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.

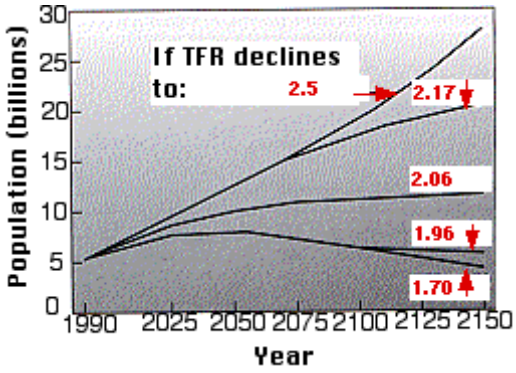
Developers and Planning

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.

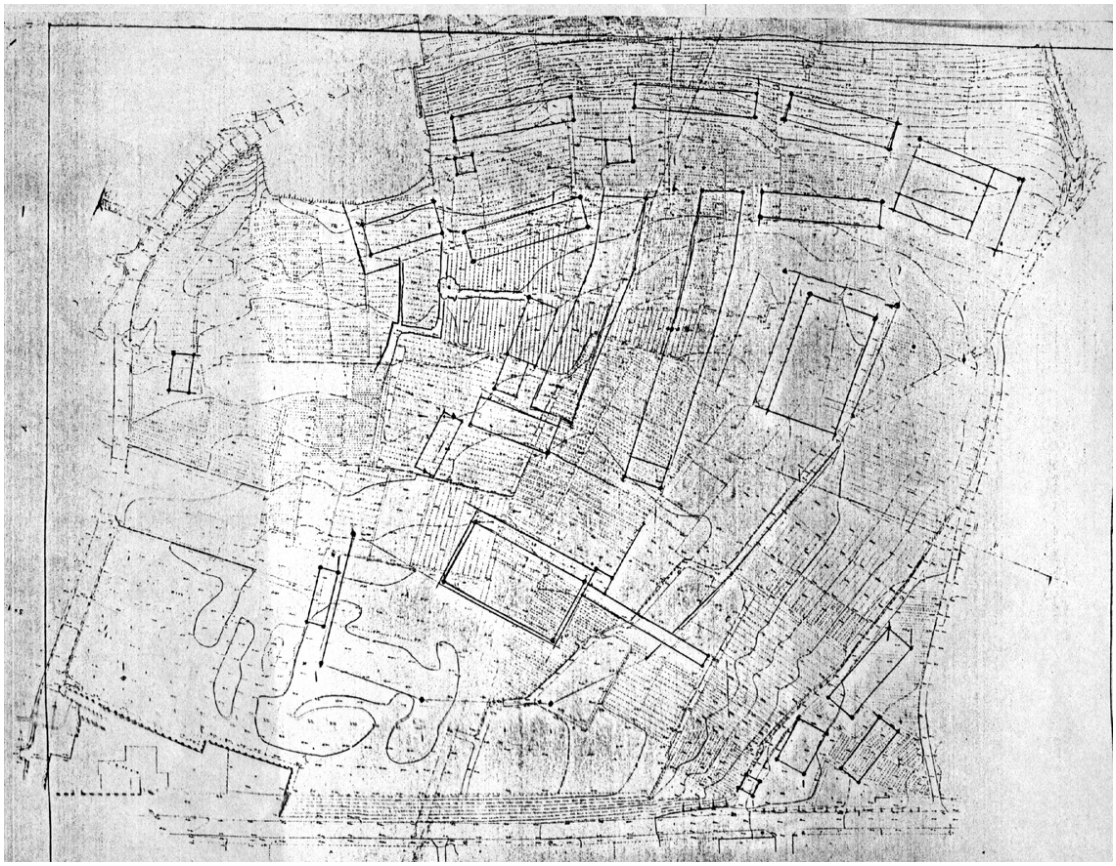
XIV The Eishin Campus

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

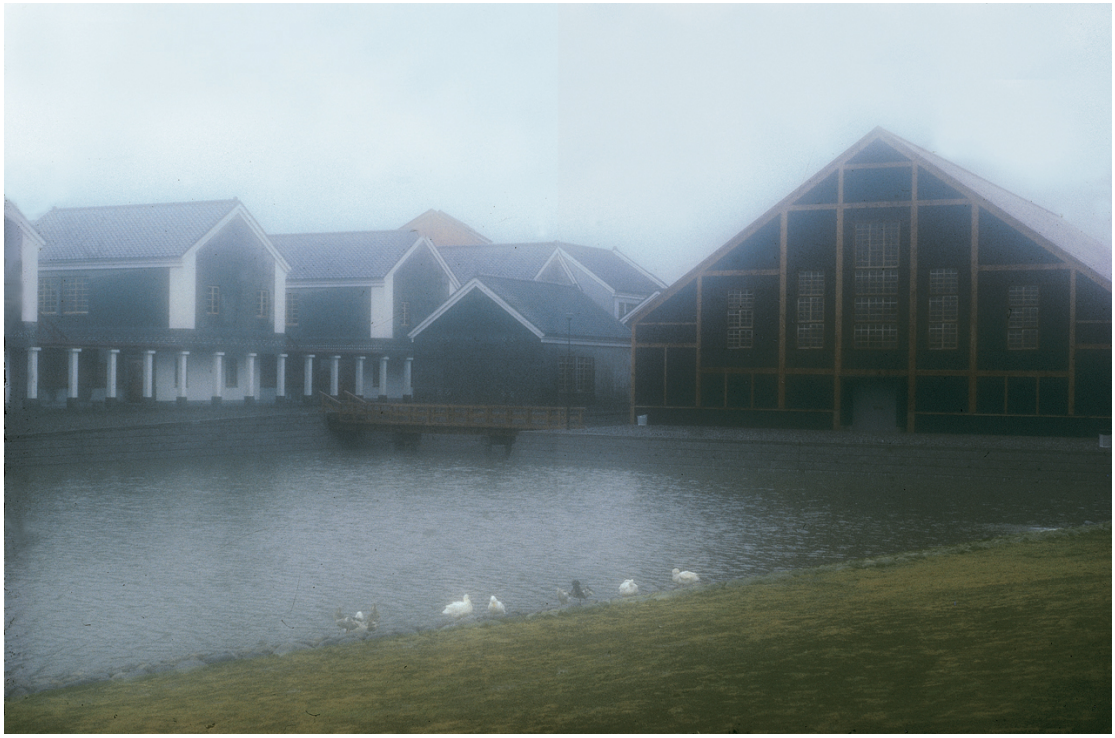
Classroom, attention, soft light

Inside the music school

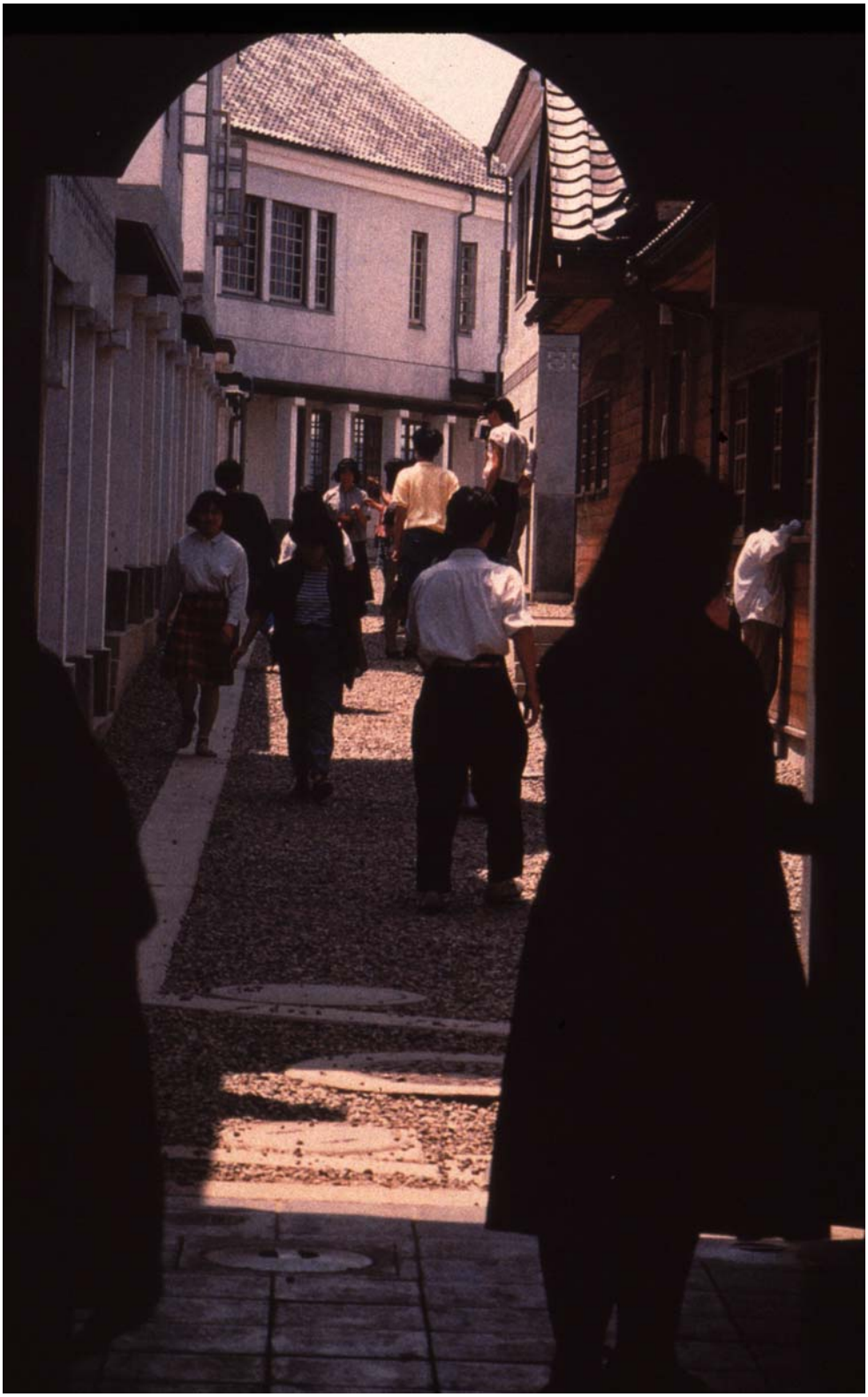
The loose and beautiful atmosphere of students in the space outside the Great Hall

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 austerely 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.

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