



4 / STEP-BY-STEP ADAPTATION

To grasp the real difficulty of an adaptive process in which thousands of adaptations have to occur, imagine a small system with thirty variables. Let us say that the state of each variable is represented by a coin, successfully adapted when it is heads, unsuccessfully adapted when it is tails. My goal is to get all thirty coins lying heads up on the table in front of me. Now, consider two possible approaches to achieving this goal:

(A) THE ALL-OR-NOTHING APPROACH. I toss the coins all at the same time — all thirty coins at once — and then look to see if they have all come down heads. If not, I spin them all again, look at them all again, again check to see if they are all heads. If not, I start again. In this approach, the essential rule is that they must all come down

heads together. Even if twenty-nine come down heads, but one comes down tails, it is not good enough. I have to do it again, until all thirty come down heads at the same time. With this approach, it will obviously take a very long time indeed to get the system to the desirable state (all heads). In fact it will take on the order of 2^{30} trials (about 10^{10}). If I could do one trial per second, this would take 10^{10} seconds or some three hundred years.

(B) THE STEP-BY-STEP APPROACH. In this approach, I spin one coin at a time. When it comes down heads, I leave it lying on the table, and go on to the next coin. Here I am doing the adaptation step by step, one step at a time. With this approach, it will take on the order of about two seconds per coin, or about sixty sec-



Forming centers in the early stages of a house-building process in Mexico. From the very start, the emphasis is on step-by-step adaptation: design and construction are integrated. Christopher Alexander, Julio Martinez, Howard Davis, and others, Mexicali, 1976.

onds altogether — roughly one minute to complete the adaptation.⁸

The step-by-step approach works. The all-or-nothing approach does not work. This is the secret of biological evolution. During the course of evolution, the adaptation of the thousands and millions of variables that must occur to make one successful organism happens step by step, essentially one gene at a time. That is what makes evolution possible. It would be impossible for nature to “design” a system as complex as an organism all at once.⁹

The same *must* happen when a building is designed and built, if it is to be well adapted and to have living structure. A building has too many aspects, too many variables. We cannot get each aspect of the building right unless it is possible to work out one aspect at a time. This

is how we get the system of thirty coins to be all heads, except that in a building it must be possible to do this for *thousands* of variables, one after the other, both during design and construction.

We may infer, then, that to make things come out right in the built environment, to bring adaptation into society and to regain our capacity to make buildings and streets *just right* — there is a simple condition that must be met. *The process must go gradually, in a way that allows assessments, corrections, and improvements to be made about the degree of life which occurs throughout the structure, at all scales and at all levels. This process must occur continually throughout conception, design, and construction.* And the process must be sufficiently widespread to affect all scales of building and construction.



5 / FEEDBACK

Of course, it is not enough merely to go step by step. As part of the step-by-step adaptation, there must also be a *feedback* process.

In traditional society, while a thing was being made, it was also *continually* being assessed for its degree of life — checked, corrected, improved, checked, corrected. This assessment was driven by some criterion of how much life the thing had — in some form, anyway — and the process was effective in allowing this criterion of life to guide the thing. Naturally, the thing, whatever it was, then gradually became alive.

However, in modern society — especially in those cases I have illustrated in chapter 4 that are plainly negative — neither the design process nor the construction process provide opportunity for gradual step-by-step feedback to influence the whole. Whether or not degree of life is noticed as an attribute while the building is being conceived, drawn, and built, this perception has little opportunity to influence the whole. *Feedback is not allowed to be effective.*

So, to work well, a living process must not merely be step by step. It must be step by step *with* a built-in feedback of such a kind that each step taken can be checked at once for the increase of life which will occur, accepted if it has it, rejected if it does not.

It sounds obvious. But it is not what happens in the processes of architectural design and construction that contemporary architects typically follow. During design, typically, we start with a schematic drawing. This drawing, being complex, usually contains hundreds (if not thousands) of decisions. Yet these decisions, if we separate them from one another, have been made on paper without one of them being tested.¹⁰ Of course, at some stage the drawing is shown to the client, and the client has the right to comment on a completed whole. But by that time, the drawing, in its outline, is all but set, containing hundreds of untested decisions. Often not one of the hundred steps which led to its creation has been tested, nor have we, the architects, had