

SUSTAINABILITY AND MORPHOGENESIS

THE BIRTH OF A LIVING WORLD

SCHUMACHER LECTURE, BRISTOL, OCTOBER 30, 2004

Christopher Alexander

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Christopher Alexander

University of California, Berkeley, and University of Cambridge

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PREAMBLE TO THE LECTURE

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The core issues of sustainable development, as presently understood, are the following. They may loosely be grouped into technical and philosophical issues and I have grouped them in this way:

Technical issues

- Protecting and recycling all natural resources
- Saving soil and water resources from exploitation and erosion
- Taking measures to protect planetary climate stability
- Reduction of wasteful energy consumption
- Using appropriate green building materials
- Developing renewable non-destructive cycles of food production, material production, and land management.
- Development of non-destructive energy sources such as solar energy, tidal energy, and wind energy
- Water and waste management are carried out in a way that recycles water and uses refuse and waste for fertilizing land.
- Recovering and maintaining bioregions.

Social and Philosophical issues

- Birth control to help reduce and stabilize the earth's population
- Protection of vanishing and threatened species
- A good spiritually healthy relation between inhabitants, users, communities, and their environment.
- Physical and social health of the environment.
- Protection of the natural ecology of plant life and animal life in their relation to human life.
- The economics of sustainable thinking are introduced to overcome the negative effects of large scale corporate development.

Let us now turn to the key empirical propositions of my lecture. I claim that when environments are generated by morphogenesis – that is to say, by morphogenetic processes – they will then have the following qualities:

- First, by the very nature of morphogenetic processes the environments generated will, of themselves, support and encourage contemporary technical issues of sustainable development.
- Second, they will also encourage, sustain, and encompass a large number of key social and philosophical attributes which the adherents of sustainable development wish to reach, but which present day technical methods do not achieve.
- Third, our environment-building activity will step back from its present technical orientation and vision of corporate gigantism as a source of solutions to sustainability, and begin again, from a deeper source, with a primary orientation for all society to achieve health of the whole in the largest sense,

and to develop new solutions to individual issues of “sustainability” from a deeper understanding of wholeness.

In short, these are the key empirical propositions of this lecture:

- (1) When environments are built by morphogenesis they will of their own accord become sustainable.**
- (2) Among strategies for dealing with sustainability, morphogenesis alone can deal with ALL the issues of sustainability together.**
- (3) This effort will reorient all our efforts, and achieve the deeper agenda of the sustainable movement, in a form that is more profoundly satisfying, and more in keeping with our social and cultural aspirations.**

THE LECTURE

Bristol, October 30, 2004

Oh what a lovely welcome, thank you. I am very honored to be speaking before you. Thank you so much.

I Preface

I am on a rather delicate ground in what I'm going to say today. I know how much careful thought has gone into the issue of sustainability, and I know that hundreds of advocates and devoted sustainability enthusiasts are sitting in this room. And yet... and yet... I have developed a serious concern about sustainability (in its contemporary meaning) which I hope we will share. But it may make you uneasy. During the course of this lecture I am going to try to link sustainability (as it is so often thought of today, from a technical point of view) with another, second meaning of the word, which fewer people think of. This second meaning of the word, which is so far removed it is almost another topic, refers to the wholeness of the land, the extent to which we see our land (rural, urban, or wilderness) as sacred, and the extent to which we treat our interaction with the land as a sacrament. The extent to which we recognize the beauty of what we make in the land is of paramount importance. It is not just an add-on or a luxury. Rather, it goes to the core of what sustainability really is. And I'll try and explain why I think so and what that involves. And, coupled with this, there is the issue of spirit. I was brought up as a Catholic. But what I'm to say about these matters has little to do with what I learnt as a Catholic. It has to do with empirical findings connecting the process of morphogenesis – those processes which bring life to the land – to issues which deeply touch us -- the human soul. If you don't believe in the soul, that's all right; you can call it what you like, or if you wish call it nothing at all. I am fairly sure I will still be able to make sense of it for you in perfectly straightforward fashion that is empirical and grounded in experience.

Now, briefly put, what has been worrying me about our current view of sustainability, is that the enthusiasm for technical gismos and for technical analysis and solutions, whether it be in the realm of transportation, or in the realm of air quality, or many other aspects of sustainability that can be expressed in practical terms. Of course those things are in themselves sound, but they are very, very one-sided. And so a world built according to the present sustainable paradigm, the technical sustainability paradigm, would be quite a horrible place. Perhaps many of you may wonder what on earth I am talking about when I say this. During the lecture I'll show you some pictures to explain what I mean. But even without pictures, we may be able to agree that anything that is too one-sided has great pitfalls. If you look, for example, the built world only in terms of money, you run into terrible problems. We all know how that goes. If you were to look at everything in the environment from the point of view of structural engineering it would be hopelessly one-sided, too, and one couldn't accommodate what happens to cows in a field, or what happens to children with their mothers. So you really cannot deal with things from the point of view of one particular limited perspective and hope to see the whole. Our present technical view of "sustainability" -- the focus on renewable resources -- is such a one-sided perspective. Of course, the issue of making sure that resources are renewable and taking care that we don't run ourselves into a dead wall of energy, food, and water,

and damage the planet as a system, is of colossal importance, very, very serious... I in no way wish to belittle it. But the current technical view of this problem is nevertheless very, very one-sided, and I hope to persuade you to move, with me, in a direction which is less narrow. And less dangerous.

And, please let me give a small warning and an apology. In this lecture you'll please forgive me because I'm drawing things from the four books of *The Nature of Order*, which have just been published, and I can't summarize 2,000 pages in 40 minutes. So if some of it seems unclear, or too fast, please examine a slower and more detailed version in the four books.¹

II Introduction To Morphogenesis

Things in the biological world, almost by definition, are created continuously by morphogenesis, that is by a process which is all the time growing and adapting, whether it be in a growing embryo or in a forest or a field, and which gives form, progressively, while growth and change and adaptation are happening.

In real morphogenesis the form of what is coming, or what is about to be, is always drawn from the form of what was in the moment just before. That is, things are always going like that. If a tree is growing for 500 years, it is continuously unfolding from its previous state, and then what we see and recognize is first of all in itself a process. But even if you just look at it in its static state, it is at that moment the end product of transformations that have been going on, and on, and on. And these are the things which give it shape, form, and substance.

Traditional society also managed to do something very much like that – that is to say, morphogenesis -- with buildings, plazas, streets, fences, windows and so forth. And I shall show many examples of this phenomenon. But the point is that up until somewhere around a hundred years ago -- until it started to get off the tracks -- a human-inspired version of this natural morphogenesis, was going on whenever something was built. This was true of fields, forests, churches, houses, streets, even a window or a bench. Whatever it was, it was shaped, modified, shaped again, and adjusted and so on, and so on, and so forth. As a result of the morphogenesis and the complex adaptation that was possible under these conditions, the places people made had life.

The idea that we have inherited from the thinking of the last years is that when you build something you make a plan which is so detailed that it can become a specification for a contractor and protect you in a court of law if something goes wrong with a particular line of bolts. This legal reasoning began to dominate architecture and construction – and as a result of accepting it, we slipped into a fiction which was that it is actually possible to make a blueprint of a piece of the environment or the completed environment, and have it work. Now ***this is a fiction***. It is very clear that if it was applied to a human being or a daffodil it wouldn't work. Well, you can't make a daffodil that way, you can't make a human being that way even if you had all the micro tweezers in the world and a stack of blueprints that thick, and tried to assemble it. It's just a nonsensical idea. Because morphogenesis is of the essence in the way a thing achieves not only its beauty, but its adaptive

resources and its organization, which is beautifully adapted internally. And this morphogenesis happens at a tremendous number of levels. It's not just something large, it is happening at the cellular level, it is happening at the molecular level, it's happening in the limbs, it is happening in the skeleton, and so forth. I mean that hundreds of systems at different levels of scale are all adapting, moving forward, adapting again, and so forth and getting their shape in this way.

Now my hope in giving this lecture is that those of you who share perhaps an uneasiness about the too technical nature of sustainable architecture and sustainable thinking, that somehow by putting a model before you which deals with the very things that you have this uneasy fear about, about where it's all going, could be reassured, re-established in a different way. And that there then is a real chance of making the Earth precious, as it once was, and as it still is in various places. But also we have to face the fact that it has been desecrated in many places. Even for those enthusiasts of sustainability a wind turbine four hundred feet high may sound like a very good idea because of its potential impact on renewable energy. But if it is also a desecration of a quite a large piece of land, it's a bit of a problem.

And so we need to think about these things in a way that puts them in balance.

III Non-Sustainable Techno-Architecture

Now I think I'll show a few pictures.

First of all just to be clear about what I was just saying with regard to "techno-thinking", here are a few of the better-known examples. This is William McDonough's Ford plant in Detroit.



Grass on the rooftop of the Ford plant, William McDonough

It has grass on the roof, and somehow this was viewed as a wonderful step forward in sustainability. Now I don't argue that putting grass on a roof might not be a step

forward. It is a perfectly sound idea, and one that has been used for thousands of years. But is there any sense in this picture that this piece of grassland grew out of the land that was there before? That this was made to respect whatever land there was? This place doesn't have that kind of atmosphere at all. Without meaning to malign Mr. McDonough I think I have to make a guess that this was simply not in his heart when he did this.

Here is another important building from the pantheon of conventional sustainable wisdom.



IBM headquarters, Amsterdam, William McDonough



Interior of the IBM building, Amsterdam

This is in Amsterdam, the IBM headquarters in Amsterdam. Now this building may indeed have good materials or special ways of handling heating systems, perhaps water and so on. But its failure to honor and enlarge the land is really quite bad.

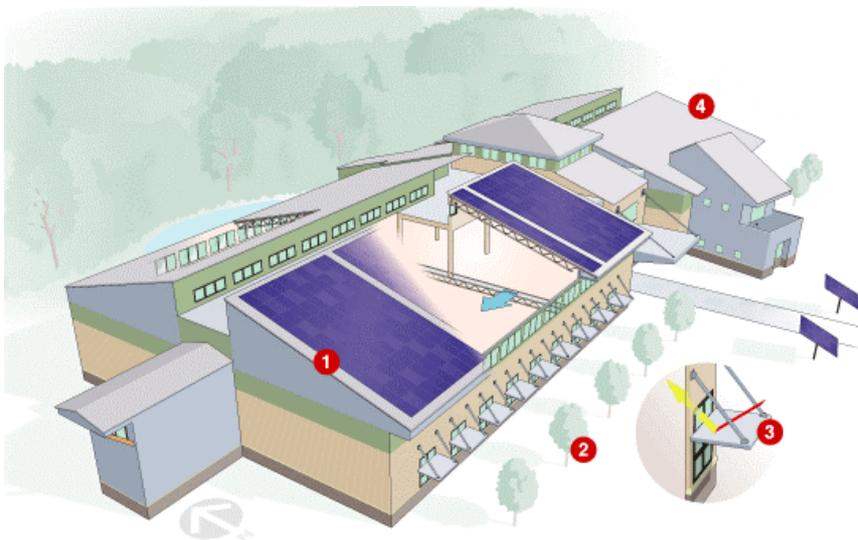
And here is another famous green building at Oberlin College.



David Orr, the Science complex, Oberlin College, Ohio.

What is positive about it, is that David Orr has very, very carefully chosen the materials. That is an important and good thing. But these sorts of landscapes! Is this what we want of the earth? I wonder how many of you think so? I do know that the situation is urgent. And, I suppose in a slightly simple-minded view one might say it's got a nice little curve on the roof and it is making an effort to be harmonious with the place where it is. But this is still really a very, very shallow nod to that kind of thing.

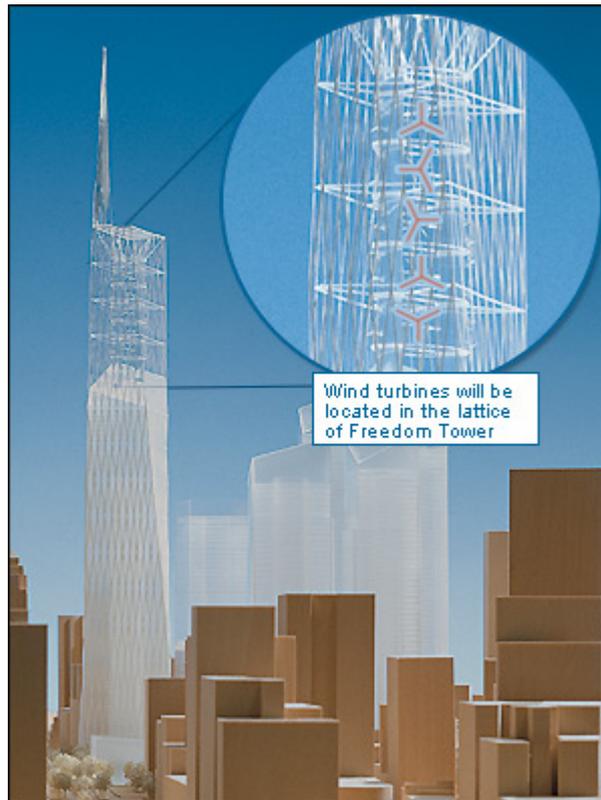
On the next page, I show further energy saving buildings. The last one is a little bit different. Again carried away by the enthusiasm for producing wind energy, one could say "Gosh, this is a step forward". But again, I don't think so. These projects do not help the land, nor do they support human feeling. Above all, they do not beautify the land in its own terms.



Cambria project



Solar panels



Freedom tower, Gotham

On the next page are two photographs from the recently built BedZed project in Sutton, outside London. This is perhaps the best and most imaginative, and most sophisticated sustainable housing that has been built so far. Yet even so, elegant and inventive as it is, it is still a technical product, which lacks the deeper properties of something truly living, or of something *truly* sustainable.



*BEDZED, zero energy development of 100 apartments at Beddington, Sutton, near London
architect Bill Dunster*



Aerial view of BEDZED

IV Respect For Land And Morphogenesis

In contrast to the previous highly technical pictures, here is a very ordinary bit of a not-very picturesque village in Sussex, about a mile from where I grew up, in Chichester.



Lavant, West Sussex

This is Lavant. I chose Lavant as an example because it is rather ordinary. It's not cute, it hasn't got thatched cottages in it. It's not Shakespearian. It is not antique or precious art-historically, rather it is made by a slow and gradual common sense process of morphogenesis. If you look at it carefully, you see how the this bridge was made, you know how it was started, you can read the order in which things were done, you can see progressive adaptations. The bridge was built narrower. Then the flared parapets walls you can see, were added. This, that parapet that comes off, was done to make the safety of the passage across the bridge easier. Then a side bit of bridge with a row of posts just so pedestrians could walk, when traffic became a little bit more. It's entirely un-pretentious. It has no pretension to be "designed," and it is also in no sense a high-end kind of beauty. It is very ordinary, but it is quite deeply harmonious.

That is a model of sustainable structure. And one has to ask if the Amsterdam IBM building could aspire in any way whatsoever to this sort of harmony in the land.



A street in Jaisalmir

Here is a place in Rajasthan, a small town called Jaisalmir, and shown here a lovely kind of street with houses where these adaptations were going on within a simple and very elegant framework. But you can see simply from the what people are doing and how they look that something has been achieved here which roots people in the land.

V Casy's Soliloquy from *The Grapes of Wrath*

To bring the point home, I want to read you a passage from Steinbeck, a very short passage, quite a beautiful passage. It's from *The Grapes of Wrath*, and it's before they set out from Oklahoma. Casy, the one-time preacher is ruminating, trying to decide whether to go or not, and he doesn't consider himself a preacher anymore. And he just talks about his thoughts.²

"I been thinkin" he said. "I been in the hills thinkin almost you might say like Jesus went into the wilderness to think his way out of a mess a troubles. I ain't sayin I'm like Jesus," the preacher went on, "But I got tired like him, and I got mixed up like him. And I went into the wilderness like him, without no campin stuff. Night time I'd lay up and look at the stars. Mornin I'd set and watch the sun come up. Mid day I'd watch the dry country. Evenin I'd follow the sun down. Sometimes I'd pray like I always done. Only I couldn't figure what I was prayin to or for. There was the hills, and there was me. And we wasn't separate no more. We was one thing. And that one thing was holy."

Now if we set our sights to the right place, that is what we need to be shooting for. That's not theology, that is an ordinary man speaking, of course through the mouth of Steinbeck. It's not high falutin'. The feelings are feelings that exist in all of

us, but in our age we have begun to accept a view in which we have basically been taught (and are often obliged, now, it seems) to forget about these feelings.

VI Real Adaptation And Fake Traditionalism

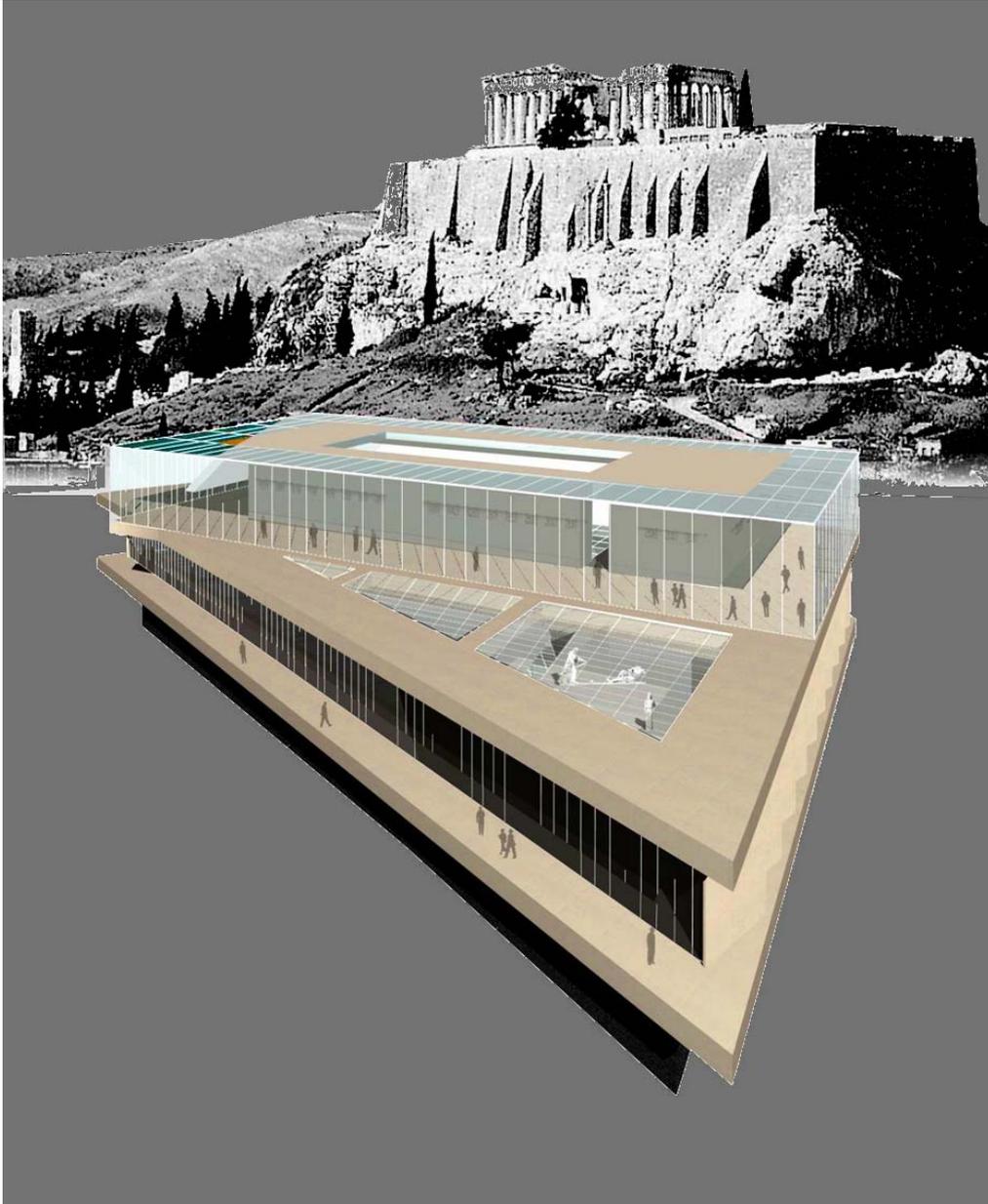
Now of course in England, the magazine *Resurgence* has done a wonderful job of directing our attention towards the living Earth, and away from purely technological sustainability. For years, now, *Resurgence* has been trying to move towards this kind of living thought and experience, and away from the purely technocratic. But the difficulty is to have a coherent frame of thought in which that something that is an embodying thing – the thing of Steinbeck’s that I just read out -- is actually present when we make streets, traffic lights, buildings, paths, and so forth. Yes indeed, the issue of “green” materials and so forth has its place. But this other matter of being one with the land, being what Steinbeck calls “holy,” is a very much different order of business, something deeper, something more all-embracing, something that goes to our essence as human beings. This is a deeper kind of sustainability, and a deeper kind of sustenance.



The Acropolis, 5th century BC.

Let me just go a little further. There on the rock, stands the Parthenon, after centuries of respectful adaptation to the land. And here, below (next page), is a picture of the new Parthenon Museum, in the position it is to occupy, praised by international architects, sponsors, and well-meaning, misguided, too richly-endowed foundations. Without the intention, I am sure, they have raped the land, destroyed the beauty and harmony that was built over centuries, with a shallow, money-guided image, to hold the treasures of the ancient Acropolis. But in so doing, the Acropolis itself is being destroyed.

What is destroyed is a very subtle structure, built gradually, with enormous sensitivity, and then destroyed by people who simply lack the understanding of that structure, and who could not see the lack of connection between the image of the new museum and the place which it is supposed to respect and extend, and deepen.



A profoundly destructive intervention: The new Parthenon Museum

The one thing this horror clearly does not do is to respect the land. Does it enlarge or enhance the structure that was there before? It does not. It is not even conceived within that kind of thinking. And so it destroys the possibility of that holiness that Casey was thinking about in the soliloquy I read.³



Development outside Pulborough, West Sussex

More of this kind of horror. Here is a development outside Pulborough, Sussex. Which is intended to be traditional. This has been a catch word for developers in the last decade or two. So it is vaguely aping the appearance of buildings that seem traditional. And in this example, this particular group of developers were trying really hard to persuade us that gosh, gee, golly this is almost like the real thing. **But it really is not.**

And here, another example of the same thing, also in Pulborough.



Another example of fake traditional: only a simulacrum

A simulacrum of the real thing. It is almost worthless, because it is not the product of real adaptation. It's just something which is pretending to be. The buildings do not have these shapes because of subtle adaptations – only to try and sell them by persuading people (falsely) that it IS the real thing.

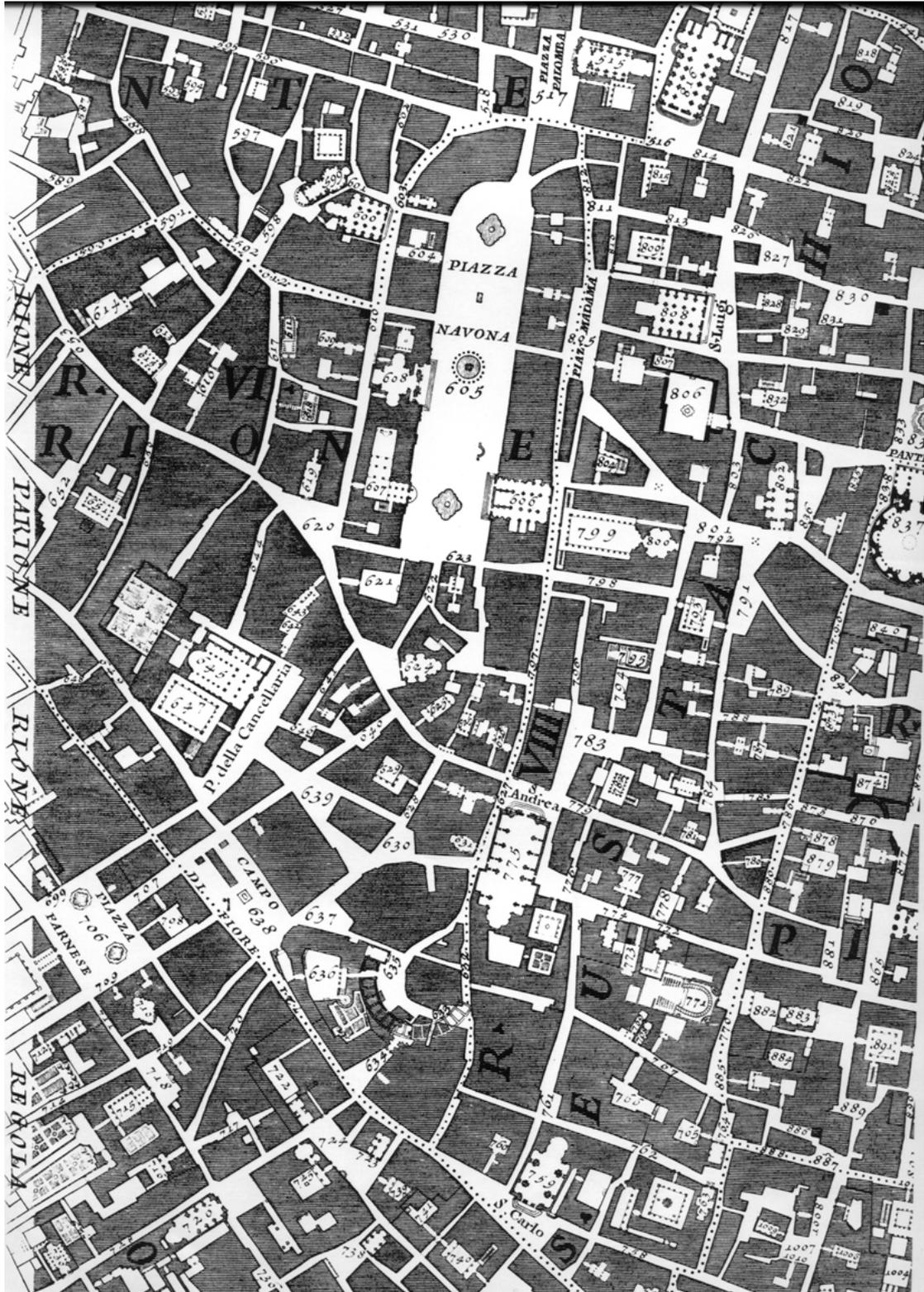
Let me show you, by comparison, what the real thing looks like.



The real thing

As you can see, this is a really different order of business. You know that it shows something very modest indeed. Not a whole bunch of money behind it necessarily. But it is, it has, that same rough, gradually formed quality which makes it possible to be a truly comfortable person there. A full discussion of this difference is given in Book 2 of *The Nature of Order: The Process of Creating Life*.

And on the next page we see another example of the real thing: a physical plan of a large part of Rome, as it was in about 1750. Here ,too, we see an almost endless tapestry of shapes, size and angle, not willful, or made in a design to be creative, but something that arises from the process of paying attention, with great care, to the situations which exist and develop, and what it takes to solve them and make them comfortable.



The Nolli plan of Rome, c. 1750

Here is a plan of Rome, as it was about 1750, drawn by Nolli. If you look at it carefully, you find hundreds of bits of evidence of the subtle adaptation that had taken place over centuries. If you look at the shapes of streets, the little jigs and jogs and places, then a very formal church. This widens here, and then this particular bit of street is narrower here and is wider here, and so forth. All for reasons having to do

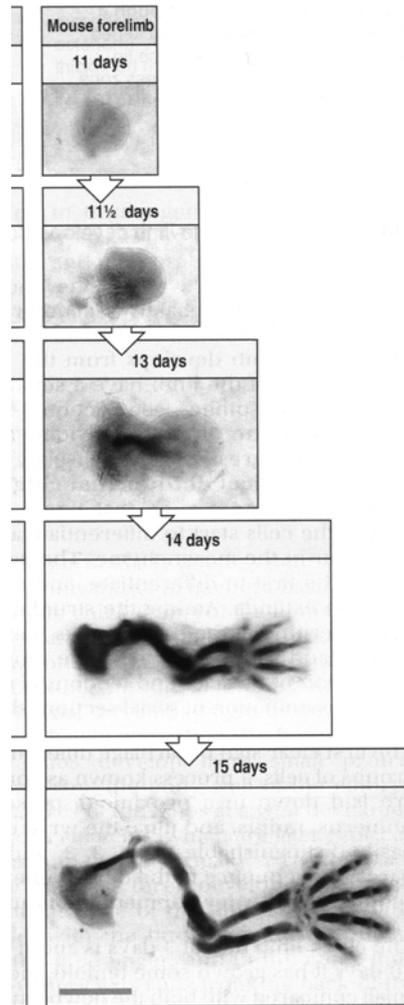
with adaptation. All having to do with that subtle creation of harmony, practical and geometric harmony, being made step-by-step, day-by-day.

If I were to take this plan to The Royal Institute of British Architects in their contemporary mode, as a model of what kind of thing one ought to do, I suppose they would (in their current mentality) say, “Well, this is very nice, you know, but we are now in the 21st century and the Nolli plan was drawn almost 300 years ago: it’s a kind of plan which perhaps just happens to be something old that you like. But, of course, it has no relevance to our present-day era. This is not how we design buildings, or streets, or public buildings, or roads, or parking structures. But the idea that this kind of morphology is irrelevant to our era is highly debatable. It all depends what you see in the drawing! If you see only a bit of history, then one might justifiably say that it is irrelevant. But if we see a particular, and interesting deep structure, then, speaking as a scientist, it’s not just an old thing. Its age is not what makes it interesting. What makes it interesting is that it is a completely different kind of structure, an important **type** of structure, generated differently, produced differently. The comfort that it creates is not because it has been built a few centuries ago, but because it’s simply better. It is a living structure, because it is better adapted. Unfortunately the heritage of 20th century thinking has made us so careless that we don’t recognize this structure as more profound, and also do not know how (technically) to create this better adapted kind of structure in the context of today’s society and banking institutions – what we now think of as “development” processes.

The beauty and adaptation of the Rome plan is not there merely because the growth and construction of that time were gradual. What was in place, at that time, was a morphogenetic process, which not only allowed things to go gradually so that adaptation could occur, but also guaranteed that coherent wholes would form even while this gradual, piecemeal process was going forward and allowing each place to be different and unique according to its circumstances. That is the essence of morphogenesis, and it is for this reason, that I refer, repeatedly, to morphogenesis as the core of the problem we face, in generating a living world.

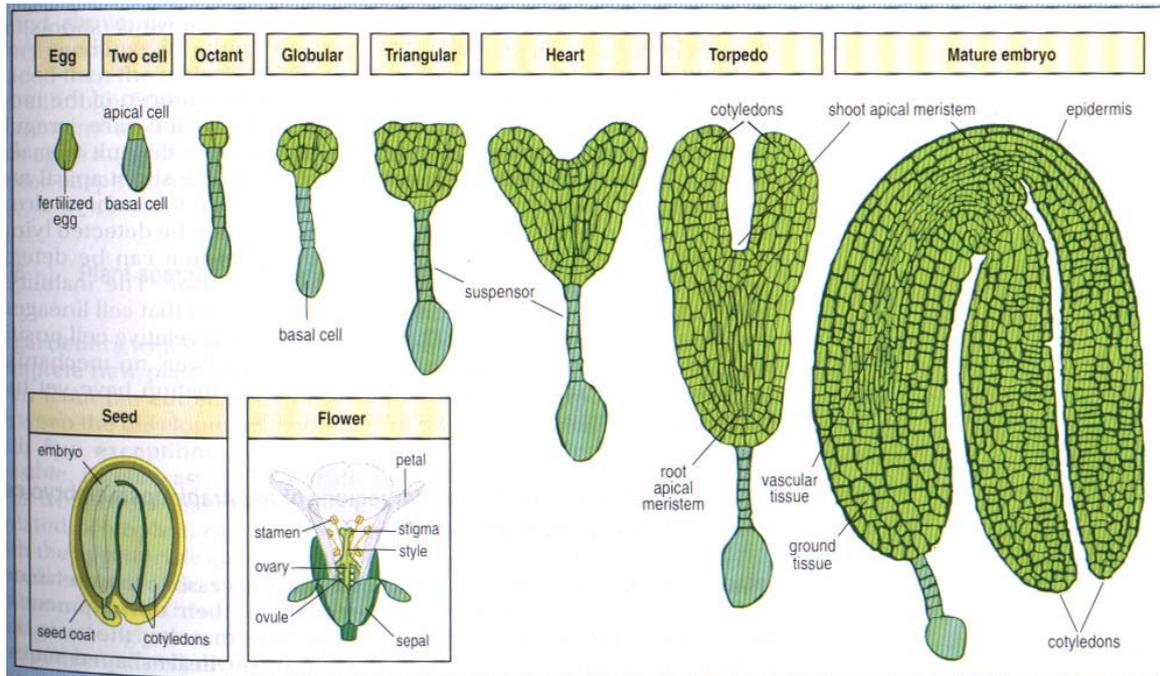
VII Examples Of Morphogenesis As it Occurs In Nature

Now, let me show a few examples of morphogenesis in nature. Here are shots of the foot of a mouse, developing in a mouse embryo. The evolution of the stages shown on the next page only takes three and a half days.



Morphological development of a mouse forelimb

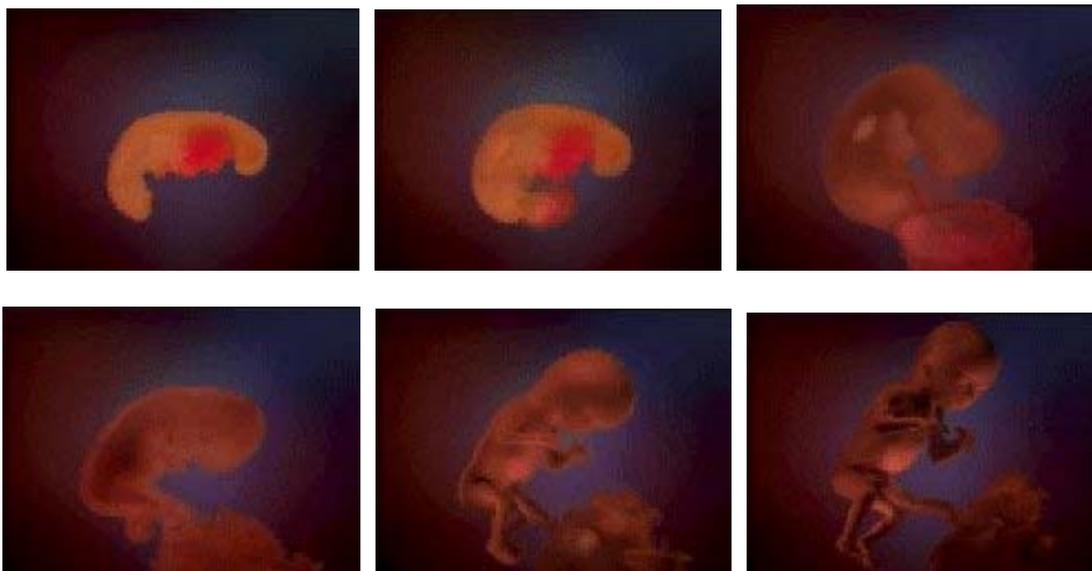
Now in each stage, so you have what's hardly more than a darkened blur which is a different material from that in the gray area around it. Gradually it starts to settle out and form configuration which is not yet bone, but which is cloudy material that will become bone. But it is already taking its shape. In the third picture (14th day) you see how the two prongs are already there, of these two bones to be. This two-pronged whole is moving out, so that the whole is enhanced and made more complete and so forth. Now these transformations are something I have been studying a great deal, and they can be described by the occurrence of centers in the structure and then certain configurational properties which bind the centers to one another. There are 15 of these transformations, I describe them in detail in Books 1 and 2 of *The Nature of Order*. In biology this is an understandable process, but at the moment it has not been well understood *from the point of view of its configurations*. There's been a lot of work done, successful work, on how chemical fields steer, switch on genes, switch off genes, and so forth. And therefore the differentiation of cells and the way that works has been understood pretty well. But the overall configuration and its ability to adapt while it's growing has hardly been studied.



Morphological development of an angiosperm

Here you have a similar sequence, in this case a plant, an angiosperm. This time it is a leaf structure. But what I want to draw attention to is the enormous configurational variation among the cells that are shown here. In the drawing you see the variety of cell shapes and sizes. This kind of configurational variation only comes about in morphogenesis. It cannot be generated by a blueprint-driven process; it can only come about from the unfolding of the whole as it arises from the state of the previous whole, and by the iterated repetition of this process.

Here we see further examples. Look, here, at a human embryo growing.



The reason I want to show the human embryo growing, and make you sit through it for about a minute is because again, the structure of that human being is

being created moment by moment, through morphogenesis. This is simply a different way to think about how the world is formed. In fact it hasn't really been thought about yet. I've spent pretty much all my life trying to find a path to do these things. In the last stages of this lecture, I will show you projects where you can see morphogenesis happening on a fairly large scale in towns and buildings. Before I do that, I am going to show you one more picture of this type in biological systems. Here we see a film of blossoms (six stills taken from the film, are shown below).



But again I want you to think, not that this is just a bunch of blossoms that are opening their buds. Instead, please try to imagine a physical world of our making in which the transformations that are occurring here, in our world, our created world, our habitable world of every day, is also growing, changing, moving towards an unfolded whole, in which each state arises from the state before, not by tearing and destroying, but by smoothly growing from what was there before. And then, in the latter stages, the world, the neighborhood, the street, has the same harmony and wholeness and well-being, as the blossoms in this sequence of the buds opening.

The structure here is moving, not only growing. It is moving around, at the same time that what is created is constantly varying from place to place. These variations here are not caused by the DNA. They're caused by the impact of the different buds and organelles, and the dynamics of the system in which they are acting on each other to adapt cooperatively as this system goes forward in time.

VIII An Entirely Different Model Of What It Means To Have A Sustainable World

Now you may begin to see what an intensely different model this is, for our conception of a sustainable world. At present, I do not think there are any satisfying, or exact definitions of what “sustainable” means. There is, of course, the very narrow definition of making sure that resources are not treated in a bad way, or in an impossible way. But I don’t think anyone who has thought deeply about the issues, can be satisfied with this kind of answer – not least, because it leads inevitably to a limited and ugly technocratic way of understanding the world.

I am fairly certain that those of you who believe in ecological thinking and sustainable thinking and so on, have something in mind which is this much deeper thing. And I am fairly certain that your reason for being interested in sustainability is because you see a vision of a world which is beautiful. That is where you are trying to get to. And what I’m saying to you here is if you don’t follow the advice of these blossoms, you won’t be able to do that. This gives us a path towards the beauty of the world. It takes that meaning of sustainability – that which unfolds, and makes itself beautiful, step by step, continually, and for always. This is a completely different way of thinking about building, and planning, and architecture, and ecology.

The sustaining which has to be done, is that every action sustains what was there before. If what was there before was good, it continues its goodness, extends it, and enhances it. If what was there before was not so good, the work to be done, and the process of sustaining, heals it, repairs its flaws, begins to find that something in it, which is alive, and whole.

This conception is larger than the present narrow view of resource counting. The cycle of reuse can indeed be part of a sustainable world; the cycle of attention to land, in such a way that it bears fruit, replenishes itself, can be a part of sustainable thinking. But the world must also sustain us, in our existence, sustain animals, sustain plants, sustain water, sustain wind. The morphogenesis itself reflects, and IS, the source of the sustenance.

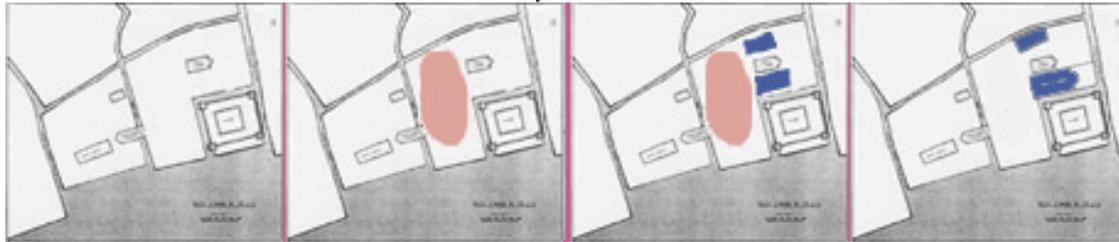
IX The Morphogenetic Unfolding of St Mark’s Square

Now I want to show you an example of morphogenesis as it occurred in history, over a long time span. This is St. Mark’s Square in Venice. I am going to show you a very short little movie, which is the plan of St. Mark’s, roughly as it evolved about 560 AD, up till sometime in the early 17th century.⁴ And it runs a bit fast so I just want to prepare you for what you’re going to see. You’ll see a plan of its state at some era, then you’ll see a light gray cloud which is a latent figure in the configuration. And, you can feel it there. If you look at the gray cloud, you’ll see that it’s a product of the actual configuration of buildings and walls and so forth. Then the step after the gray cloud is a dark gray addition which is usually a building or buildings or some kind of configuration like that which came next. So first there’s

a perception of a latent centers, which are not realized, and then there's a point taken to make those latent centers exist. And then, we move and cycle round again.



cycle 1



cycle 2



cycle 3



cycle 4



cycle 5



cycle 6



cycle 7



cycle 8



cycle 9

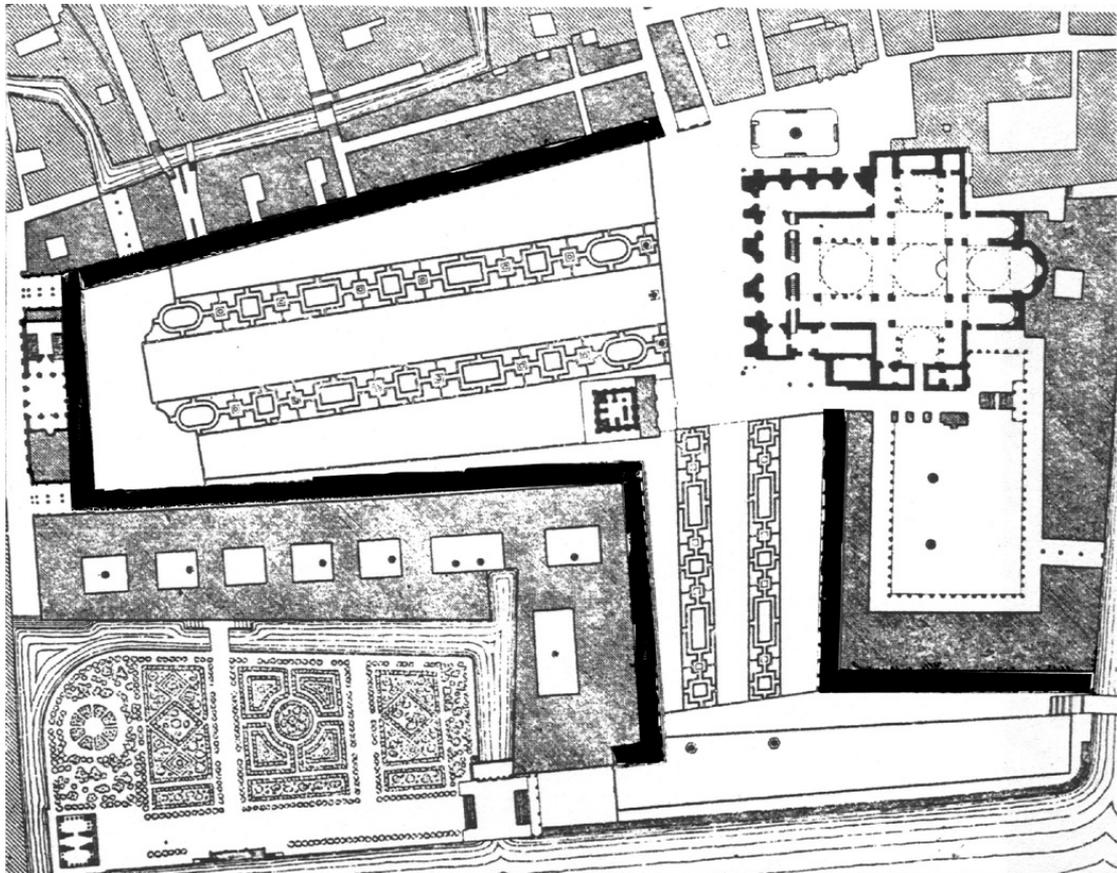


cycle 10

You see, in each cycle, the pink cloud is a latent center, and it guides the formation of the next step of building. In cycle 3, the pink clouds together form a space: and the blue spot they indicate as a salient center to repair and intensify those latent centers, is what becomes the campanile. those things are done. In cycle 4, it is the later version of St. Mark's itself, which gets built. In cycle 5, the whole square is enlarged, expanded out into the Grand Canal. The sequence of ten cycles, as I have drawn them, give us a morphogenetic view of the evolution of the square as a whole, all be it in this case of over a thousand years. So this very beautiful structure that was created, was actually created by patient attention to which places have life, and how people make themselves aware of the latent centers that are there, and how these latent centers may be judged and then enhanced. Which are the latent centers which are capable of, or likely to have life? And what has to be put there to enhance that life?



The Basilica of St. Marks



Plan of St Marks Square, c. 1620



The people and the place. A view towards the Grand Canal

And what we get from all this morphogenesis is not just beautiful geometry, but life, beautiful life. Probably you all know it, but it is important to emphasize that the successful end-product of morphogenesis is a living connection between the people and the place.

X Morphogenetic Unfolding of a Window In a Texas House

I'll show you another example of morphogenesis in architecture. It is a window: a window at the end of a dining room in a house we were building in Texas. The window overlooks Lake Travis, in Austin. What you see in the first picture is the rough window opening, with a few studs showing, that we had already placed, after discussing the subdivision of the opening. Then we began to experiment with the way the window might be designed. To do this, we used surveyor's tape, pinning it up, looking at it, only moving on when we felt something had improved. The five pictures below are from a movie I made of the sequence unfolding.⁵ (See the DVD). The movie is a record of the steps we followed. Then at the end, I show the actual tape as it was by the last step (unfortunately I didn't take pictures while we were doing it, so it had to be reconstructed). , a whole lot of tape -- something that in the States is called surveyor's tape. I don't even know if it exists here. But anyway it's just a kind of inexpensive ribbon type thing, which is really useful for making mock-ups of all sorts. In the photograph you see how we pinned lengths of tape, to help ourselves visualize the layout of this window overlooking lake Travis in Austin, Texas.



Sequence Of Surveyor's tape mockups Generating The Form Of The Window By Morphogenesis



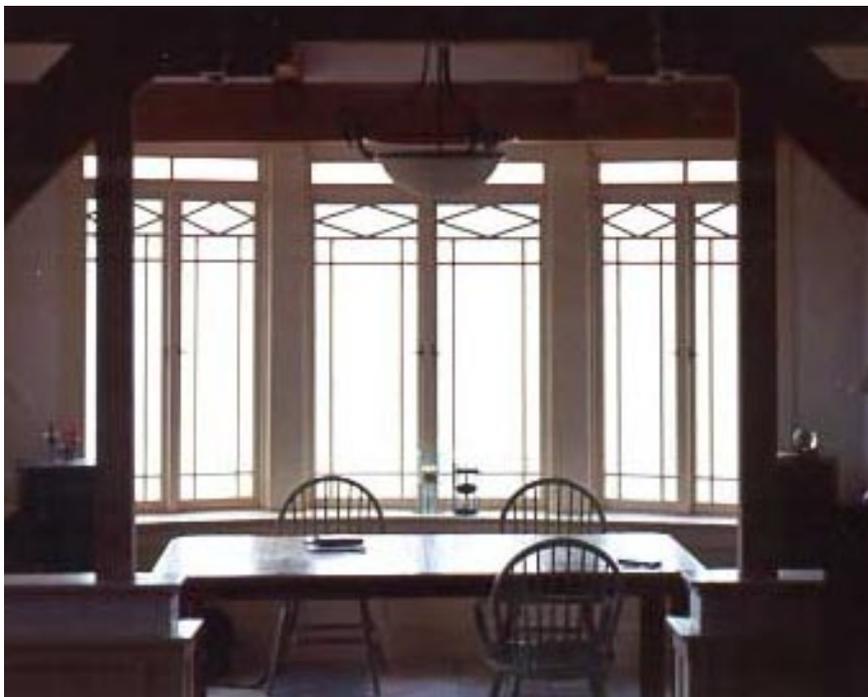
Final surveyor's tape mockup for the window in the Gioja house

Let us ask exactly what it means to call this sequence “*morphogenesis*.” As in the case of St Mark’s Square, each configuration in sequence contains centers that are latent, weak spots or undeveloped regions in the wholeness, which demand to be completed or enhanced.

This is a geometrical process, it comes from the field by a process in which the uncompleted field tells the process what to do next. Of course it is possible, sometimes necessary, that this step, when taken by a human being, is taken in a state of mind which gives in to the harmony that is there, and seeks to, or knows how to, complete and extend that harmony in a harmonious way. But we must not lose sight of the fact that the same thing happens in nature, where there is no intuition acting – but the process of nature acts by operating on the deep structure of what is there. It draws the new structure from the deep structure that is there.

Above all the result, at each step, is not chiefly a matter of opinion, but concerns a judgment of what deep structure is there, and how this deep structure may best be extended. It comes from respect for what is there, and mainly that. In the case of the window I am showing, to start with, it’s just a bunch of two-by-fours forming that bay window, but there’s no bay window yet. There are just openings. Then we go in with the surveyor’s tape, and this short movie summarizes what kind of thing we actually did to build up a whole structure: each step comes from the previous step by a kind of morphological improvement. Here again, as in the St. Mark’s example, the form created, has been grown, step by step, at each step what is grown next comes from what happened just before.

Here is the final window as we built it in Texas, and as it stands there now.



*The window as completed, in the completed dining- room,
after the sequence of transformations shown above*

XI The Direction Of The Adaptations: How Does The System Know In Which Direction To Go?

The crux of the process described in the last sections hinges, of course, on the ability to see and judge what is the wholeness, and what preserves the deep structure of the wholeness. Which among various possible “moves” in an unfolding process, does the most to extend and preserve the structure?

There is, fortunately, an empirical answer to this question. Many years ago, while working with my graduate students I made a simple, yet highly surprising, discovery. I was teaching my students to get a feel for the process I have been describing in this lecture. The crucial question, that one always comes down to, is “How can you compare two things to determine whether one is more profound than the other, or more “wholeness-preserving?”

At the time, we were already working on the fifteen properties described in *The Nature of Order*. These fifteen properties are not so difficult to elucidate. But it is more difficult to say “Well how do you know for sure which of two vases, or which of these two tables, or which of these two entrances, which of the two, A or B, is more profound, more harmonious?” How do you make that judgment? And, above all, how can one do it so there’s agreement among people, and not just a lot of people squabbling about their private opinions?⁶

I found out that there was a series of questions that could be asked, which were rather strange. Essentially something along the lines of “Okay, you’ve got in front of you, two possible moves, two possibilities, let’s call them A and B. So you’ve got your A and you’ve got your B that you’re comparing. Now, tell me, which of A and B is more like a picture of your own soul?” I would always hasten to add, to the person being asked this question “It is not necessary to believe any religious interpretation of the word “soul,” to answer this question. It doesn’t matter whether you believe in such a thing as a soul. This is completely irrelevant, as long as you are willing to take the question seriously, and ask yourself whether you can make a judgment (even if it seems like nonsense) deciding which of the two is more like a picture of your own “soul.”

And there are various other ways of asking that question.⁷ You can ask things like which of the two is more healing, which has more life, or which one has the greater effect on your own wholeness. There are a number of slightly different questions like that, all slightly different, but all with the same essential core to them. The one that asks which of the two is more like a picture of your own soul, although it is an abstruse version, (and in terms of academic thinking during the 1980’s it was certainly the one which sounded most outrageous) is the one which I find most useful (and most reliable empirically). I have put this forward as a new kind of empirical measurement. This measurement does not (for the moment) ask whether the soul is real, but it simply gives you access to structural information about A and B, which you cannot easily get any other way.

What makes this type of measurement important, is that when people do it, and make judgments in that way, comparing A and B, and B and C, and so on, it turns out that they agree, to an extraordinary extent. Like other experiments the results are

somewhat statistical, but on a given comparison, typically four out of five will agree. And then, having made the judgment that way, then gradually they begin to realize that the A, or the one they have chosen by this criterion, is having a more profound effect on them than B and C and D.

But if you then begin to isolate the things that are sort of high in those dimensions, it turns out that they will be the ones that are produced by a more pure morphogenetic process. In other words, all that is happening to reach that kind of result, is that the thing takes the world, takes it's wholeness, transforms somehow to embed that wholeness and enlarge it. And so these are the very things, then, which are viewed as having spirit.

I know this is a dreadfully collapsed summary, but I hope you can see the significance of what I am saying. Because if (as I am telling you) it is an **empirical** result that enables you to use this kind of measurement to go forward in an unfolding process, and it enables you choose the best "next step", each time the process continues, why then you can say "Well, naturally, this is what we want to do for the land (or the building, or the doorway, or whatever), whenever we can, to move it forwards in that direction."

That is more on the morphogenetic level of permitting these subtle adaptations that I was illustrating in one or two of the pictures. And so in terms of actually uniting the thing, although its not right to call it a thing really. But anyway, the living organism that is a town, or a building, or whatever, becomes closer and closer to us the more that process goes forward. So then we are satisfied, we are enlarged, we are made well. We are at home.

So this connection between morphogenesis and the question of the spirit in things (actually the embodiment of soul), in things, places, organization of land. This is a real empirical connection which we can rely upon.

XII Wholeness-Preserving Transformations

The nature of this positive "direction" for a living system – the direction that takes the system towards a more harmonious state while the wholeness is preserved, extended, and enhanced, may also be described in another way, which relies on the sequence of steps that are needed to get to it. This is the main argument of Book 2 of *The Nature of Order, The Process of Creating Life*, and is extensively discussed throughout that book.⁸

The idea of wholeness-preserving transformations is visible in the unfolding of St Mark's Square (page 23 of this essay); and visible, also in the morphogenetic unfolding of the window in Texas (page 27). In each case, the process goes cyclically, through a process of discovering the latent centers in the system, then taking a next step which enhances the configuration of centers in the wholeness, thus proceeding to a deeper wholeness, consistent with the earlier wholeness.

What we experience after the fact as geometric harmony in a system, is precisely the fact that such a sequence of self-consistent wholeness-preserving steps

has occurred, and that we can see the trace of such a self-consistent sequence of transformations in the geometry.

But the forms resulting from a morphogenetic process also carry a characteristic *signature*, in their purely geometrical aspects. To understand this geometric signature, consider the following. The geometries of St. Mark's Square, and of the Gioja window in Texas, though enormously different in scale and purpose, are similar in a number of important ways. Both, viewed as structures, are more granular, have many levels of structure, more than we were used to in the technical products of 20th century architecture. They are not aligned so rigidly to a Cartesian grid as contemporary buildings usually are. They are not modular in the precise arithmetic sense of equal and identical components stacked up alongside one another. Both contain minor irregularities where needed, to make everything come out right.

But they are not *highly* irregular. Neither are they “organic” or “funky” in the deliberately unorganized geometric manner espoused by certain contemporary artists and architects who seek something spiritual, or something resembling nature. Buildings are, after all, buildings; there are profound reasons for the appearance of nearly straight lines and planes, there are good reasons for windows and doors which are roughly planar, corners which are roughly right angles, and so forth. The apparent organic, rambling form of order, seeks justification in arguments about biology – but these are shallow arguments.

The geometry of my two examples, is very general. In the case of a built world that arises through morphogenesis, it is a geometry which is largely straight, but sometimes (more rarely) curved. It is a geometry which often has rough right angles (once again for compelling reasons), but it sometimes contains varying acute and obtuse angles. It includes repetition of elements and spacing, but the repetition is rarely perfect, and the elements are distinguished according to their unique contexts. All in all, the geometry has a subtle, friendly, kind of organization, which contains symmetries, and rough equality of spacing, but simultaneously contains gradients, echoes, and variation which follows from the situation and the context. A very much more complete account of this geometric signature is given in Book 1 of *The Nature of Order*, especially in chapters 5 and 6.⁹

This kind of geometry is, oddly, a kind of morphology which though known in many traditional cultures, has never yet been explicitly identified, nor espoused, by architects, as the right way for the forms of building to come out. It permits magnificent symmetries, and centers; yet it is supplemented by irregularities, throughout the fabric, that are always necessarily present to make the adaptation work. It is governed by the principle that centers are to become living, and shaped in any way that brings them life.

Thus this particular geometric character, or signature, which I describe as a necessary result of morphogenesis at work, is the easiest way to judge the character of landscape and building, the quickest way to make a first judgment whether the morphology will protect and complement the Earth. It takes some practice and experimentation to become aware of the subtleties of the step by step process, and careful judgments, but you can achieve the signature better and better as your skills develop over time.

XIII Deep Interaction Of Morphogenesis And Sustainability

I can now return to the list of sustainable issues listed in the introduction to this lecture (pages 2 and 3), and explain how the morphogenetic orientation serves all our aspirations for a sustainable planet. First, let me once again repeat the core ideas of adaptive morphogenesis.

- The movement of every system, and every part of every system, is a movement of the whole, though it goes forward incrementally, in small steps.
- The incremental change and adaptation is going on all the time.
- What moves forward, is always “the whole”. In morphogenesis, each movement forward addresses the entire system, with special reference to its configurational wholeness, and preserves and extends that wholeness through the small incremental acts.
- Minute adaptation and repair are going on at every level, continuously.
- The wholes which emerge, and continue to emerge, derive from the wholes that were there just before, thus creating historical continuity, cultural continuity, and morphological continuity with the form and essence of the land. This is the principle of wholeness-preserving transformations, mentioned repeatedly in the text above.¹⁰
- The minute and careful adaptation of land, requires intense participation by people who live in a place and care about the places where they work and live.

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I now give twelve examples from the list of prominent sustainable issues, so that the necessary intertwining of sustainability and morphogenesis becomes clear in variety of concrete, practical cases.

Bioregions

Consider the issue of bioregions, an important item on the sustainable agenda. A widespread program of morphogenesis, applied to a land, will identify and respect the internally coherent regions which are defined by watersheds, rainfall, tributaries, and natural irrigation of land. Morphogenesis chooses this, not because it is especially concerned with water or economics as such, but because the structure of water in the land, is a natural part of the wholeness in the system. A rule of development which protects and enhances the natural flow of water as a necessary part of morphogenesis, will therefore support, and lead towards the goal of sustaining bioregions.

Green Building Materials

The idea of green building materials is intended to promote materials which are low in energy cost during production, which do not have to be transported over long

distances, and which come from renewable vegetable or mineral resources. This is congruent with the principle that materials used on a building site should as far as possible reflect the materials of the surroundings, both those in the other nearby buildings, and those in the mineral and vegetable deposits available nearby, not merely for economic reasons, but because these will be most harmonious with the land. This principle, arising directly from the practice of morphogenesis, will stimulate precisely the agenda that green materials emphasizes, except that it gives the principle a slightly more positive and less arbitrary quality, because it emerges from the land itself.¹¹

Further, the most fundamental aspect of building materials, from the point of view of morphogenesis, is that the various parts of any thing being built, allow themselves to be modified, shaped and adapted according to its local needs, themselves dependent on its context in the building, and the detailed wishes of the users. All these needs are reflected in easily workable materials, and fail to be reflected in the high tech components that are hard to work, expensive to modify, and tend to overwhelm a configuration by their intractability.¹²

Protection Of Natural Ecology

Detailed explanation of the large scale management of ecological regions has been given by Stuart Cowan. His most ambitious and comprehensive model is the Conservation Economy, in which the patterns and features of a self-sustaining economy regional ecology are spelled out, in an implementable form.¹³

Self-Sustaining Local Economies

Many experiments around the world are making efforts to regenerate local economies. Myanmar (Burma) made such efforts starting in the late 1980s by trying to reduce flows of cash and information across its borders. Later a repressive military government imprisoned Aung San Suu Kyi who had championed this effort, and Myanmar entered a mixed economy, which still benefits from the effort to keep the cycle of money flow internal to the country.¹⁴ The town of Gaviotas in Colombia took 30 years to regenerate its natural environment, and then discovered they could participate in the global economy using their natural resources.¹⁵ The Grameen bank has made thousands of loans to village people who build successful businesses and contribute to local economies.¹⁶ In all these experiments the emphasis is on small scale morphogenesis, which is coupled with an effort to maintain cash flows in the local region. The type of cash flows typical of these experiments are precisely those which are aligned with morphogenesis.

Protection Of Vanishing And Threatened Species

The disappearance of species is largely a question of habitats disappearing, and disruption of habitats. When we undertake planning and building through morphogenesis, one of the cardinal principles is that the important structure that is in existence now, must be preserved, and improved, and extended – and when damaged repaired – even while introducing new structure as well. As a consequence of this principle, habitats must be maintained and repaired – in a fashion comparable to the subsidized rebuilding hedges in England, now made available by DEFRA. The repair of bird populations, butterflies and moths, under the impetus of this kind of program,

thus takes care of itself as part of an overall strategy, not only as part of a local ad-hoc action. Thus, the program of planning itself, if done through morphogenetic processes, is likely to repair and rebuild species populations.¹⁷

Taking Steps To Protect Climate Stability

Possibly one of the most difficult tasks of all. Ozone, carbon dioxide, global temperature, cloud cover, ice age etc. In recent published discussion of this problem, the fundamental principle which has been enunciated is that the chaotic nature of the weather system, makes it amenable to control by very tiny regulations.^{18 19} It is significant that the NASA team studying this problem, have concluded that the approach is that of making very small changes which maintain the overall structure of what is happening, while damping the damaging effects: an approach which is nearly synonymous with the morphogenetic approach, since the most fundamental concept is that of leaving the system alone as far as possible.²⁰

Changing The Local Use Of Cars Towards A More Pedestrian Emphasis

The growing move towards a more pedestrian emphasis, for reasons having to do with physical health, regeneration of community, and reduced reliance on external non-renewable energy resources, have all been coupled with an increase of morphogenetic process in the construction of the built environment. This occurs because the smaller scale and slower speed of pedestrian environments encourage differentiation and repair, while the more gross morphology of cars trucks and freeways, is less repairable, less well adapted, and less capable of sensitive adaptation to people, plants, animals and land.

Reducing Energy Use And Developing Renewable Energy Sources

This issue has been at the forefront of sustainable thinking, and is the topic which has been most frequently discussed.

Continuous Maintenance Of Every Part Of The Environment

This obvious and vital element of any living world, is surprisingly absent from most discussion of sustainable thinking. You cannot have an environment which works, unless it is truly, and literally, being sustained by improvement, repair, and continuous adaptation, continuously, and at constant intervals. Yet almost the only book on this subject is Stewart Brand's *How Buildings Learn*, which is rarely if at all, referred to in the sustainable literature.²¹ How could something so centrally involved with the idea of what it means to have a self sustaining world, be ignored? One more bit of evidence of the invisible corporate background of present-day sustainable ideology.

Under conditions of morphogenesis, this idea of continuous repair and maintenance of the fabric of the whole, is natural, and inevitable. Adaptation of the system, is the central issue, and it must be dealt with daily vigilance. There is a continuous stream of information about the things in the environment which are not working well, or not working as well as they should or could. To keep in touch with the process of ongoing adaptation, the environment must be made, and administered, in such a way that continuous repair of global; structure is natural, and inevitable. Thus conditions of morphogenesis require materials, and systems which are easy to fix, change, and

reconfigure.²² This does not point in the direction of the tinker-toy gimmicks of the 1970s. That kind of change has been proven ineffective, expensive, and unsatisfactory. Instead it points the way to a new generation of techniques, laws, and cash flow schemes.

Ownership Of Habitat And Houses By Individuals, Even Under Conditions Of Poverty

The 20th century view of world housing was dominated by the notion that either governments or private commercial companies should be in the business of creating housing for the world's poor. Careful analysis of this idea has shown conclusively that it is only in the interest of the companies involved, and is not in the interest of the families and individuals who need shelter. It is not in their interest economically, nor is it in their interest as far as adaptation to their individual family needs is concerned.²³ The ravage of land by developer's tracts is not helpful to the environment, nor to society.

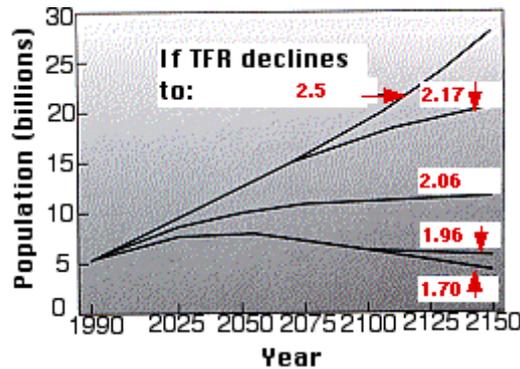
Developers and Planning

The largest single source of damage to the environment, world-wide, has come from the monolithic and centralized profit-driven corporations engaging in large scale construction of roads and houses and office buildings. For careful discussion of the more than twenty different ways this activity has severely corrupted the life-giving nature of construction process, see chapters 19 and 20 of Book 2 of *The Nature of Order*.²⁴ The essence of the problem, which reappears again and again in many different forms, is that local adaptation of land, buildings, interiors, spending of money, care of plant life, care of animal life, encouragement of local community, are all damaged by the careless and money-oriented work of a developer. You can only get the love and care required for true adaptation, from small scale effort, by thousands of people, protecting and caring for what matters to them on their own land. This is profound connected to the idea of communal morphogenesis, and stems from it, since it is only this kind of thoroughly decentralized human effort which can make sure that each local act is both adaptive, and also oriented towards the growth and emergence of organic, not top-down, not imposed, global structure.

Stabilizing World Population

It is even possible that morphogenesis can play a role in the most difficult contemporary problem of all – world population growth. From the point of view of sustainability, it is the world population which dominates the problem and the difficulties. Issues of food, agriculture, climate, effluents from production, all become more and more acute as the population increases. In the year 9000 bc the world population was about 5 million. In the year 1 ad it was about 200 million. In 1600 ad it was about 500 million . In 1900 it was about 1.5 billion . Today it is 6 billion rapidly approaching 7 billion.²⁵ The pressure on resources, the negative consequence of too-great a population density (not only for human welfare, but also for animals and plants) is enormous. The aim of a sustainable world cannot be reached unless the total fertility rate, worldwide, reaches levels in the neighborhood of 2.0. It is now about 2.8. Kimball summarizes the situation this: The graph below (based on data from the UN Long-Range World Population Projections, 1991) gives 5 estimates of

the growth of the world population from now until 2150, assuming that TFRs decline from the 1991 value of 3.4 to the values shown.²⁶



- A value of 2.17 (only 5% above 2), would by 2150 produce a population of over 20 billion and still rising.
- A value of 2.06 will produce a stable population of about 11.5 billion.
- A value of 1.96 (5% below 2.06) will cause the population to drop back to close to its present value (6.1 billion) while
- A value of 1.7 by 2150 would allow the population to drop back to about 4 billion.

I believe it could be feasible to imagine a system effect through which large scale planning and construction through morphogenesis, would have a subtle system effect on slowing down the population growth itself. The way this might work is through a global mechanism not unlike Lovelock's daisy world.²⁷

The practice of widespread morphogenesis can encourage, and ultimately require, participation by all individuals in the complex adaptive process which generates our world environment. This requires care, affection, and time, so that people can decide slowly, what is important to them, and then build it, or guide its construction, gradually in their own surroundings. All this is at odds with the non-sustainable corporate model of population growth, and huge capital investment to create apartments and condominiums and slums for people to inhabit. Thus the process of morphogenesis, by stimulating and encouraging care and slow development of every family environment, could discourage population growth, and encourage, rather, careful adaptation and the creation of beauty, thus helping to reduce the world population as part of its overall system effect.

XIV The Eishin Campus

A few years ago I built a pretty large project outside Tokyo. It is a campus, for a combination high school and college. It stands on what used to be tea bush land. And it's about 300 meters by 300 meters, about nine city blocks. A reasonably big place. The work was done in conjunction with about a hundred staff and students of this place, while it was existing previously in a temporary home closer to the city of Tokyo. And, given our situation, I haven't really got time to show you all the things I'd like to show, but I'll just show you a smattering of what it was like out in the tea

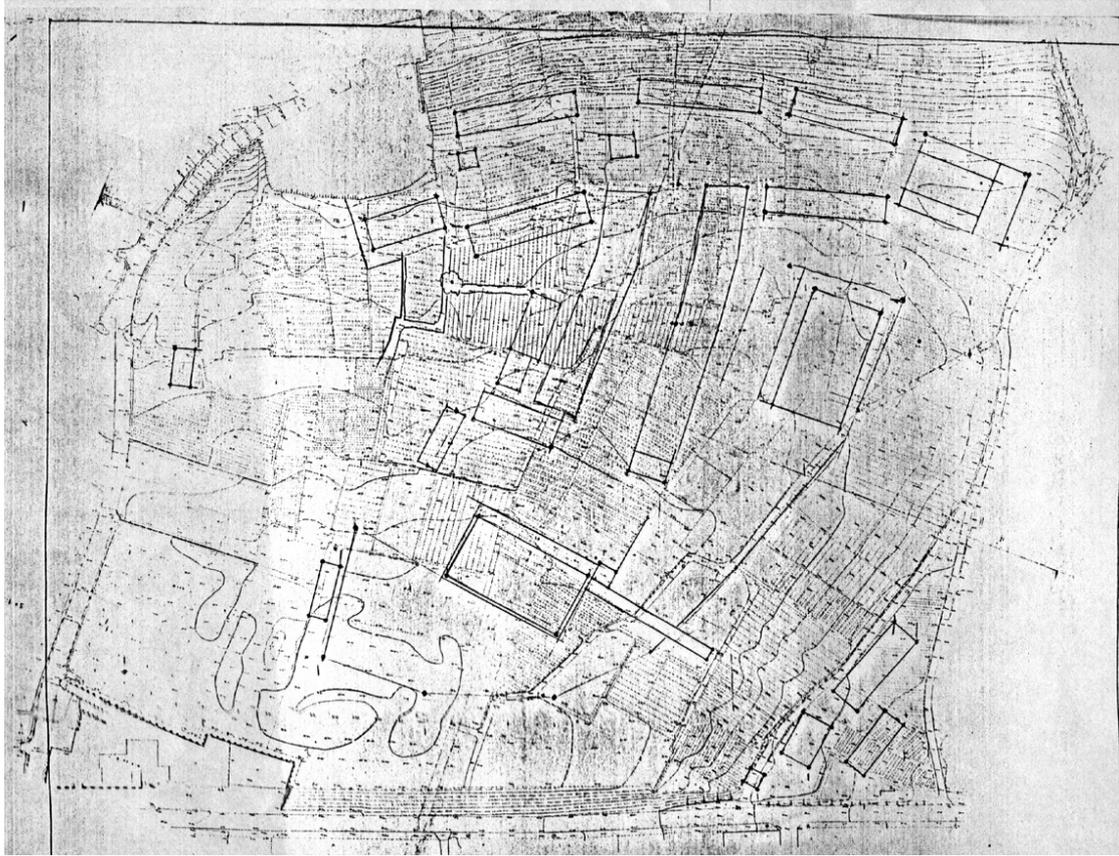
bushes, laying out these buildings. This was well into the process. We didn't just walk in and start laying things out. There had been about a year's work with the Pattern Language, and the community of the staff and students. And that thing was then implanted into the land, and these flags were used by us to establish how a building should be there.



The flags we used to lay the campus out



Members of the community looking carefully, to see what to do next



*The drawing we made by transcribing the positions of the flags to a topographical plan
This became the final plan of the campus*



Thinking together, while placing the flags



Modifying stakes to mark the entrance street, once the volume of the great hall was in place, and allowed us to make more accurate judgments about the angles and positions of the street and its edges.



A mockup, in painted paper, of the plaster surface that was to be put on the great hall columns

That was a drawing after we had been out there, and this was all taking a lot of time. And then that was the thing. And then we used similar techniques when the buildings themselves were being built. So we were constantly doing what morphogenesis told us to do. In this particular case (opposite page) we were laying out the width of the main entrance street of the campus, at the time when we could begin to visualize the Great Hall that was there, and various other things, positions of things. And then while we were under construction, again we made mock-ups of most of the buildings (lower picture, opposite page). For every building, we made mock-ups of how the building went. And until we got it, what we felt was the best that we could get it to, we didn't stop. It was a very, very slow empirical process.



The Eishin Campus from a distance, in the snow



Landscape of the campus: Tea bushes and the cafeteria building



Rain and students coming to the campus



Tulip blossoms in spring and judo hall in the distance



Water's edge: the classroom buildings along the lake we built



The Central Building, a multipurpose hall for students

And this is, here are some pictures of that place. This is, I'll run through these without comment. All of what I'm showing you here are things that we built. Again I want to emphasize that in every single case, morphogenetic methods were used to get the results that you see here. And this gives you some feeling for how people are in that place.



Break dancing in the Central building



The students' boat at festival time



The Cafeteria



A favorite spot: Students on the roof outside their classroom, overlooking the main street



Hisae Hosoi, the chief administrator of the school



One of the arcades of the college buildings



Students congregating in the main street of the high school



The great hall, already in use, even while it was still under construction



Volleyball courts on the campus



Great Hall, Main gate, Administration building, and Faculty building



In time of snow: one of the classrooms and its garden



The gymnasium: the largest all wooden built in Japan in modern times



Great hall stage, during a major concert



Part of the Great Hall in an earlier state, with all white plaster



Garden of the Faculty building, seedlings, tea bushes



Students arriving on campus, in the morning, through the entrance street



Classroom, attention, soft light



Inside the music school



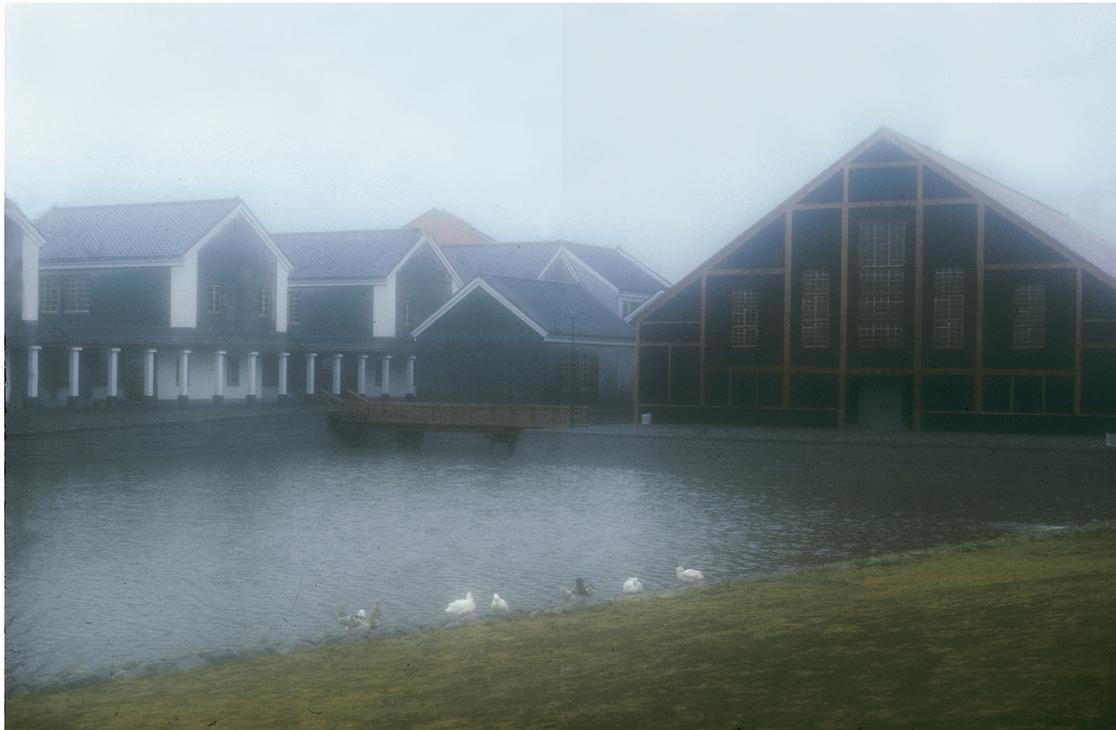
The loose and beautiful atmosphere of students in the space outside the Great Hall



The clubhouse – a building donated by families of graduated students, not in gratitude, but so that they, too, graduates and their families, could legitimately come to the campus and be there, years after graduation, and maintain a presence and a foothold there, because they loved it and wanted to keep their memories alive



In time of rain, the main street of the Campus



The lake we built, the arcades and classrooms around the lake, and the gymnasium



One of the internal pedestrian streets of the campus



Another of the internal pedestrian streets of the campus



Evening light on the whole campus

I once, there was a man making a movie about this place. And he at some point in the movie, he gets hold of an art student, and sort of pulls him aside, and asks if he's willing to talk with him, the director. Talk to the camera, and just make a few comments about this place. And he said, the student was sort of black turtle neck, very austere dressed. And he said, "Yes I grew up in Tokyo. My life in the streets of Tokyo was like a dog. I was always parched, and ran about with my tongue hanging out mentally. And when I came to this place, Higashino, ..." And he stared into the camera for a few seconds, in silence, and then he said "...for the first time in my life I felt that I was free."

So all this stuff about morphogenesis may perhaps sound elaborate, even rather theoretical. But you can see from these pictures that the impact of this new view of architectural and ecological process is not theoretical at all. It has dramatically different effects on the environment that is created. This is a new view of what is sustainable. What is sustainable, is what supports the earth, morphologically. And what supports the earth, morphologically, is what unfolds, according to the structure-preserving nature of morphogenesis.

Now we have a view of sustainability which is not a techno, money-inspired, soulless, use of gadgets, but a truly visionary, and scientifically sensible view of how nature unfolds, and how our settlements must unfold, in the same way that nature does – but since it is architecture, not only nature, it produces geometric structures that are unique to buildings and human beings, but still "natural," still profoundly helpful to the beauty of the earth, and still always preserving the deep structure of the earth, at every moment as their construction and modification occurs.

XV Schumacher College Extension

Now, many of you probably know Schumacher College in Dartington. In 2004, I had the opportunity to demonstrate the difference between a morphogenetic approach, and the present day technical approach to sustainable architecture. Schumacher College had been considering a design for an extension. It was designed by an architect, well-known especially for his skill in dealing with topics of sustainable design. Professor Brian Goodwin, head of the Masters program at Schumacher College, was unsure about the validity of the proposed design, and asked me to demonstrate what kind of project was likely to emerge if a morphogenetic approach were used instead. I agreed, and he then commissioned my firm, the Center for Environmental Structure, to make a first phase design for the extension.



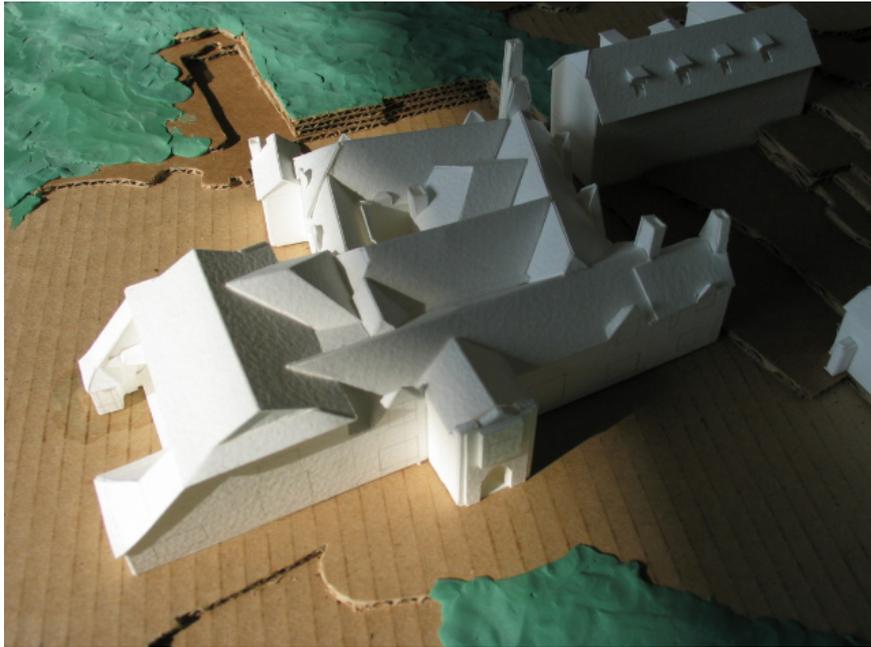
Schumacher College as it now exists: The front of the building known as the Old Postern



Up the front path



Roofs from the back



Beginning from what is there now.

We built this small model of the present Schumacher College and surroundings and topography, so that we could use it as a laboratory to investigate the impact of structure-preserving transformations.



Representation of the circle that one can feel in the land and the front of a possible terrace.

Beginning of the morphogenetic process. We could see and feel a circle in the land, and knew it would be important in guiding the development. And, even in this earliest move, we suggested a curved terrace in front of the building, reflecting the circle, and making a place of repose.



A new courtyard beyond the library, though approximately rectangular, also echoes the circle, and especially in the top right hand corner follows a curved line.



The new courtyard and the circle in the land are integrated. The curve of the new courtyard replaces one edge of the circle. In addition, the buildings in the lower part of the picture are retained with their physical fabric only slightly modified, thus maintaining continuity with the character and structure which exists.



Looking up the front path of the real place. Then imagining how this view might be transformed to include a configuration in harmony with the wholeness that is there now.



Looking up the front path, making the main dome golden, seeing a forest cathedral made from the tall trees at the back of the old Postern



A connective path to the forest garden behind the college

A path is made to the beautiful biological experiment known as the forest garden, thus creating a usable connection to the land lying north. The gate to this path passes under the golden dome.



Trying domes: Bankoku Sasagawa, one of the CES staff, working on the model

Trying different dome shapes and sizes, to find the best fit to the land and to the existing buildings. Even the small extensions visible in the upper buildings have

common lounge areas approachable from the outside, and are also marked by small half-domes.



In the trees. Here we see the result of a policy of subtle adjustments, reaching out into the land in all directions, and maintaining connection with the trees and forest cover on surrounding land, so that it all becomes connected, and maintains its wholeness.

In this state of the model (previous page) you also see how the circle in the land has been memorialized in small megaliths, standing about 30 feet apart, and standing upright in the grass, to mark the original circle that was observed.

Now we had to find out how big these stones should be!



Testing a mock-stone in place for one of the circle stones



Testing a smaller stone (visible behind the twigs) which fits better and is less aggressive



A sketch of a new library re-using an existing building, but modifying it to honor the land, and made in a way that has some spirit -- with green glass and plant-like tracery to form windows of a special character reflecting the values and philosophy of the College.

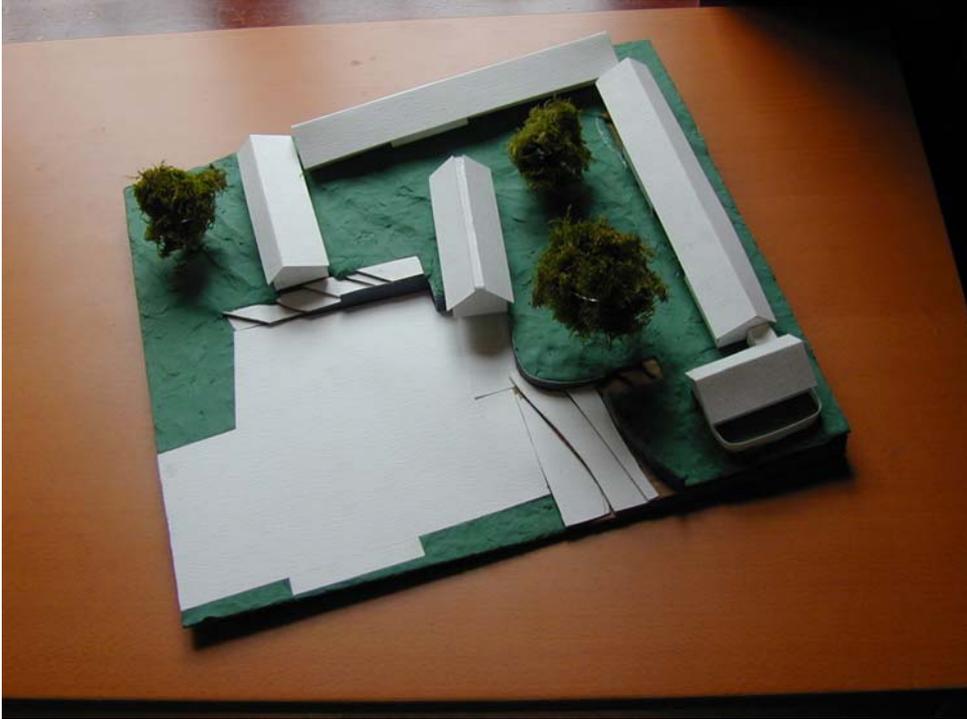


Testing the appearance of the new Library windows on the model

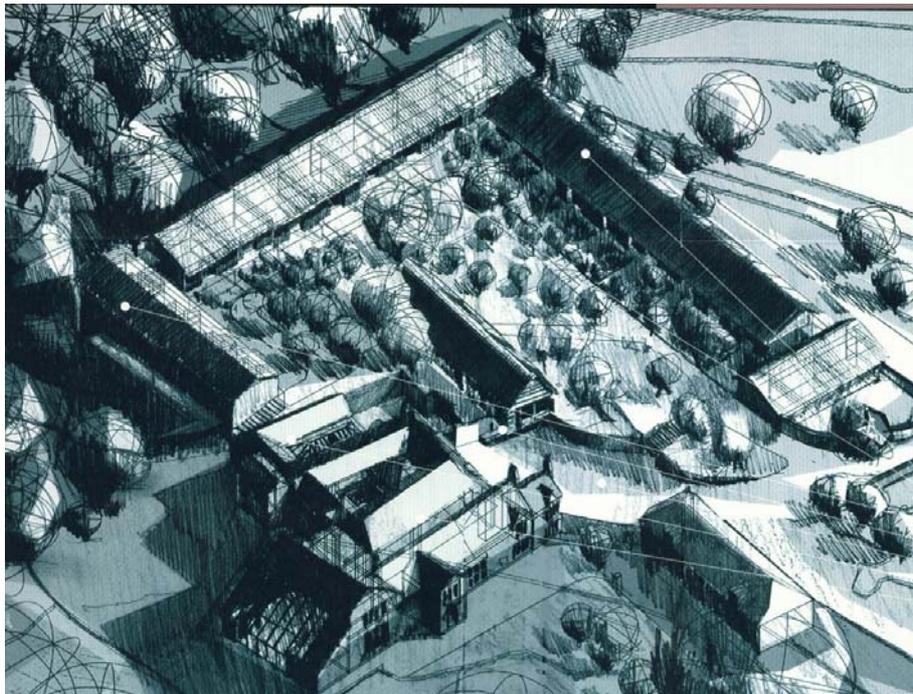


Director of Schumacher College, Anne Phillips and Chris studying the model together

A More Technical, And More Conventional, “Sustainable” Approach

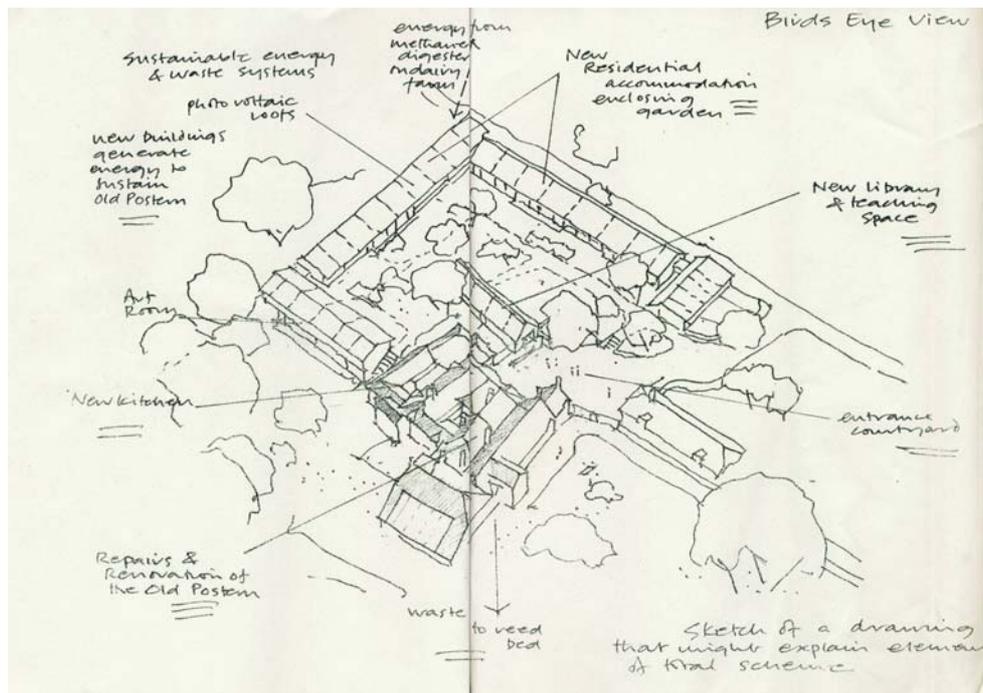


Model of the original Ronalds sketch design (first commissioned by Schumacher college). We made this model, in three dimensions, and at the same scale as our model, so that the two could be compared. The white area bottom left of the photograph, represents the footprint of the existing Old Postern building. We did not have the resources to duplicate a second Postern model for this design, and it was impossible to remove it from the other.



The architect's rendition of his recently proposed sustainable design with re-use of rainwater, thermal walls, possible solar panels, roofs oriented to sun.

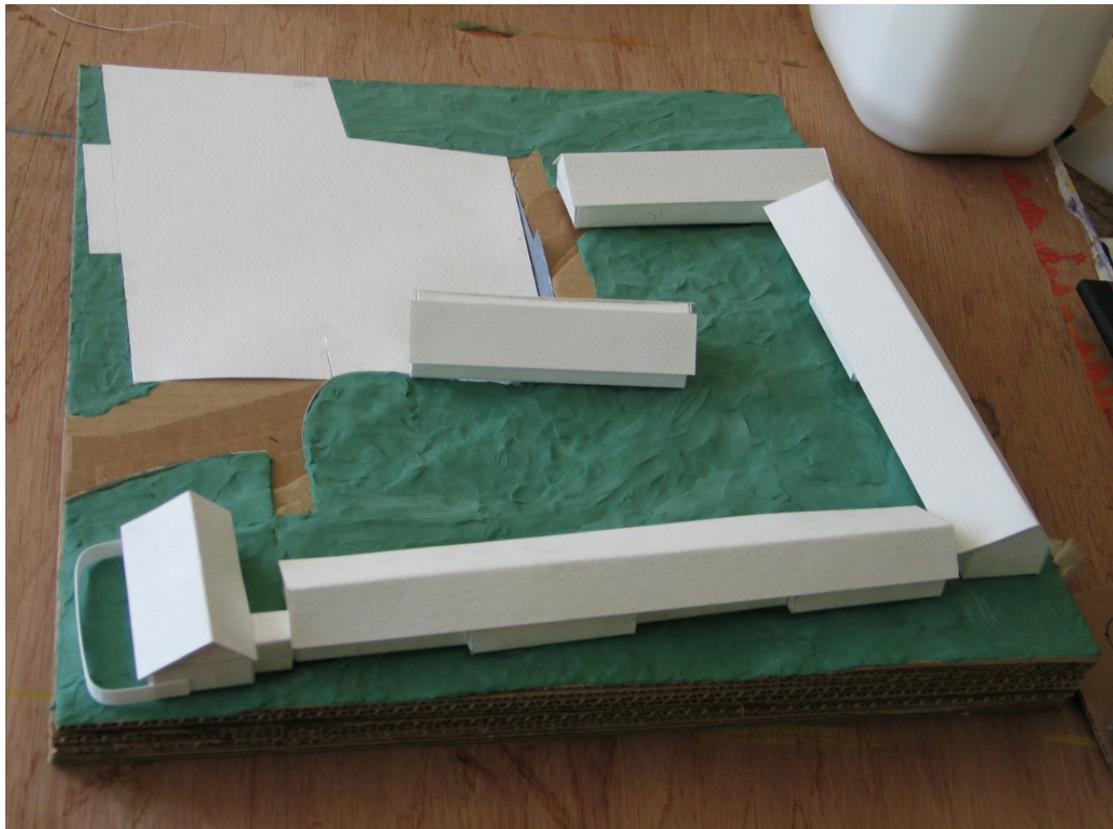
This design is more technical in orientation, but done with less concern for the wholeness of the land, and less awareness of the wholeness that is present in Schumacher College as it exists today. It pays less attention to the configuration that has grown over time, and for the subtle harmony to be achieved by building on what is there already. I believe it is also less sustainable in real terms and in terms of sustaining human life and plant life and money. It also involves needless destruction of existing buildings.



Architect's own sketch of techno-scheme. It includes photovoltaic panels, reed-bed sewage treatment, sustainable energy and waste system. In theory it is sustainable. Indeed, it is plain that the architect made a very sincere effort to incorporate all available technical-sustainable thinking.



CES design overview, seen from the east



The Ronalds design, also seen from the east.

A sustainable design, when it is made according to technological views of what is sustainable

Clearly the technical solution is intended to be sustainable in all sense of the word. What is remarkable is that, in comparison, this project appears gross and scaleless.

That is, I believe, a direct result of the approach used to produce the design. The technical approach focuses on a narrow range of issues and emphasizes them, above all others. The whole point of the morphogenetic approach is that it produces finely detailed structure, at a variety of scales, and produces sustainable and coherent wholes, at all the intermediate levels of scale, that are appropriate for human life, social life, biological life and ecological life.

What the morphogenetic approach generates – if it is done correctly – will always be something like this:

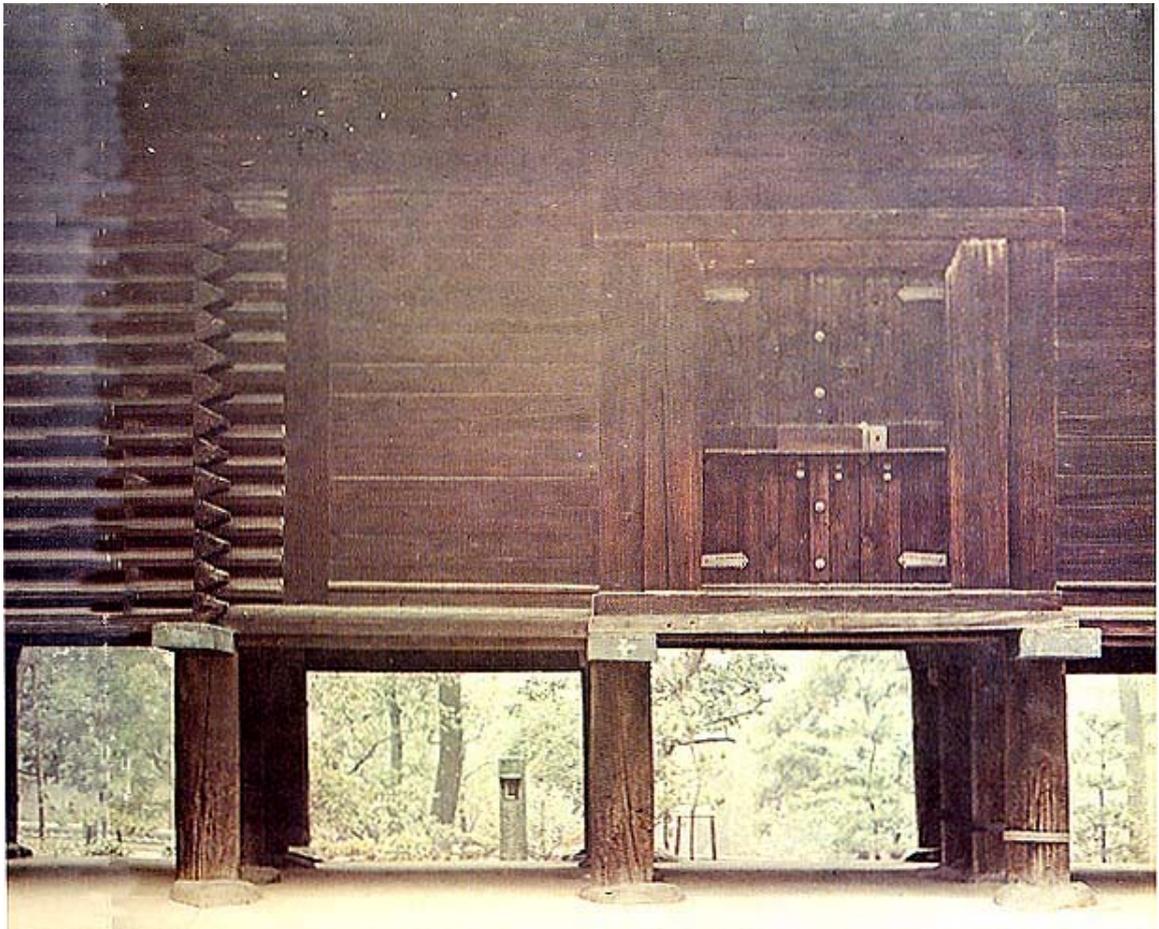


A living result of morphogenesis

A design made through a process which allows each step, slowly, slowly, to preserve the existing whole, and create something that fits into, and enhances, and makes precious, the existing land

XVI Approaching the Human Soul

Let's see. I think it would be helpful to show you half a dozen or a dozen pictures of some of the great places of the spirit, that have been made by human beings. And I think that it would be helpful – indeed very important -- to remember that all of them, in every single case, were made by the kind of morphogenetic process I have been talking to you about. These things represent true sustainability, they sustain the heart, and sustain the soul. They sustain the humanness of the person. And they sustain the Earth. The very last picture, shows a temple called Myo-Honji in Kamakura. In Japanese, the phrase “myo-honji” means “subtle reality temple.”



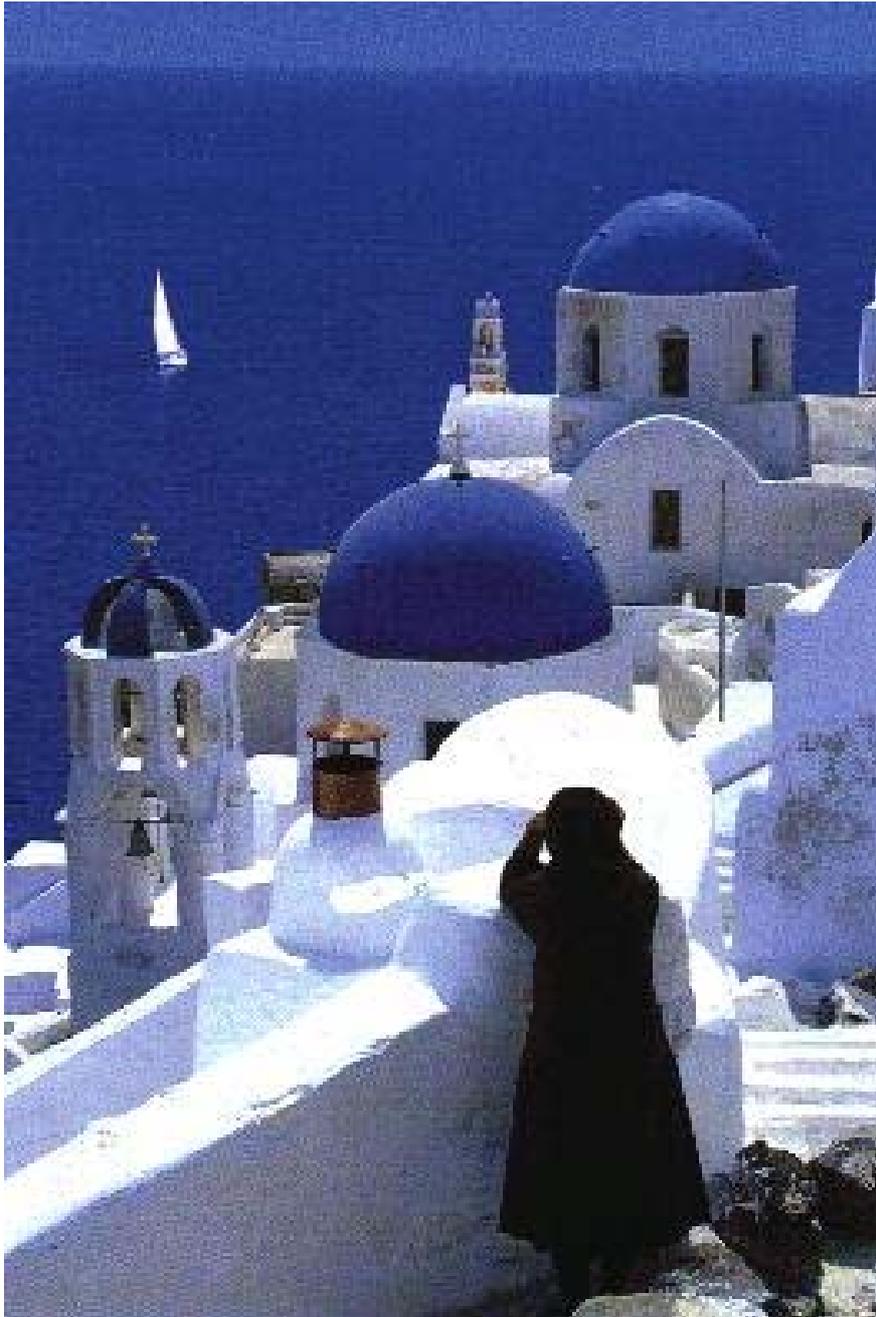
Shoshoin treasure house, 8th century, Nara



Church in the Aegean sea



Another part of the Aegean



Another church



Sand Garden of Tofukuji



The bridge at Tofuku-ji



Moss garden, Tofuku-j



San ju san Gen do – the thirty three bay temple in Kyoto with a thousand golden buddhas



*Myohonji, Kamakura.
In Japanese “myohonji” means “subtle reality temple”*

I was going to show you other things, but I think it’s probably in everybody’s interest that I don’t. So I will stop now....So thank you very, very much. Very lovely, lovely, thank you so much.

Thank you very, very much, for listening to me.

¹ Christopher Alexander, *The Nature of Order*, Four volumes, Center for Environmental Structure Publishing, Berkeley, California, 2002-2005.

² John Steinbeck, *The Grapes of Wrath*, Penguin classics paperback edition, 2000, page 85.

³ Text on structure preserving.

⁴ Will be available on the CD of wholeness enhancing processes.

⁵ This sequence may be seen on two DVDs. The Schumacher Lecture DVD, available from CES in California, or at PatternLanguage.com. And secondly, the DVD entitled Change Your World, also available from CES in California.

⁶ The following discussion is a drastically reduced summary of the empirical findings reported in Book 1 of *The Nature of Order, The Phenomenon of Life*, CES Publishing, Berkeley, 2002, see especially chapters 8 and 9, pages 313-70.

⁷ This question, and the many ways of asking it, are discussed at length in chapter 9 of Book 1 of *The Nature of Order*. The chapter is called “*Beyond Descartes: A New Form Of Scientific Observation*”, and indeed the whole chapter is devoted to this question.

⁸ See chapters 1-17 (pages 15-494) of *The Nature of Order*, Book 2, *The Process of Creating Life*, CES Publishing, Berkeley, 2002

⁹ *The Nature of Order*, Book 1, *The Phenomenon of Life*, pages 143-296.

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- ¹⁰ Pages 2-3.
- ¹¹ See pages 518-19 and following pages of *The Nature of Order*, Book 3, *A Vision of a Living World*, CES Publishing, Berkeley, 2005.
- ¹² Ibid, pages xxx-xx.
- ¹³ Stuart Cowan, Conservation Economy, with Ecotrust, <http://www.conservationeconomy.net>
- ¹⁴ Myanmar at a Glance, World Bank, website
http://www.worldbank.org/data/countrydata/aag/mmr_aag.pdf.
- ¹⁵ See Alan Weisman *Gaviotas: A Village to Reinvent the World*, Green Books, 1998.
- ¹⁶ Grameen bank reference.
- ¹⁷ DEFRA subsidy program
- ¹⁸ **“Macro-engineering options for climate change management and mitigation”**, Isaac Newton Institute in Cambridge from 7-9 January, 2004. **Cambridge UK Conference Look Into Climate Engineering, January 26, 2004**
- ¹⁹ **Toni Thayer, Global Weather Control System: Flurry Of News Stories Just Released**
Hoffman, R. N., 2002: Controlling the global weather. *Bull. Am. Meteorol. Soc.*, **83**, 241–248. also
Ross N. Hoffman, Controlling Hurricanes: Can hurricanes and other severe tropical storms be moderated or deflected? Scientific American, October 2004.
Ross N Hoffman, *Controlling the Global Weather*, Atmospheric and Environmental Research, Inc. PDF ...
http://www.niac.usra.edu/studies/study.jsp?id=715&cpnum=01-01&phase=II&last=Hoffman&first=Ross&middle=N&title=ControllingtheGlobalWeather&organization=AtmosphericandEnvironmentalResearch,Inc.&begin_date=2002-03-0100:00:00.0&end_date=2003-01-3100:00:00.0 02/18/05, 5399 bytes
- ²⁰ Ross N. Hoffman, Christopher Grassotti, John M. Henderson, S. Mark Leidner, George Modica, and Thomas Nehr Korn
Controlling the Global Weather. Atmospheric and Environmental Research, Inc.
131 Hartwell Avenue, Lexington, MA 02421-3126 Telephone: 781.761.2288 15 July 2004 **Universities Space Research Association (USRA), NASA Institute for Advanced Concepts (NIAC)**
- ²¹ Stewart Brand, How Buildings Learn, ...
- ²² John Holland, Complex Adaptive Systems, ...
- ²³ Shlomo Angel, *Housing Matters*, Oxford University Press, 2001.
- ²⁴ See *The Nature of Order*, Book 2, *The Process of Creating Life*, CES Publishing, Berkeley, 2003, pages 511-50.
- ²⁵ *Historical Estimates of World Population*. Source: U.S. Census Bureau, Population Division, International Programs Center.
Last Revised: 26 Apr 2005
- ²⁶ J. Kimball, Human Population Growth, *Kimball's Biology Pages*,
<http://users.rcn.com/jkimball.ma.ultranet/BiologyPages.html> September 2004. Diagram courtesy of John Kimball.
- ²⁷ Lovelock, The Gaia Hypothesis, ..