. Suppose at some stage in a building process there is a certain field of centers. Now you want to transform this field in such a way as to deepen certain latent centers, while leaving the overall structure of the field intact. To succeed you must introduce new structure in the "least" way — that means, in a way which causes the least disturbance to the existing field. To do this, you must choose the simplest thing to do, at every step, because anything more than exactly what is required will tend to complicate and destroy the structure which exists.

Imagine a beautiful hillside, overlooking the ocean. A wild hill, grassy, a few scattered trees, plunging down to the ocean far below. Suppose that we are going to place a small gazebo on this hillside. What shape will be best for the gazebo? Of course the hill itself, as far as its structure is concerned, is complex and loose. The terrain rambles; trees are placed irregularly. The rocks plunge down at different angles. The grass is green here, yellow there. There are bushes in this hollow; over there on the slope there are orange poppies. In short, the whole thing is complex and asymmetrical.

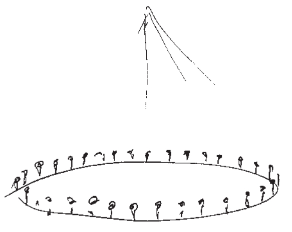
Now, what shape of gazebo preserves this structure best? An irregular, asymmetrical, "organic" building will *not* fit well into the landscape. It will merely be tedious, and forces attention on itself (below, left). Surprisingly, the best one is the simplest: perfectly symmetrical, possi-



Effect of an asymmetric structure on the land: Not harmonious

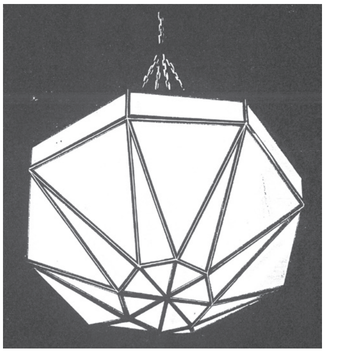


Effect of a symmetric structure on the land: Harmonious



First sketch of a simple light

Simple light as it now hangs in the Great Hall



Ugly light proposed by contractor; too much irrelevant structure

bly square, possibly octagonal or round (page 467, right). In any case, not itself complex and irregular. The simple little square leaves things around it more alone. It concentrates its structure inward towards itself, and does not spread out its feeling or its structure into the surrounding landscape. Thus it does not contaminate the wild beauty of the hill.

The appearance of local symmetry in this example is very interesting. That is because the symmetrical structure induces one new center just where it is needed and nowhere else. Asymmetrical structures tend to induce many centers in many places, and so create unnecessary extra structures of centers that interfere with the existing order. In most cases, a symmetrical increment is the one which more leaves the field of centers alone; it is the most relaxed. Often it is the one which preserves structure most profoundly.

On this page I show another example of such a process at work: The lights of the Great Hall on the Eishin campus in Japan. At a certain stage, when the building was already under construction, we had to decide what form of lights to use. I knew that the light for this big dark hall would have to be made of many small lights, high up. A single big light would make too much glare. So I just drew absolutely the simplest arrangement for a large number of small lights that I could imagine: A circle of lights, hanging from a point (above, left). In the end this was also, the form of the actual lights we built, almost exactly (see middle photograph).

The act of making this drawing contains a fairly pure example of the rule "always do the simplest thing." In early discussions we had already decided that the lights were to be candelabras — hanging lights with many small lights attached to them. And we had, also, decided on the positions of the lights. There was to be a single row, down the middle of the nave. So, now it was a question of just drawing the simplest center which had these qualities. It was something hanging, something with several bulbs. The thing I drew is the simplest structure which has these qualities.

That is all. There was nothing else we needed to do. When it was built, after careful mockups to decide its exact size, its material, and details, it came out very much like the drawing (above, middle). But we had to build these lights ourselves, since the contractor declared himself unable to do it.

In the third picture (above, right) I show a catalog photograph of the light fixture proposed for installation by the general contractor while the discussion was going on. It is ugly, irrelevant, harsh to the circumstances. It is harsh and irrelevant because it has too much structure that is not required by the situation. For example, the octagonal shape. What calls for an octagon? The small plastic triangles. Why do they have to be there? The strong edge around the top. Why is it there? The octagon made of triangles at the bottom. Why is it composite? None of these questions has a good answer. By comparison, the lights we built (and installed) have a more simple-hearted peacefulness because they contain nothing other than what is needed. In this sense they are more completely childish.

Again I want to emphasize: The appeal of the light is that there is nothing there except what is required. When I first drew it, Hajo (our executive architect in Japan) thought it was *too* childish. There was a shocked look on his face. I, too, thought that it was perhaps too childish. Yet childishness is what we see in the St. Gall plan, too. The result of a process in which, at each moment, the artist introduces the simplest possible thing to extend the existing field, and copes as sparingly as possible with the existing necessities through structure-preserving transformations.

5 / NATURAL SYMMETRIES

The geometry of living structure — what comes from the fifteen transformations — is the result of a process in which a complex system becomes at one and the same time *both* richer *and* simpler. Each new bit of structure, each new center, adds new differentiations. But each time, as soon as we get the new differentiations, we at once try to boil the garbage away so that the structure is simplified and concentrated. We try to keep it continuously simple, even while we fill it with more and more structure. The ultimate aim of this process is to find a perfectly simple structure which contains an immense wealth of structure.

We are constantly trying to simplify, to produce a system of centers and symmetries which is the simplest possible. The more we keep to simple symmetries when there is no reason for anything else, the more the whole thing gets purified. When we can, we remove smaller local symmetries, and simplify them even further, by enlarging the symmetries. We aim, by the end, to remove all extraneous structure. What we want is to cut and cut and cut until there is almost nothing left.

To clarify the connection between symmetries and simplicity: Complexity (in the bad sense) consists of distinctions which unnecessarily complicate a structure. To get simplicity, on the other hand, we need a process which questions every distinction. Any distinction which is not necessary is removed. To remove a distinction we replace it by a symmetry. During this process the building gets simpler. Gradually we get just that syncopated system of local symmetries, rough but regular, symmetrical in details but syncopated in the large, that is typical of all real life.

Since each step will be most structure-preserving when it adds only the simplest symmetries, we may then expect that the end-result of a long sequence of such steps will be almost entirely made up of *local* symmetries. This means that the geometry of a wholesome living structure will be almost entirely made up of *local* symmetries, while yet being mainly asymmetrical in the large.

In Book 1, pages 188–92, I described an experiment which showed that the number of local symmetries in a thing has a big effect on its coherence. Now I want to go further and develop the idea that the structure of local symmetries may be nearly all there is, and that this is the most fundamental way of understanding living structure. Look at this sketch of a niche from a