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GENERATIVE CODES

THE PATH TO BUILDING WELCOMING, BEAUTIFUL, SUSTAINABLE NEIGHBORHOODS

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A Simple Question: What Is It That We Really Need From The Neighborhood Where We Live?

Most of us share a general, intuitive understanding of the qualities we would like to have in the neighborhood around us. It is not very complicated.

A sense of privacy—we are left alone when we want to be alone. Friendly people who know you, and whom you greet and occasionally talk to. Safety—safety from violence, from theft. Physical safety from traffic and noise. Safety for children. Safety at night. A beautiful place—one that lifts your heart when you walk around or look out of the window. Intimate and personal. Trees and gardens. Water, perhaps. A place to sit in public that is really a wonderful place. Streets and public places where everyone feels at home, instead of ones where no one feels at home. A uniqueness of the neighborhood, so we know it both when we are home and when we get home.

And, of course, we also hope for these qualities in a newly built neighborhood, or in a refurbished neighborhood. This is the dream, one might say, of every developer. A developer with a conscience, who dreams of building neighborhoods, who hopes and wishes to build something for people that has these qualities.

Yet we all know that developers rarely—if we are more honest, perhaps never—reach this ideal. There is something about the way that things are set up in the contemporary process of building houses that prevents it, perhaps even virtually forbids it.

The reason is not hard to find. Making a neighborhood that has these qualities is a human process. It is generated by a long chain of human events, involving respect for people, respect for one another, respect for land and place, and respect for age-old ways of making things: the origin of every genuine human structure. Above all it comes from the land, and it comes from the people.

When successful, it binds land and people together into a social-spatial fabric or tapestry. The list of qualities at the beginning of this section are that fabric or tapestry of which we are dreaming. We will never get that kind of neighborhood unless we consciously set out to make that fabric. The fabric must be generated by the processes we use, and in the processes we support, which try to build houses and public space and neighborhoods—it is this fabric that must be gen-

erated. Without it, nothing valuable can ensue. With it, the neighborhood has a very strong chance of life.

Building that fabric—successfully, in modern society—is what this paper is about.

What is a Generative Code?

A generative code is a system of explicit steps for creating such a fabric. It defines the end product, not by specifying the end product itself, but by defining the steps that must be used to *reach* it. Unlike a process that defines the end product and then leaves the details of getting there to the developer, the processes initiated by a generative code assure that the end product will be unique each time it occurs, and will be unique in exactly the ways that matter.¹

The generative codes we are concerned with here are the processes specific to the environment—our world and its construction, especially in areas that we may roughly call “neighborhoods.” They are, to be more precise, codes that are capable of driving or guiding the organic unfolding of a neighborhood (new, existing, or partly existing, greenfield or brown field) in such a way that the neighborhood and the people who do and will live and work in it have a good chance of flourishing personally, economically, and ecologically. Like the example of biological generative code, such a code is necessarily highly complex (in its effects) though simple (in its structure). It is *necessarily* dynamic. It specifies processes, happening under a variety of types of control, that will contribute to the proper unfolding of the whole, and delineates the interaction of the people concerned in such a way that what results may, with good fortune, become a living neighborhood.

An example of a generative code in another context is the thing known in surgical medicine as a “procedure.” It defines a surgical operation in such a way that it can be learned and transmitted. Those who have learned it are able to apply the procedure to widely different individuals, each with unique circumstances, producing unique results according to the idiosyncrasies of the patient.

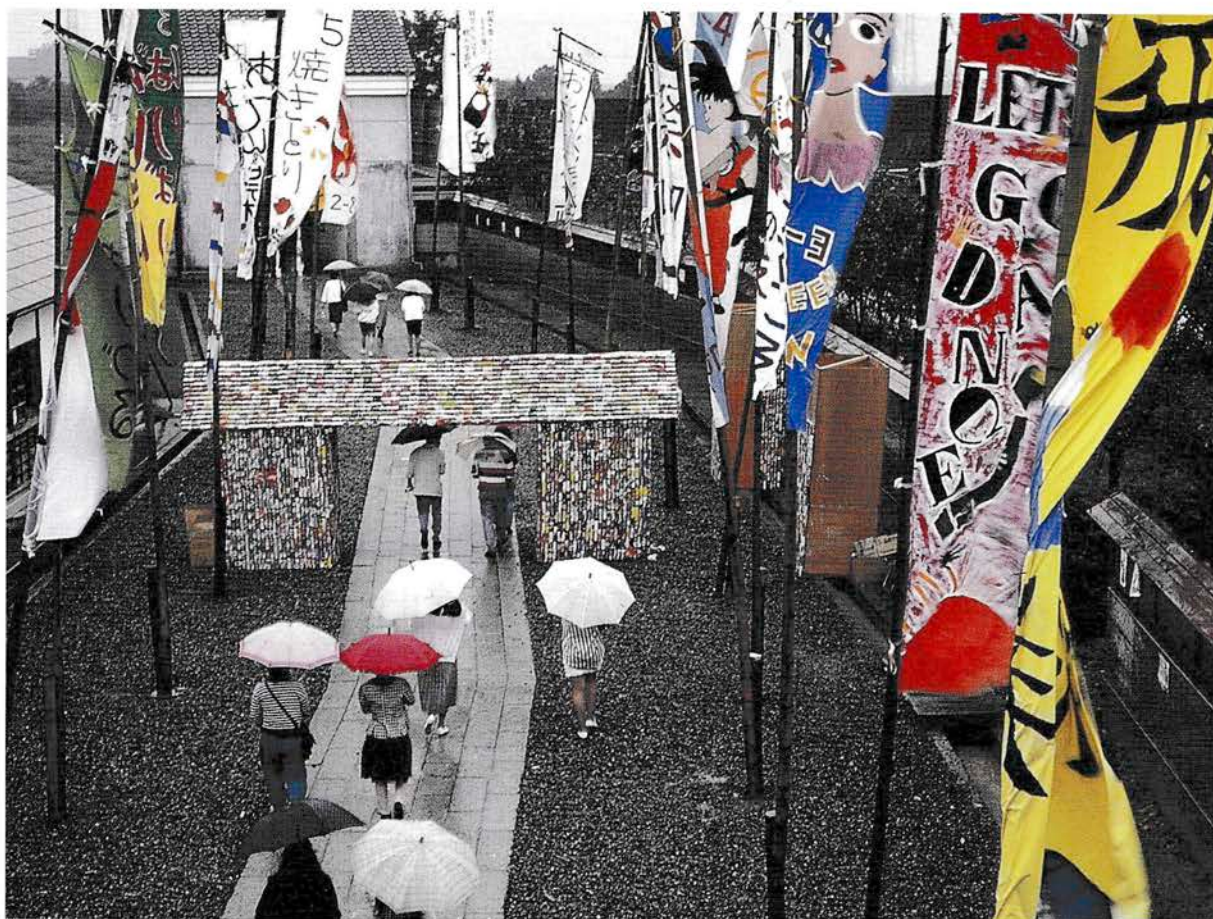


FIG. 1 Eishin Campus, street entrance.



FIG. 2 Eishin garden with cherry trees.

Another generative code is the system that allows a plant to unfold from a seed—a system not yet understood in full detail. It used to be thought that the genetic information in the plant's DNA was all that you needed to define the process, and so the end product. It is now known that the situation is much more complicated, and consists of interlocking processes taking place in different organs and organelles, chemical concentrations, enzymes, and interlocking sequences of action and production.

At one time in our recent history as a people we underestimated the complexity of ecological systems, and only recently found out that crude mechanical methods of agriculture kill living systems and destroy living species. In the same fashion we have, during the last fifty years, lived through an era where crude methods of urban development have given the impression of a capacity to create our built environment. We are now entering a new era in which the delicacy of this operation and the delicacy of the procedures we must use to do it are first becoming visible and practicable. If we are careful, in the next ten years we may find that we *do* have the capacity to generate living neighborhoods on earth. But the techniques we use will turn out to be very different, and more subtle, than we previously thought. Like the other examples cited, the code itself is simple. But the result

of its interacting elements can be complex and beautiful.

The word “generative” also has an additional, crucial meaning. In a generative code there is *always* a sequence, an order, to the instructions. The specifications provided by the code not only describe geometrical features (as in a form-based code like a zoning ordinance), but also describe the approximate sequence in which these features must be introduced to help the neighborhood become whole. This aspect of generative codes, novel for urban codes, may be described as the specification of an unfolding.

The idea of unfolding is entirely straightforward. It simply acknowledges what has not been acknowledged up until now in urban codes—namely, that the *order* in which things are introduced is as vital as the specification of the geometrical features. This is both common sense and ordinary. It is a natural part of the specification of a surgical procedure wherein sequence is paramount. It is a feature of virtually all biological specification and coding, where it is now known that DNA alone bears partial responsibility for the ensuing form, and that the larger part is borne of the unfolding processes inherent in cell dynamics.² Unfolding sequence is even a natural feature of a recipe for baking a cake. There we are very familiar with the fact that an approximate adherence to the right *sequence* is at least as important as adherence to the ingredient *specifications*, if not more important.

So this generative feature of urban codes—that the code must contain a description of the approximate sequence in which the elements of the code are best brought forth in order that a living whole may unfold successfully from them—is natural and ordinary. It is surprising that it has not previously been noticed, or implemented on a significant scale in anything we currently view as an urban code. Yet this sequence is the decisive aspect that allows a code to give life to a neighborhood.³ An urban code may only be defined as generative when it has this feature.

When generative codes are used in a process of development, the following characteristics typically get woven into the social-spatial fabric:

1. A more beautiful and coherent geometric form that is natural to the land.
2. More probable successful integration and adaptation to plants, trees, animals, and land forms, resulting in communities and built areas that, like traditional towns and villages, seem part of nature.
3. Successful fine-tuning and deep adaptation.
4. More successful integration with living processes in the daily life of the inhabitants.
5. Better fit with individual, local needs of any given building, garden, space, or enclosure.
6. Far greater likelihood that genuine community will emerge in the new place.
7. More uniqueness of each place, street, building, and project.
8. More profound linkage to sustainability and environmental objectives.
9. An easier path to the desired end state described above.

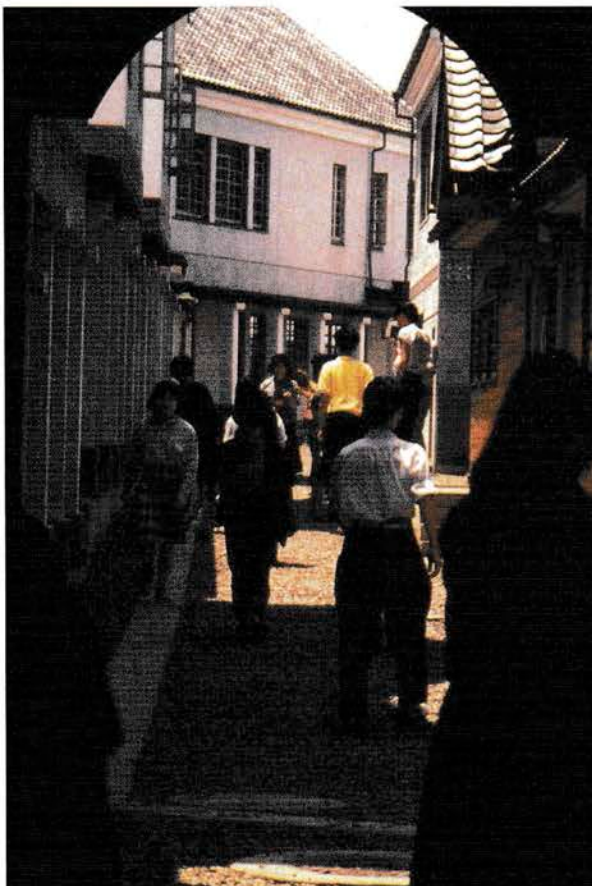


FIG. 3 Archway and pedestrian street.



FIG. 4 The farmer's market in Fresno, California.

Historical Background

In the modern era the first conscious, deliberately thought-out efforts to guide and control neighborhoods were already types of code: the zoning ordinances introduced in Chicago in the last decade of the nineteenth century. New York City adopted the first citywide zoning regulations in 1916 as a reaction to construction of the Equitable Building (which still stands today, at 120 Broadway).⁴ The advent of building codes, in their modern form, also started in the nineteenth century; yet what is generally accepted as the first building code was part of the Code of Hammurabi, dating back to 1700 BCE. Legal covenants, attached by deed trust to a particular piece of land, are also used in many countries, and may also be viewed as a type of code.

In all these cases the essence of the code was that it described and defined certain *geometrical* or *configurational* features, and then required that they be present in the finished product.

Gradually, during the last two or three decades of the twentieth century, the shortcomings of this prevailing, "old" system of urban codes became clear and inspired a number of major changes. The big innovation came in the late '70s and early '80s from Christopher Alexander's pattern languages, and from Andrés Duany's subsequent effort to

introduce form-based codes similar to patterns as tools for guiding development in cities and neighborhoods. At first this "new urbanism" movement (by now world-wide), focused on the inadequacy and poverty of the older code elements themselves, and replaced them with rules dealing with sidewalks, front yards, windows, building facades, street widths, parking, mixed use, and so forth. Many of these rules represent a distinct functional improvement over previously existing ideas of development, suburban tracts, and urban housing. But, like the elements of existing building codes and zoning ordinances, the elements of these New Urbanism codes are rules enforced by law, which require that a certain number of *geometric* conditions are met within a neighborhood.

The built result is often more like a carefully plotted piece of fiction than real life. For a time you might be fooled into thinking this is real, but sooner or later its artificiality can be glimpsed. Indeed, the ultimate effect of these form-based codes on built projects is by no means universally liked or accepted. A deep fear and suspicion of them pervades our culture—as demonstrated by *The Truman Show* and the "Arcadia" episode from the sixth season of *The X-Files*—for fairly understandable reasons. The application of these codes, although intended to help developers do a better job of

building neighborhoods, in fact, has too little effect on certain other, deeper things that matter more. The qualities listed at the beginning of this paper—simple, basic qualities that all people desire—are still lacking, and though they may appear in developers' stated ambitions, those same developers rarely have any capacity for achieving them. The places built are, after all, still "developer built," and thus, typically still have the inevitable taint of rigidity, sometimes coupled with a large dose of commercialism. The people who live in these places inevitably feel like the inhabitants of a "machine for living." Negative qualities occur and are felt by inhabitants, despite the fact that the architects of the new form-based codes rightly see themselves as crusaders battling this very problem.

In short, the step of outlining the new form-based codes, as far as it has gone to date, has not been strong enough to make a real difference in the process of creating vibrant and healthy neighborhoods that people genuinely care for. The difference between these new form-based urban codes and older building codes and zoning ordinances is somewhat positive. New Urbanism projects do make practical advances in pedestrian space, the placing of cars, and mixed-use development. The rules have changed, becoming more complex, and now pay greater attention to important practical aspects of the habitable character of the ensuing neighborhoods. This is all positive, in principle, though sometimes too rigid. The *geometry* therefore becomes more different, more complex, more interesting, and possibly more useful, too. Such change is highly desirable since, without a doubt, one of the things wrong with twentieth-century cities lies in the fact that their geometry and layout emphasized cars in undesirable ways, and their buildings were faceless, too slick, too gigantic, and tired.

Despite these advances, the products of New Urbanism, in their geometry, still make only very small improvements to the human condition. The emergence of living structure, of real social life, is not really more firmly guaranteed by these new urban codes than it was by the earlier, less pleasant combinations of zoning and building codes. Despite greater sophistication, the results still tend to be lifeless; the shapes are different, but the inner social character, and the emotional health of the inhabitants, has not really become better. It is true that they slightly resemble traditional buildings, but not for any obviously good reason, and the wholeness—of work, of spirit, of plants and animals and people—that was felt in traditional society has not yet come into being in the products of New Urbanism.

In short, you cannot change the soul of a person by putting on lipstick, nor can you do this with architecture. You cannot make the world a better place to live in by changing the style of the buildings. The products of the new form-based codes have so far still been primarily stylistic. Although they also contain certain practical benefits for living, they are fundamentally making changes only in the *appearance*, not in the underlying substance or social-spatial fabric, of the communities they create.

What does make a neighborhood a good place to live in is the experience of inner psychological freedom, the freedom

in the air, the possibility of unconstrained activity and interaction, emotionally satisfying work, an atmosphere of enjoyment, and the invitation to be alive. It includes a certain friendliness. It includes the sum of the activities and interactions that occur there. It includes ownership by everyone in some degree, a situation in which streets and blocks control their own destinies.

Actual freedom, this liberating and nourishing kind of freedom, does not come from the style of the buildings; it comes from the way people feel ownership of the place, and that, in turn, comes from *the way the place has been generated*, and by the way it is continuously being generated as its life goes forward.

Specifically we may say that this nourishing quality will arise in a place to the extent that three things are respected:

1. The land: What is built preserves and extends the deep structure of what is there already.⁵
2. The people: What is built comes from the actions and wishes of the people who live and work there, not from a faceless corporation.
3. The communal spirit that is felt: The work of generating the place comes from the heart, and has at its root a spirit of communality and love of life that is palpable, and can be experienced because it is visible, and above all, because it is truly there. The social life of a neighborhood comes about from the existence of a profound, articulate public structure in the space, which bestows community, and the opportunity for community, on the people who live there.

We believe that certain recent experiments have now begun to demonstrate—at least on a preliminary basis—that newly built neighborhoods created in this better and more generative way fundamentally alter how people living and working there feel about the place and about themselves.

We are very much afraid, however, that—although they are vitally important—these three considerations have so far been almost altogether missing from contemporary development, including New Urbanist development.

That is because New Urbanism and its experiments, just like virtually all other contemporary forms of architecture, have been built on the foundation of modern development as a *mechanical process*, without sufficiently questioning the assumptions underlying this process or getting to the root of these assumptions. Because the New Urbanists have so intensely desired to succeed in a practical way, and implement large areas of built projects, they have embraced, without enough critical awareness, the machinery and the monetary and control structures of the modern developer, lock, stock, and barrel. That is to say, they have embraced the very thing that was, and is, the origin of a great part of our environmental ills in the first place.

In addition, they are also trying to solve the problem at the level of physical design, which requires some kind of perfect blueprint executed by a faithful builder or developer. But what we are learning now is that nature doesn't work that way, and the best projects are generative and continually adaptive, not master planned. The solution is going to have



FIG. 5A AND 5B Stakes for house lots, streets, and building masses in a neighborhood in Santa Rosa de Cabal, Columbia, and the site plan arising from this process. All these stakes were placed by family members themselves with help and guidance from Center for Environmental Structure staff.

to be a new kind of evolving, adaptive, generative, design-build approach.

History of Experimental Projects with Generative Codes at the Center for Environmental Structure

Work on generative codes, mainly in private contexts, began in the late 1970s at the University of California and the Center for Environmental Structure (CES) in Berkeley. The following is a summary of our experiences in these kinds of projects.

Since the appearance of *A Pattern Language* in the late 1970s, Alexander and his colleagues have been engaging in a long series of experimental projects, all designed to deliver communities and neighborhoods that are more “real”—that is to say, more focused on the human aspects of spatial and social structure, and how real people actually feel about their environment—and endeavoring to produce a built environment that truly makes people happy in their day-to-day lives. All these projects have been designed to overcome the shortcomings of modernistic architectural development projects, largely because they have used entirely different means of design, planning, production, and procurement.⁶ In recent years we have also been working rather consciously to make progress in the very direction where we observed our colleagues working on New Urbanism, and its form-based codes, most seriously at fault.

Unfortunately, the difficulties and challenges involved increase exponentially with an increase in scale. To obtain projects that would demonstrate these concepts on a larger scale, therefore, requires certain agencies being willing to create a bubble in which pilot projects can take place.

To do this we have taken an intuitive approach, in which we place the feelings of people at center stage, and allow that to guide a process of design and construction that is able to produce the real thing.⁷ This means that we try to shape our procurement processes in ways that improve human beings’ sense of belonging to the communities that are created. This simple rule of thumb, this attitude, has guided most of our choices, and insofar as it has been practically possible, we have taken every step to make this one aim has been the center target.

To achieve these results we, like Andrés Duany and his colleagues, took off from our own findings in *A Pattern Language*. But the directions we took were different.⁸ Duany and his colleagues, in their form-based codes, made the attempt to codify and *require* that pattern-like entities be embodied in the geometry of the design, in the form of simply expressed and rigidly enforced rules, *while leaving the process of procurement largely unchanged*. In our work at CES we paid as much attention as possible to the process and tried to create (new) formal ways of supporting a more humane and more involved process, which included the inhabitants and neighbors of the project in hand, and had the intrinsic quality that its steps would heal the surroundings and heal the community itself. Thus we con-

sciously focused on the process that would *generate* the deep structure of the world we were responsible for, and it was this generative emphasis that gave our work its meaning and result. Hence the term *generative codes* has gradually emerged as the best descriptor of all the work we have been doing.

The following table shows a strong correlation between two variables:

A. The number of generative features present in the development process by which each one was created, and

B. The success of the different CES projects, in creating life, as judged by people familiar with the project.

See the last two columns in the table.⁹

The two evaluations of the nineteen projects were submitted to a rank-order correlation test.²⁹ Spearman’s correlation coefficient (ρ) is 0.67, which is very high for such a small sample. This degree of correlation among nineteen items is significant at the 0.002 level, meaning that a correlation this high would have occurred by chance only two times out of every thousand random trials.

The nine columns (3–11) stand for nine features of the procurement process, present or absent, in the way each of these projects was handled. One may say that these various projects turned out well in rough proportion to the number of YES indications that appear next to them. Turning out well, in this sense, means that in the resulting environment there is, to a strong degree, human satisfaction: the place is considered beautiful or pleasant; people report a wholesome feeling from being in the place.

It appears, then, that the presence of these features in the procurement process correlates positively with the success of the ensuing project. So, after several decades of such experiments, we may now say that our evidence strongly suggests that the following aspects of the procurement process play a vital role in people’s satisfaction with the results:

- The creation of a neighborhood always starts with respect for, engagement in, and careful enhancement of the community life of the neighborhood, even in its smallest details.
- Clients and users had a major part in the creation of the pattern language that was the basis for the generative code.
- To feel genuine satisfaction and identity with a neighborhood, the clients themselves and users must physically play a significant role in laying out buildings, streets, dwellings, and public spaces.
- Further, it makes a real difference when people do this on the ground, walking around together on the land itself, placing strings, stakes, and markers, reaching a mental state where they almost feel that the buildings are already there.
- It also makes an enormous difference to the success of the project if the plans are drawn *from* the stakes left in the ground (the opposite of what happens in typical production processes and housing construction procurement today). This can be achieved economically by use of high-tech surveying methods that allow a direct translation of the field position of a stake to the digital drawing that defines the project.

SOME OF THE EXPERIMENTAL PROJECTS DONE BY CES

A This column shows the number of generative features (from the nine features in columns 1-9) that are present in the process that formed each project – the number of YES's in the row.

B These numbers show our own intuitive evaluation of the finished environment in each project, in human terms and when judged as a healthy and wholesome place to live, on a scale of 1 to 10 (10 being the highest).

FEATURES OF THE PROCUREMENT PROCESS		Primary focus on growth of community as the main object of procurement process	Pattern language by clients	Layout by clients	Layout on the ground	Drawings done after layout (not before)	Direct construction management	Budget under our control	Subs directly controlled	Focus on well-being of the human community guided every phase of work	A	B
PROJECTS												
Modesto ¹⁰	1975	YES	YES	YES	YES	YES	NO	NO	NO	NO	5	2
Mexicali ¹¹	1978	YES	NO	YES	YES	YES	YES	YES	YES	YES	8	7
University of Oregon ¹²	1981	YES	YES	YES	NO	NO	NO	NO	NO	NO	3	4
Shorashim ¹³	1982	YES	NO	YES	YES	YES	NO	NO	NO	NO	4	3
Sala ¹⁴	1983	YES	YES	YES	YES	YES	YES	YES	YES	YES	9	6
Guasare, Venezuela ¹⁵	1983	YES	NO	YES	YES	YES	UNKNOWN	NO	YES	NO	5	4
Fresno ¹⁶	1985	YES	NO	NO	YES	NO	YES	YES	YES	NO	5	6
Eishin ¹⁷	1985	YES	YES	YES	YES	YES	YES	NO	YES	YES	8	9
Pasadena ordinance ¹⁸	1987	NO	YES	YES	YES	NO	NO	NO	NO	NO	3	3
Whidbey Island ¹⁹	1988	YES	YES	YES	YES	YES	YES	YES	YES	YES	9	10
Emoto ²⁰	1989	NO	NO	NO	NO	YES	YES	NO	YES	NO	3	6
San Jose ²¹	1990	YES	YES	YES	NO	NO	YES	YES	YES	YES	7	7
Colombia ²²	1991	YES	YES	YES	YES	YES	YES	YES	YES	NO	8	5
Upham ²³	1992	NO	NO	YES	YES	YES	YES	YES	YES	NO	6	8
Agate housing ²⁴	1993	NO	NO	NO	YES	YES	YES	NO	NO	NO	3	5
Texas ²⁵	1994	YES	NO	YES	YES	YES	YES	YES	YES	YES	8	8
West Dean ²⁶	1995	YES	NO	YES	YES	YES	YES	YES	YES	YES	8	10
Sullivan ²⁷	2000	YES	NO	YES	YES	YES	YES	YES	YES	YES	8	7
Sanders ²⁸	2004	YES	NO	YES	YES	YES	NO	NO	NO	YES	5	7



FIG. 6 One of the alcoves in the Linz Café, Linz, Austria.

- Possibly the biggest single factor is the control of the project through construction management, not by a general contractor, but by a project manager who directly controls budgets and subcontractors, and who is in touch all the time with the members of the community.

- Further, it makes a great difference if money explicitly enters into the process, such that the contract documents control the total contract price but also allow flexible reassignment of line item costs while the process moves forward, so that matters of importance can be addressed during construction without raising costs.

- It is also vital that subcontractors are directly controlled by the architect and local families, under the supervision of a project manager, so that many hundreds of small adaptations can be made as the project advances without causing delays or cost overruns.

- In conclusion, we believe that even when housing has to be built without community and without real people as clients, the creation of the housing must be handled in a form that introduces community and unfolding from the first minute of the first day. And the project as a whole is seen as a human endeavor, not as a technical endeavor, and that this human endeavor has as its continuing, principal object the day-to-day enhancement of each individual in the community, so that they can then give back to the community, the well-being that they have received from it.

These nine features summarize the content of columns 3–11 in the table. We believe, and to a first approximation have now demonstrated, that these nine aspects of project management and procurement play a key role in allowing people to feel affection for the places where they live and work, generating a community atmosphere, enhancing the degree of life experienced, and encouraging positive feelings among neighbors and respect for the place they live in.

The fact of a high rank-order correlation of 0.67 between the presence of these nine features of a development process, and the experienced quality of life in the finished projects, with the correlation deemed statistically significant at the 0.002 level, CANNOT BE UNDERESTIMATED. For the first time, we believe we have the bedrock of an empirical finding, which opens the door to empirical and practical re-assessment of the entire modern process of environmental development.

The Process of Procurement

From the very beginning of our experiments, the most important lesson we learned over and over again was that it is the process of procurement, above all, that *must* be modified. By procurement we mean the *entire process*, from beginning to end, starting with the first conception of the project and including: the involvement of clients and potential inhabitants; design and planning; obtaining permits and budgeting; project management, construction management, and management of contracts and subcontracts; and finally the physical construction, plant life, and ecology. Design is only a very small part of all that. It is vitally important, but not nearly as important as the process of procurement as a whole.

The reason for placing such importance on the procurement process as a whole is easy to explain. In the normal procurement process—the one that is standard for modern developers—the sequences of the project are rigidly divided into phases. Each of these phases is begun, completed, and then handed on to the next process. Because this entire present-day procedure is mechanical, the result, not surprisingly, is mechanical as well.

In the kind of procurement we have practiced, the different players pass in and out of the overall procurement procedure, much like threads of a multicolored skein of wool, where the different colored threads pass in and out and in again, while together the threads all run through the skein from beginning to the end, always focused on the well-being of the whole.

Consider the following players in a typical community:

- Individuals who live there, initially, already
- Individuals, families, and businesses who are likely to enter the new community
- Planning officials of the local authority
- Architects who work with the community
- Developers who provide some capital for the construction
- Engineers who deal with soils and/or other existing

conditions requiring remedial action

- The project manager who oversees the process in its entirety
- Community advocates who play a role in helping make sure that individual persons are represented and involved all the way along
- Banks or lenders who have a financial stake in the new neighborhood
- Construction contractors and subcontractors
- Craftsmen
- Children of the families
- Ecologists taking care of the existing fauna and flora
- Local business support services

In a successful project, one which captures the qualities we listed at the beginning, all these different types of persons and professionals are involved, and must be involved. But it is not sufficient for them to be involved merely at the beginning, in a token meeting or *charette*—one meeting is not enough. All of these individuals need to pass in and out of the process, continually, as it moves along. They contribute when they have something to contribute or when they are needed. Their timely involvement in the project is manageable—and as we ourselves have seen on various occasions, it can be managed successfully, in practice.

For coherence of organization, the entry of all these different people into the project needs to be orchestrated by a designated project manager, who works for a fee, not for profit, and under the guidance of a generative code. Most important, and perhaps most notable, the developer is not the primary player, but rather just one of the players whose interest in the project is financial. His financial interest does not give him the right to control the situation. Rather, he must play his role appropriately and help to nurture the complex process that is going on. In our view, it is the project manager who has the primary responsibility for bringing the different players in, at different times and on many different occasions, as required. It is also his responsibility to safeguard the coherent unfolding and the myriad internal adaptations of the whole.

The generative code is the document that oversees this process and provides the chart and organizational backbone for the project manager's actions, as well as the weaving in and out of different players at appropriate moments in the process. This code sets out, as clearly as possible, the steps that must be taken, in their rough order, and the people who are most appropriate for each step. Each element of the code embodies a decision that unfolds the whole, at its proper place and time, and this generative code is constructed so that the whole—the neighborhood, all its personal and indi-

FIG. 7 A festival in Eishin Square.





FIG. 8 Students in an arcade.

vidual details, all its subtle adaptations of buildings to one another and to the land—is taken care of, gently, by the way construction management and contracts are handled.

These are examples of how generative code unfolds the whole:

- Existing businesses within the neighborhood are protected and the community integrated into the new construction so that current jobs and economic flows are protected, so the community grows as a whole.
- Unfortunate housing and vulnerable families are supported by inclusion in the new neighborhood, and their unique characteristics are encouraged to become part of what emerges next.
- Main pedestrian places are chosen by community members walking the site and looking at the most beautiful places, views, and spots that have a settled feeling.
- Gardens are chosen, when possible, by the families themselves, so that their house is related to a piece of land they like.
- The internal layout of each house is made (whenever possible) by the family who will first live there, and they do this by placing blocks on the slab, so that interior walls and partitions are based on the real feeling that has been marked

in the actual place.

- Windows are placed from the inside of each dwelling, after rooms have been decided, so that views and light are as beautiful as possible for each room in the house.
- Ornament is done in brickwork, leadwork, and interior plaster: inexpensive ornamentation is provided by the craftsmen within a tight budget provided by the project manager.
- Outdoor walls, balustrades, seats, and fountains are provided from a community budget: householders in the vicinity decide on the layout, and provision comes from a line item in the budget allocated to this purpose.
- Public gardens and main pedestrian thoroughfares are laid out with walks, trees, low walls, seats, fountains, and views over local landscapes.

This is where the depth and power of the generative code comes from.

If we hope for a better architecture, we must learn, and acknowledge, that the subtle structure of a created environment depends almost entirely on the key features of the procurement process. Generative code drastically changes, redirects, and improves the procurement process so that the better architecture we hope for can be achieved.

Operational Underpinning of a Generative Code: Independent, Community-Oriented Project Management

How then, is this to work? Most important, how does a generative code make it work?

The motive for making money must be tempered by a motive to create a beautiful and healthy neighborhood with a coherent, integrated, caring attitude toward community that brings quality of life to its inhabitants. All this must be done through a new and presently unfamiliar organizational configuration.

In order to understand this, let us review the most basic project management tool: a PERT (program evaluation and review technique) chart. A PERT chart describes the events that will occur in a complex project, the length of time each event is likely to take till completion, the time sequence in which these events must occur, and, most specifically, the precedence relation between events (e.g., event A must be completed before event B can start).

In the field of construction these events are usually confined to the actual construction itself—although certain non-construction preliminaries (such as getting permits) may also appear on the chart—mainly because they have a crucial capacity for damaging effective completion if not taken into account and undertaken in time.

Now, in pure building construction itself, it is perfectly obvious that different events or jobs are interdependent, and that the emerging whole we think of as the building is unfolding gradually. This is in no way mysterious, and no one expects that the building is going to appear magically on a certain day. But in community building, when we make a

neighborhood, we face a different, more complicated task. The idea that planning, design, community building, adaptation, and so forth are all necessary events, and necessarily part of the work of community building and healing the environment, which must continue through the procurement of a building, is not yet familiar; yet when we think logically about the myriad decisions that must, in a sensibly conceived neighborhood building project, occur in an interdependent and partially sequential fashion, then the idea of design, planning, and even wider fields of expertise and cooperation as part of a network of interrelated actions, begins to appear perfectly sensible, necessary, and indeed inevitable in a building project.

The items that appear in a generative code are capable, for the first time in any forceful public instrument, of dealing explicitly with the codecision making of people in a community. They deal, explicitly, with the priority of community and individual values, and with the idea that these human values must have priority over all development policies and over all methods of development that may be put forward.

We must now face the issue of money and profit, and focus especially on the current confusion between privatized

action on behalf of social values, and the potential risks and realities of this proposal.

The focus on community, and the necessity of careful attention to many vital community issues *that do not generate profit*, has not been adequately discussed. It is no secret that developers are motivated, in most cases, by the opportunity to make money out of land by increasing its monetary value. Most often this has been accepted by local governments and national governments who seek to justify and benefit, second hand, from the developer's profit motive, by being able to rely on said developers to do what the government cannot do or no longer wishes to do—that is, provide the needed capital for the huge investments required.

However, there are abundant examples of ways in which this kind of policy has backfired in recent years. The fiasco of private developers who were encouraged to take over public education at the elementary and secondary level is an excellent example. The developers rapidly moved to place priority on profit, ahead of educational aims, causing a shabby education for students. The romantic image of old-fashioned private schools as a source of excellence has no reality in these recently created schools, as present-day values do not correspond to the values built into those historic institutions, which were solid, and untainted by the desire to accumulate wealth. The modern version of this idea, using developers who have no history of educational wisdom as money-making protagonists who do it for profit, from a distance, just does not work.

A similar problem has arisen in many cities, where property developers opt for massive land clearance instead of selective infill. This has caused anguish among communities who see their own heritage, no matter how poor, being torn up by developers for whom it is less trouble to raze communities and build from scratch than to build and heal, through carefully poised improvements and infill buildings, which require more discussion; this is inconvenient for the money-oriented machine.

Simply put, all community building, and, in particular, the kind of community building supported by the use of generative codes, requires an independent and scrupulously professional project manager as the chief of operations, for several reasons:

First, the subtle interweaving of decisions, made by different interested parties in a community, can only be undertaken with success by a person dedicated to *this* task—not only to the bottom line. The field of project management, especially if coupled with people from a social service background—anthropologists, community field workers, and so on—can deliver the community project in a way that does achieve a built and grown community.

Second, it is the specialized field of project management that trains people to thread their way through such complexity while holding fast to cost and time targets.

Third, even this will only work when the project manager, or project management team, is independent: that means able to stand completely outside the profit cycle, and untainted by the mixture of motives that present-day con-

FIG. 9 The Upham House, Berkeley, California.





FIG. 10 Bridge with students.

struction and development are inevitably subject to. Indeed, it is not only the overall process set in place by the generative code that must be handled on a project management basis. We believe that the construction activities themselves must be run by an independent project manager who controls subcontractors directly, not thorough the conduit of a general contractor.

Fourth, the project managers can only be placed in a reliable and ethically sound position by a fixed-fee form of payment, the fee set as a flat percentage of the project cost. It is our experience that this arrangement generates trust and, of course, has the effect that all money saved is placed back into the project construction funds and then accrues to tangible improvements in the project. Any form of arrangement by developers, contractors, or project managers that allows savings in the project to go to the pockets of the individuals and companies concerned, works against the community, and ultimately robs it of just that increased value that the project management plus generative code are capable of bringing in.

It is also our sad experience, gained on many continents, that whenever standard contracting or development arrange-

ments are in place, whenever an opportunity arises for money to supersede human values and the human value of the community building process, then sooner or later the project goes wrong. Whether it is small-scale petty thievery (eighty sheets of plywood double billed on successive invoices), medium-scale (routinely tripling cost proposals for change orders), or large-scale (motivations for land deals that encourage a developer to make inappropriate suggestions of land coverage and density in order to further their own financial aims)—the result is always the same. It is not only the petty and major thievery that causes harm. What causes the most harm is that, in such a climate, no one associated with those motives can maintain clean hands, and the really important issues—of individual participation, community trust, the health and welfare of land, trees, houses, windows, paths, gardens, and even seats—all become tainted and ultimately destroyed. This is not a pretty picture, but it is familiar to all of us, from countless development projects, in countless nations.

For these very reasons we at the Center for Environmental Structure have operated for thirty years as nonprofit contractors and developers. People have trusted us because we wished to strengthen the basis for strong communities, which



FIG. 11 Yellow boat made by the students in front of the student cafeteria, which they also helped to lay out.

became possible only because we operated outside the predominant system.

Of course, the all-important question remains: What is to be developers source of capital? It is very clear that the emphasis on community described here cannot be accomplished through the goals and attitudes that large-scale developers typically hold today. Their role needs to change and other sources of capital must be found. There are a number of possible solutions:

1. Developers are invited to take part as financiers, but the return on their investment is carefully regulated. They are not entrusted with running the development process itself unless they can demonstrate an understanding of how to implement generative code. They are not allowed to tamper with the community-inspired aspects of the process.

2. Government finds ways of providing loans to other institutional entities at the community level, such as loans to nonprofit land trusts and groups of individual house owners.

3. In the United States, at least, a tradition of nonprofit developers has been growing up. It is in its infancy, but it creates an industry-wide precedent for development that is fee based, not profit based, and professionally committed to

healing the earth and making good environments. The experience of these nonprofits demonstrates that there is no necessary functional linkage between good neighborhood management and the making of profit, and therefore no reason to go on relying on commerce and profit as the necessary underpinning of successful neighborhood development. The belief that this is inevitable and necessary is little more than an old wives' tale.

4. Patient money is obtained from long-term investors, and from investors who require a moral commitment to positive healing of the earth from their investments.

5. It appears very likely, to us, that the key issue, at root, may be the present coupling of land speculation with zoning ordinances. It is a fact that most present-day developers make their money not by providing a service that heals communities and land, but by buying land cheap, manipulating the zoning process to gain permission for greatly increased land use, and by cashing in the surplus. This process, even when engaged by benign and altruistic people and companies, cannot help being steered towards the increase of land-use density as the principal goal—something usually irrelevant to the best interest of the community. Careful analysis of this topic can lead to entirely new forms of fi-

nance and investment, separated from the glitter of cash and oriented towards the real goal of a healthy environment.

Undoubtedly other solutions can be found by industry players who are committed to building vibrant, sustainable communities and choose to support such ventures both at home and abroad.

But it is in any case imperative that the dangerous effects of the commercial system presently in place be understood, and that the community building motive, paid by a fixed, contracted fee, be allowed to take its place ahead of any profit motive. Our experience suggests some promising avenues to explore. As a starting point, independent, community-oriented project management must be supported as the major tool of development, in a way that is coupled with generative codes of the type we have described.

Placing Practical Emphasis on Respect for Individuals, Respect For Land, and Respect for Continuity

To further explain our misgivings about the current procurement process, we offer this analysis. The standard process, which has been in place for about half a century, works through a very limited kind of efficiency that is, at its core, mechanical. It uses mechanical forms of cost accounting, mechanical approaches to human work, and mechanical approaches to profit. In order to achieve the results we have been able to achieve, we had to intervene in the procurement process. We did this, essentially, by starting from scratch and by rebuilding the procurement process from the ground up. We did not do this by appealing to any theory or to any pre-established notion of how it should be done. Rather, we simply did it by doing whatever seemed intuitively *necessary* to do to get the right results—results that were intuitively wholesome, which engaged people's affections, and which led to results that made people happy and the environment healthy.

Our experiments in procurement were, in many cases, risky since we needed the courage to try methods in which we had little experience. It was part of the given that we had to take control of decisions we had not been trained to take, and we had to try methods and procedures that were, in many, many cases, untried. We had to risk failure; we had to use the compass of instinct even when those who believed they "knew better" advised us against what we were doing on the grounds that it was risky.

- We did our own contracting.
- We used new kinds of contracts.
- We worked to fixed costs.
- We engaged the people we were working for in the initial pattern languages.
- We engaged people in the actual layout process.
- We used physical models and full-size cardboard and tape mock-ups to settle difficult points.

- When necessary we modified building code requirements on our own steam.

- Staying within budget was always a vital part of the process.

- We allowed time to slip when that was necessary.

- The one thing that led us was always *the health of the whole*. This took priority over everything else.

From what has been said before, the morphogenetic sequence—the sequence that permits coherent unfolding of the whole—does not easily fit together with the present practice of development, whether this be free private enterprise development as practiced in the United States and Western Europe, or the kind of government-sponsored housing undertaken by local authorities or federal and state governments.³⁰

In either case, the developer takes the risk, the bank lends money against this risk, and the insurance against risk—which both developers and banks experience—is provided by a highly rigid and mechanical process. Unfortunately, that makes the recipients of the housing—the public who walk and use the land within these areas—pay an immense price for this insurance: namely, they have an inhuman, sterile, and impersonal environment, thus disconnecting people from society and from land.

A Decisive and Lasting Change

This decisive change, if it is to take root, cannot avoid a confrontation with the issue of development, as we currently understand it, and developers.

In the last fifty years it has almost always been assumed that the way to get construction of neighborhoods to meet the growing world population is through the "good offices" of a developer: a person, or an institution who is willing to take the financial risk, undertake the huge effort of management, and who will, in short, get things done.

This is, of course, a rampant nod to commercialism, which, if we did not live in such a commercial era, would be seen for what it is. The life of a community cannot be held hostage by a person or corporation who seeks to make money and profit from the construction of its streets and buildings. The streets and buildings are part of the neighborhood's lifeblood, the city's lifeblood, and they must be interwoven with the activities and life of the people themselves. Anything less leads inevitably to drug abuse, crime, teenage violence, anomie, and despair—the very earmarks of twentieth-century urbanism.

This mistake was so deep-seated in the United Kingdom, for example, that the Labor government, and specifically the office of deputy prime minister John Prescott, laid their entire housing program on the foundation of development as usual, and on the primary role of the commercially motivated developer.³¹ In the programs this Labor government set in place from 2000–2005, it was therefore the developers who told the cities what to do and how to do it within the commercial system they were used to. The



FIG. 12 Some of the seventy families working on their houses in a new neighborhood.

people in their natural communities were bought and sold, and held hostage, by a very few developers who were far too careless with the lives of those for whom they were ostensibly working.

A successful policy in which developers play a major role in the future can only be trusted if it is coupled with the reorganization of the development community along professional, fee-based, nonprofit lines. The reorganization of development, creation of new legal controls and guidelines that fundamentally alter the way a developer enters into the growth process of a community, must be the bottom line of a successful policy for building and rebuilding neighborhoods. Generative codes, together with the radical shifts in power and control, and changes in responsibility of planning officers, inhabitants, and builders alike, are—in one form or another, we believe—the only possible foundation for the way successful neighborhoods can be created.

It is the generative codes *themselves*, their widespread use, and the widespread acceptance of the vision these new codes embody that matters most. The use of these codes, if properly done, will include vast changes in our

view of land, changes in our way of caring for both urban and rural land, and massive involvement of communities and businesses in the planning, construction, and repair of neighborhoods. In all likelihood, in the long run, it will wash away the system of zoning and its ills, and replace both that system and the operational behavior of city planners with new visions.

But to be quite honest, we do not yet know which group of people in society are most likely to emerge as leaders of this new kind of generative process. Where will these leaders, competent and inspired to use generative codes for the widespread benefit of society, come from? They could conceivably be architects—unlikely, but possible. They could be a new breed of developer, with a more actively engaged moral sense. They could be community leaders. Or, as suggested above, they could be project management engineers, infused with a strong dose of anthropology and people-oriented skills.

It is too early to tell. But in any case, it is the opinion of this group of authors, that generative codes, and all that they stand for and make possible, will lie at the core of a new era in human reconstruction.