

THE NATURE OF ORDER

An essay on  
the art of building  
and  
the nature of the universe

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SKETCH OF A DRAFT  
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This is a summary of a book, which is expected to be about 1000 pages long. The book contains thirteen chapters. Each chapter is made up of some 20 sections, each section about 3-4 pages in length, with many illustrations, many in color. In the following summary, each one of these sections is summarised by one paragraph.

A number in parentheses after a section, means that the written material for that section already exists, full-length, in the four volume manuscript now in the University of California library.

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PART ONE

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COSMOLOGY

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There is a basic connection between the art of building and the nature of the universe.

The failures in architecture which we have experienced in the last few decades are directly connected to the picture of the universe we have inherited. In order to reestablish the art of building as an art, we shall have to create an adequate foundation of the subject -- and this, once it is done, will force us to make certain crucial modifications in our picture of the universe.

## CHAPTER 1

## THE NATURE OF ORDER

The art of building is in a decline far more severe than ever before in human history.

It is trivial, pretentious, meaningless, exclusive. Most often it is not even fun to do.

The reason for the decline is rather simple. We have no widely accepted understanding of what we are trying to do when we build a building.

We may summarise this by saying that we do not have a coherent understanding of the nature of order.

Yet what we build arises directly out of our conception of order. If our understanding of order is damaged or non-existent, it follows that we cannot build anything successful -- let alone, anything with deep meaning.

Furthermore, as we shall see, our understanding of the nature of order, is directly tied to our picture of the universe.

So our failure to build well, too, is directly linked to the picture of the universe which we have. If we accept the picture of the world as it is, we cannot succeed in building well. On the other hand, if we insist on building well, and create the necessary intellectual foundation for doing it, we are then forced to abandon our present view of the nature of the universe, and will face catastrophic reorganisation of our cognitive structure.

## THE NATURE OF ORDER

After many years of struggle, I have finally accepted the second of these paths.

In this book I shall therefore try to build a picture of the nature of order -- and hence also, a picture of the nature of the world -- which is coherent enough to give us a foundation for the art of building.

PART TWO

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FOUNDATIONS OF THE ART OF BUILDING

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In the next eleven chapters I shall present the fundamental facts about order. These are facts of experience, which lay a new, and entirely different foundation for the art of building, from the one that we are used to.

## CHAPTER 2

## THE PHENOMENON OF WHOLENESS

We begin with the idea of wholeness.

We are faced all the time with examples of things which SEEM whole, like a wild river.

We are also faced with examples of things which SEEM unwhole, like the infamous Love canal.

Occasionally we are faced with extreme cases of an order or harmony so subtle, that it serves as a model, or target of our aspirations. This happens, for example, in the beautiful yellow tower from northern China: the 6th century tower of the wild goose (12).

In science -- the study of nature -- we have not been very strongly aware of this dimension of our experience, because almost everything is more or less whole.

However, when we consider human artefacts -- the things which we ourselves make, buildings, towns, clothes, tables, ornaments... their relative degree of wholeness is the dominant feature which comes to our attention. There is no doubt that some of them are more harmonious than others (11).

In spite of these examples, we have not, so far, explicitly recognised wholeness as an objective dimension of experience (209).

This lack of recognition is complicated by the fact that in our present cosmology, we cannot even construct a coherent theory which might lead us in the right direction.



## THE PHENOMENON OF WHOLENESS

We are therefore forced to begin with our intuitions about the subject, and must then try to construct a clear and coherent version of those facts which we perceive dimly through intuition.

Let us start with an example of something which seems obviously to feel whole or "alive": a simple fountain in a public square. We shall recognise that its aliveness is linked, to a surprising extent, to its ORGANISATION: thus, to its geometry (207).

Almost every kind of situation in the world can have, or not have, this kind of wholeness. It can happen in a place setting at a table; it can happen in a wall where people are sitting; under a tree; in a street; in a room; in a building; in part of a town. (157a)

It can also happen in purely geometric cases: things which we regard as ornaments...a cloth, a tile, a stone carving, the shape of a column, a column capital, a carpet, an embroidery, a pattern of wood strips around a barn...(48, 174)

It is evident that this wholeness we feel in things is not a purely functional matter... since it occurs equally in cases we think of as "functional" and in cases which we think of as "ornamental".

It is also evident that even a very powerful functional view of buildings, like that in the pattern language, although enormously helpful, does not adequately describe the wholeness of a building (160).

## THE PHENOMENON OF WHOLENESS

Apparently, the thing we see and feel as wholeness is something more general than function, and something which cannot be described in mechanistic terms. The order of a mechanism cannot capture it, since at least half the cases where we see it cannot be described as mechanisms at all.

It is therefore necessary for us to take the explicit step of recognising wholeness as a geometrical PHENOMENON in its own right, which occurs in space, and which exists in a realm beyond function and beyond ornament.

We shall accept the existence of this phenomenon as fundamental, in everything which follows.

## CHAPTER 3

## THE MIRROR OF THE SELF

How can we define wholeness precisely? How can we measure it? How can we know whether something is whole or not? If we compare two things, how can we tell which of the two is the more whole?

This is a problem of great difficulty, since our present cosmology insists that matters of value are not objective. People are encouraged to assume that their judgements are all based on individual and personal preference.

It is therefore natural for a person to doubt his own judgement about wholeness, since personal preferences are certainly subjective.

But judgements about wholeness are entirely different from personal preference.

Of course, to some degree, merely paying attention to the word "wholeness", as we have been doing during the last few hundred pages, already helps us to make judgements of wholeness which are more objective than our opinions.

But in spite of this way the word helps us, it can still take a lifetime of experience to judge accurately which things are more whole than others.

If we wish to establish wholeness as an objective concept, it is necessary to be able to reach agreement more easily, and in a shorter space of time. How can this be done. Is there any way of seeing wholeness which allows the observer to rise "above himself", and see clearly without his normal overlay of preference, inexperience, opinion and bias. There is.

## THE MIRROR OF THE SELF

There is a method of observation which does have this effect. It requires that the observer ask to what degree a given thing is, or is not, an image of his own self.

A series of empirical examples will make this method clear.

If we compare two objects, we can always ask "which of the two is a better picture of our own self?" (16a).

Even for two simple objects like a salt shaker and a ketchup bottle, it is possible to ask, and to agree, which of the two is the better mirror of the self (16).

Experiments show that, in general, people agree to a remarkable extent about which objects are more, or less, like their own self (17).

This is true for buildings, paintings, parts of a neighborhood, doorknobs, spoons, roads, clothes, tables, chairs, roofs, walls, doors, windows, towers, groups of buildings, parks, gardens, even for a single stone set in the earth.

Very amazingly, it turns out that this judgement is independent of person-to-person differences, and independent of culture. It seems to depend, not on any individual or cultural self, but on some greater "self", beyond our individual selves.

Thus it turns out that any given object, or part of the world, is, to a greater or lesser degree, an image of THE human self.... and that this can be determined rather objectively.

## THE MIRROR OF THE SELF

Asking which of two objects is more like a mirror of the Self, does not mean asking which one reminds someone more of their own idiosyncracies. It is more like asking which of two is a more true picture of the human soul (18).

The fact that agreement about such a criterion exists, is surprising enough. What is even more surprising, it turns out that this criterion correlates extremely well with the degree of wholeness which we intuitively feel in a thing.

Apparently we may use the degree to which a thing appears to be a "mirror of the self", as a measure of its wholeness. This idea -- which implies that wholeness (an objective condition in the world) can be measured by the degree to which it is a "mirror of the self" (a subjective condition in the mind) -- is clearly not consistent with the ideas which have been taught us by our presently accepted cosmology.

In the past, scientific cosmology has made a deliberate effort to separate observations from the individual self. Observations and theory are specifically intended to be true, without reference to the self of the observer.

Yet, as a result, cosmology has tended to shut out the person from our picture of the world. Science has constructed a picture of the world in which the human self, the heart of our experience, has no place.

The fact that a phenomenon like the mirror of the self (a phenomenon rooted in the inner world of a person) might be used as a criterion for wholeness (a phenomenon which occurs in the outer world) -- must cause a deep change in our way of looking at the world.

## THE MIRROR OF THE SELF

It implies that the structure of the universe, and the nature of the human self, are deeply connected.

This way of looking at the world, existed, previously, in all the great religions.

This is no accident. To understand it, it is necessary to focus on an empirical fact, of great significance: namely, that if we examine human history, we find that the most beautiful buildings, tiles, pots, paintings, carpets, doorways, plates, embroideries, clothes....all those which are most deeply filled with spirit... were almost all made within some kind of religious tradition.

This does not mean that we are now forced to be "religious" when we try to make such things. But as an empirical fact about the past, it cannot be denied. And it also cannot be ignored.

Apparently, there is some process, deeply seated in religion, which has enabled craftsmen rooted in a religious tradition, to create wholeness, as a normal part of their lives.

It is also significant, that almost all these religions, as disciplines, required the craftsman to give up his individual "self", in the pursuit of God, and to seek union with the great "Self" or the "One".

Even if we dismiss such ideas as nonsense, it cannot be denied that, empirically, these processes seemed to work. Apparently, there is some real connection between the self, the mirror of the self, and the idea of wholeness or "the one", which has been known for a long time.

## THE MIRROR OF THE SELF

In any case, no matter how we view that question, it remains true EMPIRICALLY, that the mirror of the self gives us a solid basis for agreement in our handling of the phenomenon of wholeness.

Things which are whole by any reasonable functional criterion - healthy, well organised, alive, balanced, coherent....are just those things which seem to be the best mirrors of our selves. And further, those things which possess the complex of structural qualities that I have described in the last five chapters, are also, precisely, those things which seem to be the best as "mirrors of the self".

Thus we establish wholeness as an objective condition in the world, with the understanding that it does not exist merely in the outer world, but that it is related, at the same time, to our experience of the self, and therefore exists in some fundamental fashion, IN AN INNER WORLD AS WELL.

## CHAPTER 4

## FIFTEEN TYPES OF GLUE

We now begin a detailed geometric account of the phenomenon which we call wholeness or "the one".

The condition we call wholeness is a condition of space in which space is "glued" together (21, 181). The glueing together of space depends, on a limited number of relations which can occur in space. These can be defined rather precisely (20).

Levels of scale. Within any given whole, there are many discernible levels of scale, and wholes exist at many levels, ranging from the largest to the smallest (22).

Alternating repetition. In any whole, there are large quantities of repetition, and, in almost every case, this repetition has a form we may call "alternating repetition" (23).

Boundaries. Everything has a boundary. Indeed, each whole has a boundary that is itself made up of wholes, and the wholes which form the boundary are almost as big and dominant physically, as the whole which is being bounded (24).

Centers. Each whole has a "center" (25).

Positive space. Every whole has another whole next to it, so that the wholes and spaces between wholes form an unbroken continuum (26).

Good shape. Each part of every whole has some kind of "good shape" (27)

Deep interlock and ambiguity (28)

Local symmetries. Each whole is marked by local symmetries within it (29)



## FIFTEEN TYPES OF GLUE

Graded variation. Throughout the whole, there are graded fields of variation, often moving outward from the center to the boundary (30).

Contrast. There is pronounced contrast between neighboring wholes (31).

Roughness. Everything which is whole, has a roughness and unevenness among its parts (32).

Echoes. In any whole, it is noticeable that the various smaller wholes of which it is made, have echoes of one another, so that there are various internal similarities visible among the parts (33).

The void. At the heart of any given whole, there is a whole which forms a void (34).

Inner calm. In a whole which is correctly made, there is a special simplicity which causes "inner calm" (35).

Not separateness. In a whole which is deeply coherent, there is a lack of separation between the whole itself, and the other wholes which surround it, so that the various wholes melt into one another and become inseparable (36).

In order to understand the way these fifteen properties help wholeness to occur, we shall examine a series of pairs of objects, in which one has a certain property, and the other lacks it. This will show us, one at a time, how the presence of the fifteen properties contributes to the wholeness of an object formed (203).

Apparently, each of these fifteen properties is a kind of glue which forms wholeness or oneness in space, by binding space together.

## FIFTEEN TYPES OF GLUE

We do not yet have any idea why such properties should exist, nor what these properties might be, nor why they work. All we know, so far, is that they do, apparently, correlate very strongly with the phenomenon of wholeness which we have earlier identified. In the following chapters, we shall try to understand, more deeply, just what they are, and why they work (202).

## CHAPTER 5

## FUNCTION AND ORNAMENT

The fifteen properties are fundamental ways in which space in an ornament, or in a building, becomes whole. However, we have only seen this so far, in the realm of pure GEOMETRY or ORNAMENT.

We shall now see that these properties are far more powerful, and far more significant. They also underlie all cases of FUNCTIONAL wholeness which can exist in the world. This means that they are not only responsible for the way that something looks: they are also responsible for the way it works (95).

In functional terms, "Levels of scale" corresponds to the existence of functional hierarchies in nature (95a).

"Centers" corresponds to the existence of centers of functional organisation (95b).

"Boundaries" corresponds to the existence of functional separations and transitions between systems in nature (95c).

"Local symmetries" corresponds to the existence of minimum energy and least action principles (95d).

"Alternating repetition" corresponds to the duplication of similar systems (95e).

"Graded variation" corresponds to the existence of gradients and field-effects in nature (95f).

"Roughness" corresponds to the results of local adaptation (95g).

Positive space. Every whole has another whole next to it, so that the wholes and spaces between wholes form an unbroken continuum (26).

## FUNCTION AND ORNAMENT

"Good shape" corresponds to the tendency natural systems have to form closed gestalts.

"Deep interlock and ambiguity" corresponds to the fact that natural systems interact most easily along extended surfaces.

"Contrast" corresponds to the fact that all natural systems get their fundamental energy from the interaction of opposites like negative and positive.

"Echoes" corresponds to the fact that there are always natural homomorphisms and isomorphisms in the different parts of any single system.

"The void" corresponds to the fact that differentiation of minor systems, always occurs in relation to some large and more stable system.

"Inner calm" is the Occams razor of any natural system - the fact that each configuration which occurs in nature, is always the simplest consistent with the conditions

"Not separateness" corresponds to the fact that there is no perfect isolation of any system, and that each part of every system is always part of the larger systems in the world around it, and connected to them deeply, in its behavior.

Each one of these fifteen properties introduces a different archetypal kind of "function", and corresponds to one of the fundamental ways in which a system comes to order (94a).

The properties therefore correspond to the basic ordering principles which we find in nature, because they correspond to the basic types of function, or types of adaptation between systems (98).

## FUNCTION AND ORNAMENT

But they not only play a basic role in the way that NATURE functions. More particularly, they also play the crucial role in the way that BUILDINGS function (44).

The patterns which make a building work, have been described in A Pattern Language. On close examination, it turns out that these patterns get their power largely from the fact that they embody the fifteen properties (96).

It thus becomes clear that the unity of space is not merely a visual or structural fact: it is a deep functional unity, in which things are tied together in their behavior (37).

Yet, as we can see in the case of pure ornaments, it is also a "non-functional" unity.

Apparently, the oneness or wholeness of space which our fifteen properties define, lies in some realm of pure structure beyond ornament, and beyond function (97).

## CHAPTER 6

## THE FIELD OF CENTERS

We now have a reasonable empirical understanding of the structure we call wholeness. Apparently it is a particular structure which exists in space whenever the space has been unified by various properties which glue the space together -- both geometrically and functionally.

However, we do not yet know what the fifteen properties really are, nor what they do, nor why they work, nor how to interpret them in a unified way.

What we shall discover, next, is that the fifteen properties are deeply related. The thing we call wholeness, is not a composite structure made of fifteen unrelated different properties, but a SINGLE structure of a particular type. This single structure is ALWAYS present when something is whole; and it is present to just that degree to which the thing is whole (37a).

The single structure may best be described as a FIELD OF CENTERS. It is a field, produced by the interaction of wholes to form larger wholes.

In order to understand it most easily, we may consider each of the different wholes as a "center". Then the phenomenon of wholeness, or oneness, can be understood precisely as a "field of centers".

A center is a fundamental entity, which has the attributes of wholeness, boundaries, centers within itself, and so forth. It is the building block out of which oneness or wholeness is made. At the same time, it is also ITSELF made up of the very same building blocks (41).

An example of a column which is whole, shows us exactly what it means to say that a center is a field of centers (42).

## THE FIELD OF CENTERS

The main idea of wholeness, can thus be summarised in the following statement: EVERY CENTER IS A FIELD OF CENTERS.

In order to understand this statement very well, I shall take it in three steps.

First, I shall explain what I mean by a FIELD. The idea is exactly the same as the idea of a field which has become commonplace in physics.

Second, I shall explain what I mean by a field of CENTERS. What do I mean, specifically, by talking about a field of centers, as opposed to any other kind of field.

Third, I shall explain what I mean by saying that a center IS a field of centers. A center is nothing until it produces a field effect (46).

We see then, that the concept of a whole or center, is such that it can only be defined as a structure of other wholes or centers. This does not mean that the definition is circular. It is simply complex, and has the character which is called "recursive" in mathematics (43).

A thing which is whole, has the same wholeness in it, pervading it, at every level, and its beauty comes from the fact that every part at every level is perfectly right in itself and in its relation to the wholes around it (47, 177).

The peculiar recursive quality of the nature of a center, or of a whole, is just that which should convince you that it is consistent with the nature of the universe. Nothing more simple minded could be deep enough to be true (47a).

THUS, REPEATING ONE LAST TIME, AND PUTTING IT ALL TOGETHER: WHOLENES IS A FIELD OF CENTERS, IN WHICH EVERY CENTER IS ITSELF A FIELD OF CENTERS.

## THE FIELD OF CENTERS

This statement is not merely an abstract formulation. It directly illuminates experience. The most heart-rending places on earth are the way they are, because they have the field of centers in them (249).

The Villa Serbelloni on Lake Como is alive, because it has a layered quality which embodies the field of centers directly (44a).

Tofukuji, perhaps the greatest remaining temple in Japan, also receives its spirit from the presence of the field of centers (44b).

In order to understand the idea of the field of centers accurately, it is very useful to compare buildings which have it, with other buildings that are superficially similar, but which do not have the same structure at all (189).

We may now recognise why the fifteen properties work like "glue". They are precisely those fifteen possible structures of centers which can contribute to the formation of a field (40).

Another way of saying the same thing, is to say that they are the fifteen different ways in which wholes can be united to form larger wholes (39).

We thus see that the wholeness of the world is part of its PHYSICS. It is above all a GEOMETRICAL phenomenon: an aspect of the structure which occurs in space (99).

It embraces function. But it lies purely in the structure of the space. And in this sense, even a building, complex as it is in function and behavior, is, in the end, essentially an ornament -- like a piece of music, a thing, which achieves its wholeness, through pure structure (99).



## THE FIELD OF CENTERS

This is a remarkable conclusion, which fundamentally alters our attitude towards the art of building, or the task of making anything.

It means, quite simply, that every process of design and/or construction -- in order to produce wholeness -- must gradually produce a more and more coherent field of centers (53).

We can easily establish that there must, in principle, be such a process. The process of producing centers is one of the most fundamental of all human processes, and is completely natural, in the most ordinary way (daisy chain, knives and forks, birthday cake) (50,51).

An example from a staircase shows how the process of forming centers makes an enormous difference in what is created (63).

We may also reconstruct the way that the Alhambra was made, also by a process of producing centers (54, 164).

In the use of pattern languages too, a field of centers is produced. Each pattern defines a center or a group of centers. Thus in Mexicali, the centering process followed a broad sweep but was constantly changing its scale, from large to small, and back again, up and down, up and down, as the process went from pattern to pattern (55, 163).

All processes in the world which are able to produce wholeness, are, on some level, realisations of this general process.

If we are trying to lay out a neighbourhood in a city, we will do it best by constructing a field of centers there (232).

## THE FIELD OF CENTERS

If we are trying to build a beautiful truss, in a roof, we will do it best by constructing the truss as a field of centers (233).

If we are trying to glaze a beautiful tile, for a fountain, we will do it best if we recognise that we are creating a field of centers (234).

If we are trying to lay out a building, we will do it best if we remember to consider the building as a field of centers (235).

In an individual room, if we are trying to shape the room, in such a way that it has a comfortable, and peaceful feeling, we will do it best, by making the room, as far as possible, a field of centers (236).

Even the creation of ornament in the building, goes hand in hand with its construction, and is constantly trying to refine the centers which are there (257).

In short, we recognise that every act of making ANYTHING, will be able to produce wholeness, just to the extent that we succeed in making the thing, as far as possible, a field of centers (237,254).

This the central, and ONLY, task.

## THE FIELD OF CENTERS

-oOo-

At this stage we must modify our picture of the world in a very fundamental way indeed. We have assumed, always, that the universe is made of atoms, floating and moving around in space. In recent years, it has also become clear that the space itself has a structure (something like a foam of bubbles, even in the so-called vacuum) and that the space where matter appears, is only slightly different from the space where there is a vacuum. Thus, we know the universe is made of space, which has ripples in it, where what we call matter happens. Everything in the world is formed out of this space/matter. The elementary particles of matter - atoms, electrons, whatever -- have always been assumed to have a more or less unchanging character, as they enter into combinations. Thus, we have tended to think of matter, as a kind of pattern of ARRANGEMENTS of elementary particles, which themselves then appear more or less unchanged in the combinations they create.

Now of course, it has always been known that an electron in an atom is not quite the same as a free electron; and that an atom in a molecule is not quite the same as an atom by itself.. but we have assumed, that this kind of difference is minor, and still easy to explain within the framework of thought that treats combinations as ARRANGEMENTS of the elementary particles.

The nature of a center, and of the field of centers, as we have understood it, now teaches us that space and matter have an entirely different nature. It appears that the space/matter changes, FUNDAMENTALLY, in its nature as it gets progressively more organised.

## THE FIELD OF CENTERS

All space-matter has the capacity to have centers in it. When a center appears there, other centers are intensified by the presence of THIS center. This is like Ernst Mach's idea, that the behavior of any one particle is affected by the whole universe. The overall configuration of centers, affects itself. Since each center intensifies others, we have a substance (the space/matter) which apparently seems to generate order within itself, almost spontaneously, since the production of order at any one point (a center), can increase the orderliness, and intensify the order which appears in other centers.

Note: It should be understood that the fact that centers intensify other centers, is not somehow a property of the "material" from which space is made. It is a property which arises for mathematical reasons, and is inherent in the very geometry of space itself.

The implications for architecture and the art of building, are enormous. As we make buildings and shape the world, we are not merely rearranging elements. We are fundamentally, CREATING the order of the world, out of nothing. As we build, we change the substance of the universe itself.

## CHAPTER 8

## COLOR AND INNER LIGHT

So far we have tried to understand wholeness, purely as a property of arrangement, of geometry.

But of course, the various geometrical elements or parts, have properties beyond their geometry.

We cannot imagine that a daffodil would be equally whole if it was blue instead of yellow. Or a Matisse painting, in which the colors have been altered.

Thus, there is a harmony, wholeness, which can lie in materials, and colors, beyond the geometry. And, indeed, it is clear that the field of centers, if thought of as a purely geometrical idea, will by itself not make things whole. The color, or the matter out of which the thing is made, must make it whole also, must participate in the wholeness.

We shall now concentrate on this even deeper field like effect.

We start with color. We shall understand the unity, most easily, by studying the phenomenon of color. Within the realm of color, we see wholeness as something which we may best call "inner light" (100).

The greatest examples of inner light come from ancient persian and turkish miniatures.

Other examples come from early medieval painting and decorations.

Others come in Japanese silks and pottery, and in prehistoric chinese bronze.

## COLOR AND INNER LIGHT

Others come in the tilework and stonework on certain ancient buildings. Inner light occurs in buildings too -- but in a building it is much more subdued, more subtle than in the case of ornament or painting (109).

In every case, the color phenomenon which exists when something is made whole, has a very special kind of subdued brilliance. It is this subdued brilliance which I call "inner light" (119).

Just as geometric wholeness is produced by fifteen definite properties, so in the realm of color, inner light is also produced by certain definite properties of the arrangement of the colors.

The light is caused by a proportion among colors, in which there is a clear hierarchy of sizes, in the different colors.

The light is caused by boundaries between colors.

The inner light is caused by roughness of individual color, a lively variation within the field of a single color.

The inner light is caused by complementarity of hue, in which opposing colors sum to white.

The light is caused by dark-light contrast, exactly the same as we found in the geometry.

The light is caused by echoes, in which each color contains traces of the other opposite ones which it is near.

The light is caused by interlock, in which each color, is embedded, physically, in the others next to it.

## COLOR AND INNER LIGHT

These properties are almost exactly parallel to the fifteen properties we have already identified in the realm of geometry (101, 102).

And the two sets of properties are causally related. Wholeness in geometry somehow helps to create inner light in color. Inner light in color, somehow helps to produce wholeness in geometry (116).

Color is thus not an isolated phenomenon. It is not something which is merely "stuck on" to the geometric structure we have been discussing. It is fundamental to the structure of space, and to our understanding of function and geometry (113).

Indeed, the way that color produces light, shows us wholeness in a deeper way which we have not seen before. It is a state in which things are so deeply unified that everything is melted.

It is even possible to think of wholeness as a kind of light.

## CHAPTER 7

## SUBSTANCE AND CONSTRUCTION

But even color is not enough.

The floor of the Baptistery in Florence is not only beautiful in decoration, it is cool, smooth marble, made of many small pieces. The beams of a stave church are not only beautiful in shape and position, they are made of massive pieces of wood, whose grain, age, carving, and color are essential to their beauty.

In ancient seljuk tiles, it is not just the design, but the glaze, sheen, color, and clay which make the thing. In shaker furniture it is the pine, glue, planing, joints, and paint, which make it perfect. In a romanesque church, it is the way that stone is laid on stone, the way that individual stones are cut, and carved, and set, which brings the thing to wholeness.

Thus, in a thing which is whole, the material, substance, out of which the thing is made, is fundamental to its beauty, fundamental to its wholeness.

The reason why these "extras" also have to be just right, is that the field of centers, simply cannot exist, unless the material conditions are appropriate.

This is not some new, additional idea, beyond the field of centers. It is the same idea. The wholeness still lies in the existence of the field. But what we may not have grasped, from the analysis which we have done so far, is that this field requires very definite conditions, simply in order to exist. Material substances, or procedures of fabrication, if they are wrongly chosen, can easily destroy any chance that the field of centers can be created.



## SUBSTANCE AND CONSTRUCTION

In essence, the key idea is simply this: The material out of which something is made, and the process of construction, must be consistent with the existence of the field of centers, must encourage it, must allow it to come into being.

Let us first try to see this for construction systems.

We want the elements of the construction to be able to create centers in the SPACE. Not all systems can do this easily. It requires that the system is specifically oriented to it.

For instance, stud wall construction or concrete panel construction, make it very difficult. The systems we used in the Martinez house, or in the Orinda house, or in the Albany house, make it easy.

Also, the actual material itself, and the way that it is worked, must allow the field to come into existence.

Sheetrock, aluminium, plastic sheets, concrete when it is incorrectly formed, pre-mixed colors, asphalt roofing, cement plaster, plywood all make it hard.

Marble dust, carefully planed fir, lime plaster, earth, paper, concrete when it is correctly formed, all make it possible, and even easy.

This happens because the material creates sensuous conditions. They may be in harmony with the field; or they may work against it. Thus the material ITSELF must be one which allows the field of centers to exist in it.

## SUBSTANCE AND CONSTRUCTION

Finally, the process by which the material is worked, the human organisation of the making, can also interfere with the field of centers, or allow it to exist.

In order to produce the field of centers, it is necessary to have direct human control over every evolving center, and thus to make each one by "hand" (296).

The fact that every center must be made "by hand" does not imply any return to primitive technology. It is consistent with the highest modern technology available (297).

But the process must allow each center freedom to develop according to its context, in an unpredictable fashion. To achieve this, we have to use a method which allows the gradual formation of centers, one by one, under conditions which allow each center to be as whole as possible according to its place within the field (250).

In practice, this means that the work of making, and the work of design, must become inseparable (251).

This modifies the nature of the builder completely. Plasterers, carpenters, concrete workers, masons, cabinet makers, will all need to be guided in their work by the emerging centers which they see. It will change their daily work.

And it modifies the nature of the architect too. No one can succeed in designing buildings, without also taking responsibility for building them physically.

It also modifies the nature of the planning process, and our attitude to land development. It modifies the nature of production, and the manufacture of materials. It modifies the use of money entirely, and modifies our attitude to money. It modifies our attitude to time.

## SUBSTANCE AND CONSTRUCTION

Above all, the basic motive for construction changes. In this new view the production of the world is aimed entirely towards the production of order, or wholeness.

And, as a result, both the physical process of making buildings, and the materials they are made of, are chosen to allow the field of centers to be made.

For example, finite element analysis on small computers, when used in the right way, allows it to be done in complex engineering structures.

Gunite construction allows it to be done in an all concrete house.

Concrete and wood in combination allow it in the Albany house.

Heavy timber construction allows it when the wood is understood as a material in three dimensions, not in one or two.

Dry stacked concrete blocks allow it in simple buildings, because they can be shaped to give the walls and columns the beautiful and individual shapes they need.

The use of one inch planks in furniture allows it because the furniture becomes simple.

All these techniques allow the creation of the field of centers in the physical structure of a building.

They are the 21st century equivalents of ancient and traditional techniques. With these techniques, we can expect a radical change in the sensuous, and physical reality of the world which is created.

## CHAPTER 9

## STRUCTURE PRESERVING TRANSFORMATIONS

We are now ready for a full description of the process of creating wholeness.

We have already seen that wholeness can be created only by creation of the field of centers. This idea is very helpful, because it is simple.

However, from a practical point of view, this idea does not work. It is TOO simple. We are now ready to grasp the real secret of the process of creating wholeness, is a general and powerful way.

Let us consider any arbitrary moment in the process of creation. At this arbitrary moment, there is always SOME structure there already. There is always a field of centers, of some sort, possibly weak, but nevertheless existing. And into this existing field of centers, we are going to inject more structure, by strengthening one or more existing centers or by creating one or more new centers.

Now, merely saying that we have to create centers, does not really tell us enough. The crucial question is always this. WHICH CENTERS SHALL WE WORK ON NEXT (52, 52a, 59).

When we try to answer this rather simple and practical question, we discover a whole portion of the theory of order, which we have so far not dealt with at all.

It rests on four key facts.

1. At any given moment in the history of a thing's development or its creation, the arrangement which exists has a definite "structure". This structure is a field of centers, some weaker than others (80).

## STRUCTURE PRESERVING TRANSFORMATIONS

2. Every next-step can be thought of as a transformation which injects new structure into the existing structure. It creates new centers, or strengthens existing ones.

3. If we consider all the possible transformations which might be taken, we can distinguish between those transformations which preserve structure, and those which destroy structure. The structure preserving ones are the ones which only strengthen centers which are latent in the field already (81).

4. Only structure-preserving transformations create beauty (or wholeness). Transformations which are not structure-preserving always create ugliness (82,83).

The fourth of these is astonishing. It means that we have solved the problem of which centers to work on next. The rule is: Always work on those centers which do the most to preserve and intensify the structure of the whole.

But, at the same time, we have also learnt something astonishing and unexpected about the NATURE of wholeness.

A field of centers which is whole, is apparently one which contains within itself a history of structure preserving steps. Wholeness is the end-result of a sequence of steps, in which every step of the sequence respects what is there.

In practice this is easy to understand. For example, it is easy to understand that the beauty of a traditional farmhouse in the Austrian mountains came about because at each step in its history, the people always placed whatever they placed and did whatever they did with enormous care and reverence for what was there already.

## STRUCTURE PRESERVING TRANSFORMATIONS

The example of the small bench by the water's edge, in San Francisco, shows it clearly, for a simple geometric case.

The example of the site plan for the New Eishin University in Japan, shows it at a larger and more difficult scale.

When placing colors, at each stage we place the color which increases the inner light most intensely (103,105,110,111).

In many cases, the next step is COMPLETELY SURPRISING. For instance, the examples of the colors in Andre's house, show how each new color, when correctly seen and placed, was a revelation. In the Eishin school, the site plan was also completely surprising. In the case of the Orinda house, the placing of the mass on the axis of the view, instead of facing it, was also completely surprising.

Every time we make a decision, the best decision is the one which leaves things most deeply intact.

Now it finally becomes clear exactly what it means to say that function and ornament are merely two special cases of a more general structural principle.

All the functions in an architectural or planning problem, can always be seen as latent centers (89).

For instance, even if we are going to build a house on previously untouched land, we can see the problem, as a problem of enhancing latent structures which are already there. Some of them are in the land itself, waiting to be enhanced. Others are in the communal life of the people who are going to live in the house. Even these, though physically distant from the land, and physically subtle, exist as latent PHYSICAL structures, latent in the GEOMETRY of space.

## STRUCTURE PRESERVING TRANSFORMATIONS

The "forces" or influences which we call functions, are thus really structures of centers in the larger world beyond the thing which we are making.

So, when we speak of trying to make a building functionally sound, what we mean, ALWAYS, is that we are trying to leave the structure of the larger world, intact.

Thus, once we understand the idea of structure-preserving transformations completely, we then understand how everything about wholeness lies in the domain of pure structure.

And we reach the strange understanding that the task of building something whole, is never a task of inventing, but ALWAYS a task of enhancing the structure which is already there (238).

And the field of centers is such, that the creation, and preservation of structure, gives rise to an endless open ended series of combinations, and that the newest and most wonderful creations arise continually from it, like froth from some endless fountain of plenitude... and the formation of new fields of centers, is, in itself, an endless stream of creation out of nothing.

## CHAPTER 10

## SIMPLICITY AND SYMMETRY

It is easy to see that simplicity and symmetry must arise directly from the idea of structure-preserving transformations.

As we have seen, a structure-preserving transformation does as much as possible, to preserve the structure of what is "there". That means, it does as little as possible to get in the way. It leaves things alone as far as possible.

Now, of course, the transformations which leave existing structures alone as far as possible, are always the simplest ones.

So it is obvious, that in general, the result of a structure preserving transformation, must always be the simplest possible.

Thus, we may say that the goal of every structure preserving transformation, is to create only what is necessary: and that means, only injecting the simplest new structure that is consistent with the complex structure that already exists. A kind of Occams razor of design.

We also observe that according to this definition simplicity is a profound and beautiful concept, far more interesting than the naive idea of lack of structure (121,168).

From this idea we come straight to the idea of symmetry (241).

Every part of the field of centers, is made up of local symmetries (242).



## SIMPLICITY AND SYMMETRY

This does not mean that good buildings are perfectly symmetrical, like neoclassical buildings. A building which is whole, will always have a more relaxed and open feeling, in which each part takes the simplest possible shape for its position in the field (243, 210)

Adding a local symmetry is the smallest increment possible, in a structure preserving process (87).

It is always combinations of symmetric things which work the best. We have seen, for instance, how the landscape of a hill, or a beautiful and complex waterfront, are left intact, most easily, by small symmetric structures near them. That is because the symmetric structure induces one new center, just where it is and nowhere else. Asymmetric structures tend to induce many centers in many places, and so create unnecessary extra structures of centers that interfere with the existing order.

Old style industrial landscapes therefore come closer to wholeness, in their structure, than many modern attempts at creating urban design (90).

A locomotive is a perfect example of a structure with local symmetries in the right places, and teaches us a great deal about the relationship between symmetry and necessity (91).

However, at other times it is equally certain that symmetries must be BROKEN, also in order to preserve structure (88).

## SIMPLICITY AND SYMMETRY

We grasp the idea of local symmetries most clearly when we realise that a harmonious structure is one whose internal similarities and differences correspond EXACTLY to the degrees of similarity and difference that exist in its conditions (92).

Thus, deeply, the correct kind of simplicity, is the simplicity which comes from childish mind.

Like a handful of flowers, gathered and put in a jam-jar, a field of centers is a field of rough and syncopated imperfect local symmetries.

## CHAPTER 11

## THE MIRROR OF THE SELF

Our picture is still incomplete in one essential detail. True versions of the one are often haunting and mysterious... the sound of a flute far away in open country, on a summer day (67). Things which are truly whole have a spirit in them. They have a soul. They seem to be alive.

To understand this kind of "spirit" thoroughly, we must now learn to understand the process of creating a center, as a process of creating a "being" (68).

In the creation of a music cabinet, step by step, center by center, we see that what is most important at each moment, is the search for a being in the field of centers (69).

The search for a being does not only control the design: it controls the cutting of each piece of wood (70).

The last inch matters. In many examples we see how a tiny fraction of an inch makes all the difference in the world: in this section we see how even tiny differences in a beautiful curve, can be understood in terms of centers (71).

And, in the realm of color too, when we make a thing, we are choosing color, above all, to create a being. Just a tiny difference in color, makes the difference between the case which is merely beautiful, and the case where a being comes to life (106).

But what is this "being" which appears in space, when centers are correctly formed.

## THE MIRROR OF THE SELF

Somehow, when an organisation of space or matter takes on a definite character, it reaches such a level of autonomy, that it becomes "like" a living being, a creature in its own right.

We can use our instinct for the emergence of such a being, to help us determine what is the right thing to do in a building, and what is the wrong thing.

But what is the meaning of it. Does space itself have the capacity to come to life. Is this a metaphor, or is it real.

I believe that it is most helpful to say that it is real.

In this interpretation, we consider space as a kind of substance, which has the capacity to come to life. It comes to life, to the degree that centers -- and so, also, fields of centers -- are created in it.

With this idea, we have moved into entirely different territory. The anomaly in the structure of space, uncovered by our discovery of the hidden relation between ornament and function, has already made it necessary to modify our mechanistic picture of the universe. Now we find an even deeper peculiarity.

In some way, which we cannot yet fully grasp, the self is mobilised, as a kind of living "being", wherever wholeness occurs in physical space.

The physical space of the universe thus appears to be entirely different from the dull inert material we have been imagining. It is more spiritlike, more personal than we have dreamed.

## THE MIRROR OF THE SELF

We have now laid the groundwork for the last essential realisation of this book: The realisation that wholeness is ultimately PERSONAL in character.

To understand the nature of wholeness completely, we must learn to recognise it as a phenomenon which is deeply and necessarily related to the realm of human feeling (161).

Even a simple example shows that different kinds of arrangement have different levels of feeling in them. The one which has most feeling is the one where the field of centers is the strongest (13).

In a more complicated example where we compare drawings of women we see the same thing: the one which has the greatest wholeness, also has the greatest depth of feeling (13a).

And of course, it is most obvious of all in the great works which we have taken as models for the field of centers. They are all deeply moving. They have immense feeling in them.

It is essential to realise that this is not just some vague correlate of "great art". It is a human quality which lies specifically, in the structure we have been discussing. As we attain a deeper and deeper field of centers, the more personal the thing becomes, and the more deeply saturated with "feeling" (284).

What is the connection between this depth of feeling, and the abstract phenomenon we have learnt to identify as the field of centers.

## THE MIRROR OF THE SELF

It is the famous "mirror of the self".

Earlier, in chapter 3, we simply learnt to use the "mirror" as a way of knowing wholeness, a way of distinguishing true cases, from less real cases. But we did not, at that time, discuss what it really means.

Now we are ready to guess at the real nature of the connection. They are connected because the structure we call wholeness, really is the structure of Self.

When we see it in the world it moves us; we feel connected to it. We recognise it. We recognise the universe unfolding, in the same way that we experience the universe unfolding in ourselves.

It is for this reason, that the value of what is done in any work of art, depends, in the end, on the extent that the artist can reach down into his own humanity, into his own most vulnerable self.

But this is immensely hard to do.

People sometimes believe that it can be done merely by "expressing" your feeling. But this is almost always shallow, and leads to various forms of "feelies" or so-called art which ought better to have been put on a therapists couch.

The fact is, that it is not easy to reach the genuinely human part of oneself, the childlike part, which is true, and simple. What you need is knowledge of precisely those facts which I have described in the last nine chapters.

## THE MIRROR OF THE SELF

This works because the field of centers really is a mirror of the human heart. It is therefore just this structure, and only this structure, which can unlock your own heart.

Thus, to summarise, the true structure of wholeness is a thing which can only be created by humananness... by personal and childlike simplicity of feeling. But this structure is, at the same time, the one thing in the world which is needed to allow this childlike and deeply personal feeling to exist within the maker.

So a person will only be able to be personal, to express true feeling, once he has mastered the abstract structure which I call the field of centers.

This very strong statement is supported by an empirical observation.

I have noticed, over and over again, that people who make things which have the field of centers in them, then experience healing IN THEMSELVES.

Apparently, as a person makes something whole with his own hands, he also becomes whole within himself.

And so we come to the most fundamental issue in this book.

In chapter 1, I commented on the fact that current cosmology has created an enormous rift between the personal and the impersonal. Science has described almost everything in the world that lies outside ourselves. But the picture which it creates does not, in any serious sense, contain the individual "self".. ourselves. And so, the picture of the world we have inherited, wonderful as it is, is dry, emotionless, empty, and unrelated to our very existence as persons. This is the famous "bifurcation of nature" described by Whitehead.

## THE MIRROR OF THE SELF

We now see that the picture of the world which we have been building here, will allow us to bridge this enormous gap.

For you only succeed in making something which is genuinely whole, or one, when you do it TO PLEASE YOURSELF (123).

Of course, in conventional terms, the idea of pleasing yourself sounds egocentric and completely wrong. But the process of recognising that it is right, not wrong, teaches us finally, a full understanding of what wholeness really means (124).

Once you recognise that pleasing yourself, and making something whole, are one and the same thing, then you truly recognise the great revolution in thought which all these facts imply (125).

At that stage, "pleasing yourself" will also take on a new meaning, more innocent, less wilful.

Then the dichotomy created by Descartes -- in which our personal life was dissociated from the world, and in which we were forced to inhabit the mentally constructed world of physics, with no lifeline whatever between the world outside and the world inside -- then this dichotomy is finally broken.

And yet, it is a world of pure structure!

This really is a revolution.



## CHAPTER 12

## NOT SEPARATENESS

The nature of simplicity, and the close relation between those things where oneness has occurred, and the melted state we may call "nothing", brings us finally to the issue of not-separateness.

The yellow tower shows clearly what this means (127).

In the end, the intricacy and richness of a beautiful thing, does not arise from the desire to make something rich or intricate... it only arises from the desire to make it one (129).

Wholeness is a state in which each thing is continuous and part of the larger whole.

It describes a state in which the world is melted.

But to make this, the maker himself must become one with it (131).

This requires the religious intention, to become one with the world (131a)

Then, in microcosm, the object itself, in its not separateness, becomes a version of the structure which is required of the world, in which there is unbroken wholeness binding everything.

In this view, we finally see wholeness in the most helpful way of all, because here it is quite unpretentious and ordinary. The more any portion of space is unified, the more inseparable it becomes from all the rest (291).

## NOT SEPARATENESS

This obvious idea cannot be realised in a building, or in a piece of a building, without the most profound change, and quietness of soul, in the maker (292).

It requires absolute removal of the individual ego, since what is created, can no longer stand out and be separated from everything else, and therefore loses its personal identity (293, 120).

And yet, paradoxically, in the moment where this absolute identity and not-separateness is attained in a thing, and it truly becomes one with the things which surround it, then it stands out, shining with a holy light and with an extraordinary power, which could never, and can never, be reached under any other circumstances (294).

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This is the central mystery of the universe... that as things becomes more unified, less separate, so also they become most individual, and most precious (295).

PART THREE

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COSMOLOGY

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Finally, in this last part of the book, we go back to the issue of cosmology. As we saw in part one, the present trouble in architecture is caused largely by a fundamental weakness in the cosmology we have inherited from the last three hundred years.

We are now ready to summarise, explicitly, what has been obvious in many of the last 1000 pages: namely, that the facts about the nature of wholeness which we have uncovered, force a change in our views about the nature of the world -- and indeed, cannot even be UNDERSTOOD within the framework of our present view at all.

We shall now describe the picture of the universe which is suggested by the facts we have discovered.

THE NATURE OF THE UNIVERSE

## CHAPTER 13

## THE NATURE OF THE UNIVERSE

The facts which we have uncovered show clearly that the character of space and matter must be very different from the view of them which we have learnt from the physics of the last three hundred years. They require an entirely new set of assumptions about the nature of the universe, and lead to us to an ultramodern view of physics.

But though entirely new, this ultra modern view of physics, then brings us to a state of mind very much like the state of mind that all traditional builders had.

I am convinced that the people of the various different eras and cultures, who did produce "the one" consistently in the past, did so because in their world view, it was NECESSARY to do so.

At the moment, in our own world view, it seems nice, but not NECESSARY. However, when we consider the changes in our understanding of the universe, and our relation to it... which are required by the facts I have described, and absorb their implications, we shall then see that we live in entirely different kind of world from the one we thought we lived in... and that, given the nature of the world as it really is, it is not merely nice to create wholeness, but ABSOLUTELY NECESSARY.

Let us first consider two different kinds of world: one in which EACH part of the world is a mirror of the self.. the other in which almost NO part of the world is a mirror of the self (139).

## THE NATURE OF THE UNIVERSE

Most cultures have built, as their world, a world of the first kind.. in which every part reflected the human soul, had a quality of being, reflected the human person in it. This was true of every house, window, doorknob, street crossing, wall, stream, bridge. Of course, in such a world each person feels thoroughly at home, because he feels related to every single thing in his surroundings.

In our own time, in the last few decades, we have for the first time in human history, built a kind of world in which almost NO part of the environment has the structure which reflects the human soul. Of course, in this world, no one feels at home, everyone feels frightened and isolated, because the world around us, is then literally alien, unrelated to us, and frightening.

Just on human grounds, it does not take much thought to realise that we should try to make the kind of world in which every single thing, and every part of every thing, reflects the human soul. Then we may once again feel part of the world, related to the world, and comfortable in the world.

This is very important, and this argument alone, should be enough to change, completely, the whole task of building, along the lines which I have indicated.

But there is a much more powerful argument.

Within the world created by Descartes, each part of the world, and the world as a whole, is seen as a machine... a mechanism. As we have seen already, in such a world, there is no reason to do any one thing more than any other, except for convenience... there is no intrinsic reason for going in any one special direction.

## THE NATURE OF THE UNIVERSE

But, according to the insights we have gained, the substance of the world is something entirely different. Apparently space itself has latent in it the being-nature, the mirror of the soul. Apparently, wholeness in space, is not merely an abstract functional wholeness, but some quality which directly affects, and is bound up with, our essence as persons.

In this world, space itself, matter itself, is personal... it seems to exist, we might almost say, in order that the field of centers can be created in it.

And, the space, or matter, as it becomes more whole, becomes more strongly knit together, also becomes more personal, reveals itself more fully, exposes the universe to view more deeply.

In this universe, the human self, yours and mine, are indistinguishable, in their substance, from the space and matter where the play of forms occurs. When we make something, its selfness, its possible soul, is part and parcel of our own self.

THERE IS, THEN, SOMETHING VERY LIKE A RELIGIOUS OBLIGATION, TO ALLOW THIS SELF TO REVEAL ITSELF. It is our task, as architects, as artists, as builders, to make this stuff, this matter of the universe, reveal itself most fully.

This metaphysical obligation, stems directly from our understanding of the substance of the universe.

It does not arise merely from our desire to be comfortable, from our desire to avoid alienation. It arises as a supreme spiritual obligation, which is our obligation to the matter/spirit, we ourselves are made of.

## THE NATURE OF THE UNIVERSE

This feeling, though modern in its form, is, in its essence, similar to the medieval mason's desire to make each stone as a gift to God.

But it arises, now, not as a religious or superstitious belief, but as a result of our new understanding of the structure of the universe.