Chapter two

The need for an analytic theory of architecture

Do architects need theories?

In the previous chapter, architecture was defined as the taking into reflective thought of the non-discursive, or configurational, aspects of space and form in buildings. In vernacular traditions, these aspects are governed by the taken for granted *ideas to think with* of a culture. In architecture, *ideas to think with* become *ideas to think of*. Spatial and formal configuration in buildings ceases to be a matter of cultural reproduction and becomes a matter of speculative and imaginative enquiry.

It follows from this definition that architecture is an aspiration, not a given. To bring to conscious thought the principles that underlie the spatial and formal patterns that transmit culture through buildings, and to formulate possible alternatives that work as *though they were culture* – since architecture must be an addition to culture not simply a removal of it – is an intellectual as well as a creative task. It requires not only the conceptualisation of pattern and configuration *in vacuo*, but also comparative knowledge and reflective thought. This is why architecture is a reflective as well as an imaginative project, one which seeks to replace – or at least to add to – the social knowledge content of building with an enquiry into principle and possibility.

Architectural theory is the ultimate aim of this reflection. An architectural theory is an attempt to render one or other of the non-discursive dimensions of architecture discursive, by describing in concepts, words or numbers what the configurational aspects of form or space in buildings are like, and how they contribute to the purposes of building. In a sense, theory begins at the moment architecture begins, that is, when spatial and formal configuration in buildings, and their experiential and functional implications, are no longer given through a tradition of social knowledge transmitted through the act of building itself. As soon as building moves free from the safe confines of cultural programming, something like a theory of architecture is needed to support the creative act by proposing a more general understanding of the spatial and formal organisation of buildings than is available within the limits of a single culture.

This is not to say that creative architecture depends on theory. It does not. But in that architecture is the application of speculative abstract thought to the material world in which we live, the reflective aspects of architectural enquiry lead to the formulation if not of theory then at least of theory-like ideas. The need for theory becomes greater as architecture advances. Theory is most required when architecture becomes truly itself, that is, when it becomes the free exploration of formal and spatial possibility in the satisfaction of the human need for buildings.

However, the fact that theory is an inevitable aspect of architecture does not mean that all theories will have a positive effect on architecture. On the contrary, the dependence of architecture on theoretical ideas creates a new type of risk: that theories may be wrong, maybe disastrously wrong. The much discussed 'failure' of modernism in architecture is seen as at least the failure of a theory – the most ambitious and comprehensive ever proposed – and even by some as the failure of the very idea of a theory of architecture.

The need for an analytic theory of architecture

As a result, in the late twentieth century a number of new questions are posed about theories of architecture which are also questions about architecture itself. Does architecture really need theories, or are they just a pretentious adjunct to an essentially practical activity? If architecture does need theories, then what are they like? Are they like scientific theories? Or are they a special kind of theory adapted for architectural purposes? If architectural theories can be wrong, and have apparently adverse consequences, then can they also be right? How can we set about making architectural theories better? And most difficult of all: how can architecture as a creative art be reconciled to the disciplines of theory? Are the two not opposed to each other, in that better theories must lead inevitably to the elimination of architectural freedom.

The answer proposed in this chapter is that once we accept that the object of architectural theory is the non-discursive – that is, the configurational – content of space and form in buildings and built environments, then theories can only be developed by learning to study buildings and built environments as *non-discursive objects*. To have a theory of non-discursivity in architecture in general we must first build a corpus of knowledge about the non-discursive contents of architecture as a phenomenon. This of course runs counter to most current efforts in architectural theory, which seek to build theory either through the borrowing of concepts from other fields, or through introspection and speculation.

However, the product of the first-hand study of non-discursivity in buildings and built environments will lead to a new kind of theory: an analytic theory of architecture, that is, one which seeks to understand architecture as a phenomenon, before it seeks to guide the designer. An analytic theory of architecture is, it will be argued, the necessary corollary of architectural autonomy. Without the protection of an analytic theory, architecture is inevitably subject to more and more externally imposed restrictions that substitute social ideology for architectural creativity. Analytic theory is necessary in order to retain the autonomy of creative innovation on which the advance of architecture depends.

Are architectural theories just precepts for builders?

Before we can embark on the task of building an analytic theory of architecture, however, we must first explore the idea of theory in architecture a little to prevent our enquiry being obscured by some of the more common misconceptions. Architectural theories do take a very distinctive form, but all is not as it seems at first sight, and it is important that we do not allow appearances to disguise their true nature and purposes.

We may usefully begin by examining the views of a well-known critic of architectural theories. In his 1977 polemic against architectural modernism and its intellectual fashions, *The Aesthetics of Architecture*[1] Roger Scruton is dismissive of the very idea of a theory of architecture: 'Architectural theory', he says in a footnote, is 'usually the gesture of a practical man, unused to words'. Elsewhere he goes further. There is not and cannot be a theory of architecture. What has been called

The need for an analytic theory of architecture

architectural theory are merely '...precepts...which...guide the builder'. While such precepts can be useful canons, they can never amount to a real theory, because they cannot be universal, and it is only with the claim to universality that theory arises.[2]

At first sight, Scruton seems to be right. For the most part – modernism is one of the few exceptions – we associate theories of architecture with individual architects. When we think of Palladio's or Le Corbusier's theory of architecture we take it to mean something like the intellectual ground of a style, the generic principles underlying an approach to design. It seems self evident that no such principles could ever be universal. The idea even leads to paradox. A universal formula for architecture would, if followed, render architecture the same and unchanging, and therefore ultimately dull.

But does theory in architecture really only mean a formula for architectural success? A scientist would find this a strange use of the word 'theory'. For a scientist a theory is a rational construct intended to capture the lawfulness of how the world *is*, not a set of guidelines as to how it *should be*. Scientific theories help us act on the world, but only because they have first described the world independently of any view of how it should be. The essence of science is that its theories are *analytic*, not normative in intent. They describe how the world is, not prescribe how it ought to be.

Might we then suggest that this is exactly the difference between architectural and scientific theories, namely that scientific theories are analytic, and about understanding how things are, whereas architectural theories are normative, and about telling us what to do? There seems to be some truth in this. It is reasonable to say that architecture is about how the world should be rather than how it is, and that its theories should therefore tend to express aspirations rather than realities. In fact, on closer examination, it turns out that this is not and can never be the case. Admittedly, architectural theories are normally presented in normative form, but at a deeper level they are no less analytic than scientific theories.

Take for example, two theories which are about as far apart as they could be in focus and content, Alberti's theory of proportion,[3] and Oscar Newman's theory of 'defensible space'.[4] Both are presented as precepts for successful design, in that both authors' books are aimed primarily at guiding the architectural practitioner in design, rather than explaining the nature of architectural experience as experienced, as Scruton's book is. But if we read the texts carefully, we find that this is not all they are. In each case, the normative content of the work rests on clear, if broad, analytic foundations. Alberti's theory of proportion rests on the Pythagorean notion of mathematical form in nature,[5] and the coincidence it asserts between the principles of natural form and the powers of the mind, as evidenced by the relationship between our sense of harmony in music and the simple numerical ratios on which those harmonies are based. If architecture follows the mathematical principles found in nature, Alberti argues, then it cannot help reproducing the intelligibility and harmony that we find in natural forms. Similarly, Newman's 'defensible space' theory rests on the theory of 'human territoriality', by which genetic tendencies in certain species to defend territory against others of the species, are generalised to human beings, both

The need for an analytic theory of architecture

as individuals and – mistakenly in my view – as groups. If, Newman argues, architects design space in conformity with 'territorial' principles, then it will be following biological drives built into us by nature.[6]

It is notable that in both of these theories, the principles for design are said to be based on principles to be found in nature. In a very strong sense, then, in both cases the normative content of the theory depends on the analytic. On reflection, it must be so to some degree in all cases. Any theory about how we should act to produce a certain outcome in the world must logically depend on some prior conception of how the world is and how it will respond to our manipulations. Careful examination will show that this is always the case with architectural theories. We invariably find that the precepts about what designers should do are set in a prior framework which describes how the world is. Sometimes this framework is explicitly set out, and rests on a specific scientific or quasi-scientific foundation, as in the two cases we have instanced. Sometimes it is much more implicit, reflecting no more than a currently fashionable way of looking at the world, as for example many recent theories have rested on the fashionable assumption that 'everything is a language' so that designers can and should design following the principles of linguistic theories in making their buildings 'meaningful'.

Although presented normatively, then, architectural theories must have a great deal of analytic content, whether this is explicit or implicit. In point of fact, faced with an architectural theory, our first reaction would usually be to treat it exactly as we would a scientific theory. Offered a general proposition on which to base architectural precepts for design – say a proposition about the psychological impact of a certain proportional systems or the behavioural effects of a certain kind of spatial organisation – our first reaction would be to question the general proposition, or at least to subject it to test by a review of cases. We usually find quite quickly that would-be general propositions run foul of cases known to us, which we then instance as counter-examples to the theory. In other words, we treat an architectural theory very much in the same way as we would treat a scientific theory: that is, we treat it as an analytic theory by trying to find counter-examples which would refute its generality. Even when it survives, we would be inclined to treat it with continuing scepticism as at best a provisional generalisation, which we can make use of until a better one comes along.

It is a mistake, then, to treat architectural theories simply as normative precepts, as Scruton does. Architectural theories are not and cannot be simply normative, but are at least analytic-normative complexes, in which the normative is constructed on the basis of the analytic. It follows that properly theoretical content of architectural theories is specified by the analytic. If the analytic theory is wrong, then the likelihood is that the building will not realise its intention. Architectural theories, we might say, are about how the world should be, but only in the light of how it is believed to be.

The need for an analytic theory of architecture

Theories in design

Why should architectural theories take this distinctive form of combining propositions about how the world should be with propositions about how it is believed to be? The answer is to be found in the nature of what architects do, that is, design. Through its nature as an activity, design raises issues to which architectural theorists propose solutions in the form of analytic-normative complexes of theoretical ideas. To understand why this is so, we must understand a little about design.

Design is of course only a part of the protracted processes by which buildings come into existence. The 'building process' involves formulating a need for a possible building, conceptualising what it might be like, initiating a process of resourcing, negotiating and organising, creating some kind of representation, or series of representations of increasing refinement, of what the building will be like, then constructing, fitting, operationalising, and finally occupying the completed building. Vernacular building is of course a less complex process. But if the circumstances exist in which 'design' is a function, then the corollary is that this more complex building process, or something approximating to it, also exists. Design does not exist as a function independent of this larger process. On the contrary, it implies it.

How then do we define design within this process? First, we note that it is only at the end of the process that the object of the process – an occupied building – exists. For most of its duration, the process is organised around a surrogate for the building in the form of an abstract idea or representation which continually changes its form. It begins as an idea for the building, then becomes an idea of the building, then a more formalised concept, then a series of more and more refined representations, then a set of instructions and finally a building. For the most part, the complex process of building takes place around this shifting, clarifying, gradually materialising idea.

The process of seeking, fixing, and representing a realisable concept of a building from an idea for a building is design. Design is what architects do, though it is not all they do, and not only architects do it. But it is design that keeps what architects do – whether or not it is architects that do it – fixed in the process of creating buildings. There has to be a control of the process of searching out, conceptualising, and representing the surrogate building through the process. Let us call this the 'design function', so that we can see that it is independent of who actually carries it out.

The design function exists within the building process for one fundamental reason: because at all stages of the process – though with differing degrees of accuracy – the properties and performance of the building as it will be when built must be foreseen in advance, that is, they must be knowable from the surrogate. Without this foresight, the commitments of resources necessary at each stage of the process cannot be made with confidence. The design function is essentially a matter of stage-managing a constantly changing representation of what will eventually be a building, so that at all stages of the process there is in view a proposal for an object

The need for an analytic theory of architecture

that does not yet exist, and which is probably unique – since if it were a copy there would be no need for design – but whose technical, spatial, functional and aesthetic properties if and when built are, as far as possible, predictable in advance.

The design function in the building process therefore involves on the one hand searching out and creating a representation of a possible solution for the design problem in hand, and on the other the prediction of the performance of the building when built from the representation. The activities that make up the design process reflect this duality. Design essentially is a cyclic process of generating possible design proposals, then selecting and refining them by testing them against the objectives the building must satisfy – to be beautiful, to be cheap, to be ostentatious, to represent an idea, to repay investment, to function for an organisation by providing adequate and well-ordered accommodation, and so on.[7] These two basic aspects to the design process can be called the creative phases and the predictive phases. In the creative phases the object is to create possible design proposals. In the predictive phases, the object is to foresee how proposals will work to satisfy the objectives.

Once we understand the creative-predictive nature of the design process, then it is easy to see how the normative and analytic aspects of theories can usefully contribute to the process. Theories can be used, and often are used, tacitly or explicitly, in two quite distinct modes in the design process: as aids to the creative process of arriving at a design; and as aids to the analytic process of predicting how a particular design will work and be experienced. Often of course these two aspects will be conflated in a undifferentiated thought process. The normative aspects of a theory tells the designer where to search for candidate solutions in the creative phases, the analytic aspects how the solution will work. For example, if you are a Palladian, then in the creative phases of design you search for a formal and spatial solution with Palladian properties – a certain range of envelope geometries, certain symmetries of plan and façade, certain kinds of detailing, and so on – confident that if you proceed in a Palladian manner then you can predict a Palladian outcome. If you are a Newmanite, then you search for formal and spatial solutions with a certain layering of spatial hierarchies, certain possibilities of surveillance, the avoidance of certain formal themes and so on, again confident that by proceeding this way a safe environment will result. Theory thus structures the search for a possible design in a solution space that might otherwise be both vast and unstructured, and it does so in a way that gives the designer confidence – which may of course be quite misplaced – that the nature and properties of the eventual building can be known from the theory.

The use of theory is of course only one way of structuring the design process. In fact few designers claim to create designs from theory, and many would go out of their way to deny it. But this does not mean that they do not design under the influence of theory. Much use of theoretical ideas in architecture is tacit rather than explicit. This is not due to malign intent on the part of designers, but much more to do with the need for theory in design, however little this is recognised.

The need for an analytic theory of architecture

Consider, for example, the problem of prediction. Having created a candidate design, the designer now has the task of foreseeing how the ‘unknown non-discursivities’ of form and space that will be created by the design will work and be experienced when built. Logically there are only two possible bases for such prediction: known precedent and theoretical principle. Prediction by precedent means prediction by reference to known cases that already exist. Prediction by principle means prediction by reference to the generality of known cases. Both are essentially claims based on experience, but the former is specific, and the latter general.

Prediction from precedent raises two problems. The idea of architecture includes the idea that the building to be created will not simply be a copy of one which exists. This means that precedent cannot be used lock stock and barrel for the whole building. Precedent can therefore only be used piecemeal for aspects or parts of the building. Since formally and spatially buildings are complex configurations, and not simply assemblages of parts, it can never be clear that the new embedding of a precedent attribute or part will not work differently in the context of the new whole. The use of precedent in design is necessary, since it brings in concrete evidence in support of prediction, but it is never sufficient, because each new synthesis recontextualises each aspect of precedent. The use of precedent therefore necessarily involves interpretation.

The pressure on designers to work at least in part from knowledge of theoretical principle is therefore intense. The apparent advantage to the architect of working within a particular theory becomes the solution to the prediction problem appears already to be contained within the theory. The normative theoretical concepts that guide the generation of a candidate design also take the form of analytic concepts which indicate that if the designer follows the precepts of the theory, then it is to be expected that the design will work in the way the architect intends. The analytic foundations of the normative theory return at the predictive stages to appear to guarantee architectural success. This is why architectural theories take the form of normative-analytic complexes. They fulfil the two primary needs of the design process with a single set of propositions.

However, it is clear that these advantages will only exist to the extent that the theory’s analytic foundations are not illusory. If they do not offer a realistic picture of how the world works, then it is likely that the designer’s predictions will refer only to an illusory reality. A poorly founded analytic theory will not inhibit the designer in the creative phases of design, but it would lead him or her to look in the wrong place. It would also mean that the designer’s predictions would be unlikely to be supported by events when the building is built. This is why bad theories are so dangerous in architecture.[8] They make design appear to be much easier, while at the same time making it much less likely to be successful. This, in the last analysis, is why architects need analytically well founded theories.

However, this is not the same as to say that architects simply need scientific theories to guide them in design. The dual use of theory in architecture both to generate designs and to predict their performance permits us to introduce a very

The need for an analytic theory of architecture

important comparison: between theories in art and theories in science, and to argue that architecture needs theories both in the sense that the word is used in art and in the sense that the word is used in science.

Theories in art are not analytic-normative complexes of the kind we typically find in architecture. They are primarily about supporting the creative process, that is, they are in essence about *possibility*. Theories in art expand the realm of the possible, by defining a new way to art or even by defining a new form of art. There need in principle be no constraints on what type of theories are used. The role of a theory in art is not to claim a universal art, or to set up one form of art as superior to another, but to open up one more possible kind of art. Theory in art is then essentially generative. It does not have to take much account of functional or experiential consequences. It uses abstract thought only to generate new possibilities in art that had not been seen before.

If architecture were simply an art, it would need theories only in the sense that painters or sculptors have theories: that is, as speculative extensions of the realm of the artistically possible. It is clear that architecture as art has and needs this kind of theory. But this is not all it has and needs. The difference between architecture and art is that when an artist works, he or she works directly with the material that will eventually form the art object – the stone, the paint and so on. What the artist makes is the work of art. Architecture is different. An architect does not work on a building, but a representation of a building we call a design. A design is not simply a picture of a building, but a picture of a potential object and of a potential *social* object – that is, an object that is to be experienced, understood and used by people. A design is therefore not only a prediction of an object, rather than an object itself, but, however functionally non-specific it claims to be, a prediction of people in relation to building. This is where analytic theories are needed, and analytic theories are analogous to scientific theories. Theories in science are sets of general, abstract ideas through which we understand and interpret the material phenomena the world offers to our experience. They deal with how the world is, not how it might be. Because architecture is creative it requires theories of possibility in the sense that they exist in art. But because architecture is also predictive, it needs analytic theories of actuality as well as theories of possibility.

It is this double nature that makes architectural theories unique. They require at once to have the generative power of theories in art and at the same time the analytic power of theories in science. The first deals with the world as it might be, the second with the world as it is. The question then is: how may there be theories of architecture which are at once creative and analytic. One aspect of the answer turns out to be simple: good analytic theories are already likely to be also good theories of possibility. The entire usefulness of scientific theories in their applications in science and technology is in fact founded on the simple but unobvious fact: that analytic theories do not simply describe the world as it is, but also describe the limits of how it can be. Scientific theories are arrived at through the examination of the world as it is. But it is exactly the theoretical understanding of the world as it is that opens up

The need for an analytic theory of architecture

whole realms of new possibility that do not yet exist.

It is this fundamental link between actuality and possibility that opens the way to an analytic theory of architecture. But before we explore it, we must first look a little more carefully at architectural theories to see how they are structured, and why, and how they might eventually move in the direction of becoming more analytic.

The problem of architectural theory

The most common problem with architectural theories is that they have too often been strongly normative and weakly analytic, that is, it has been too easy to use them to generate designs, but they are too weak in predicting what these designs will be like when built. The theories of modernism were, for example, quite easy to follow in generating designs to satisfy normatively stated objectives. The problem was that the architectural means proposed were not the means required to achieve those objectives. The theories were weakly analytic. They did not deal with the world as it actually is. The normative dominated the analytic.

Exactly how normatively strong but analytically weak architectural theories are held in place can be seen by taking one more step in disaggregating what architectural theories are like and how they work. For example, looking a little more closely at our two exemplars of architectural theories – the Albertian and the Newmanite – we find both have two quite distinct components: one in the realm of broad intention, telling architects what they should aim to achieve through architecture, and one in the realm of what we might call architectural technique, telling architects how to realise that intention. Alberti's theory, for example, tells architects that in order to design buildings that people will experience as harmonious, they should aim to reflect in their buildings the mathematical order found in nature. He then goes on to offer a method for calculating proportions to serve as a technique for realising this aim in architectural terms.[9] Newman tells architects they should aim to design spaces beyond the dwelling so that inhabitants may identify with them and control them, then specifies hierarchical techniques of space organisation in order to realise this. We might call these the broad and narrow propositions about architecture contained in a typical architectural theory. The broad proposition, or intention, sets a goal while the narrow proposition, or architectural technique, proposes a way of designing through which the intended effect will be realised.

One difference between the broad and narrow propositions lies in what they engage. The broad proposition engages a world of ideas which may be very large in its scope and may contain much that is poorly defined and little understood. The narrow proposition, on the other hand, engages the realities of architectural design and experience. If in general theories are abstract propositions which engage the real world of experience, then the broad and narrow propositions of architectural theories occupy opposite ends of the spectrum covered by theories. The broad propositions are in the realm of philosophical abstraction, where the theory engages the vast world of ideas and presuppositions, implicit and explicit, which eventually rests nowhere but in the evolution of human minds. The narrow propositions are in the realm of direct experience of the world where theories engage the minutiae of everyday experience.

Broad proposition and narrow proposition also differ in their intended universality. Broad propositions are intended to be universalistic in that they attempt to say things about architecture which are held to be generally true, and to say it in such a broad way as to allow it to be true in quite different architectural circumstances. But it is clear that we should not regard the narrow propositions as universalistic.[10] For the most part the narrow propositions are offered as possible techniques for realising an abstractly stated aim, not the only such techniques. On reflection, again this must be so. The narrow propositions of an architectural theory are techniques for bridging between the abstract and the concrete. Only an abstraction can be general. We should not mistake a technique for realising an analytic abstraction for the abstraction itself.

Now consider these broad and narrow propositions in relation to what is required of theory in the two phases of design, that is, in the first phase, ideas about possible forms and, in the second phase, ideas about the relations between forms and performance outcomes. Both of the theories we have been considering appear to supply both needs. Ideas of possible forms are contained in the narrow propositions, that is, the constructive techniques through which the theorist advises the designer to go about design to ensure success. In the case of Alberti's theory, this means the systems of worked out proportions which guide the designer in setting up the building as a physical form. In Newman's case, this means the diagrams of spatial hierarchy which the designer can follow in setting up the spatial design. Ideas of the relation between form and functional outcome are then expressed at the more philosophical level of the broad propositions. In Alberti's case, this means the broad propositions, based on the analogy with music, about the human experience of visual harmony.[11] In Newman's case, it means the broad propositions about 'human territoriality' and its spatial implications.[12] In other words, in both cases, it is the highly specific narrow propositions which guide the creative process of design, and the very generalised broad propositions which guide the designer in predicting functional effect from formal configuration.

Now the problem with most architectural theories is that this is exactly the opposite of what is required for architecture which is creatively innovative and functionally successful. In the generative phase of design, what is needed if architectural creativity is to be maximised is ideas about formal and spatial configuration which are as unspecific as possible about specific solutions, in order to leave the solution space as open as possible to creative invention. In the predictive phases, what is needed is precision about specific forms since what is at issue is the prediction of the functional outcome of this or that real design. In the generative phases, where what is required are abstract or genotypical ideas which open up realms of possibility just as theories do in art, architectural theories of this type offer a rather narrow range of solution types which are essentially no more than a set of abstract exemplars to follow – particular systems of numerical proportions in one case, particular diagrams of hierarchical spatial relations in the other. Then when in the predictive phases of design the designer needs a much greater degree of analytic precision in order to foresee how this or that innovative form will work functionally or experientially, all that the theories offer is the vague analytic generalisations of the broad propositions.

In other words, architectural theories of this type are over-specific where they should be permissive and vague where they should be precise. The designer is given concrete models to follow when he or she needs constructive creative ideas to search the solution space, and vacuous abstractions when he or she ought to be given techniques to predict the performance of particular designs. This is, in a nutshell, the problem with most architectural theories, and this is how, in real design, the normative aspects of theory come to dominate the analytic. What is needed are theories with the reverse properties, that is, theories that are as non-specific as possible to particular solutions in the generative phases of design in order to leave the solution field as large and dense as possible, and as specific and rigorous as possible in the predictive phases in order to be able to deal predictively with unknown forms where the need for effective prediction is greatest. The implication of this is that we need a fully fledged analytic theory which would offer abstract understanding rather than specific models in the creative phases of design, and phenotypical precision rather than vague generalisations at the testing stages.

What exactly, are theories?

How should we go about setting up such a theory? The first step must be to make sure we understand exactly what an analytic theory is. This turns out to be not as easy as looking the word up in a dictionary. Few words are in fact more ambiguous in their origins than 'theory'. In its ancient Greek origins, the verb *theoreein* means to be a spectator, and the products of this speculative activity, *theoremata*, were, not surprisingly, speculations. For Bacon theories were simply errors, the 'received systems of philosophy and doctrine', to be replaced in due course by something altogether better.[13] This meaning is still reflected in everyday use. In common usage, theories are speculations, of lesser status than facts, at best a temporary fix until the facts are known. A fictional detective with a premature 'theory' about a case will almost certainly be shown to be wrong. The expression 'only a theory' clearly expects theory not to be eventually supported by 'facts', but to be replaced by facts. In these senses, theories embody irremediable uncertainties, and appear to constitute a form of thought whose object is to replace itself with a-theoretical, and therefore secure, knowledge. In complete contrast, in modern science the word 'theory' today stands for the deepest level of understanding of phenomena. Successful theories in areas where none had previously prevailed, like evolution theory, are the most epoch making of intellectual events. Conflicts between rival theories of, say, the origins of the universe or the nature of matter, conducted on the obscure battlefields of macro and micro phenomena, are among the epics of the late twentieth-century thought.

So what then is 'theory', that it can be subject to such a range of interpretations and ambiguities? The source of this ambiguity lies of course not

The need for an analytic theory of architecture

in the vagaries of etymological history but in the nature of theories themselves. Theories are found in the realm of speculative thought, because they are at root, speculations. They are not in themselves, for example, statements about observable phenomena, nor even statements about the regularities that are to be found in observable phenomena. They are propositions about hypothetical processes which might be responsible for the regularities we see in phenomena. As such they have a necessarily abstract nature, and are purely conceptual entities. You cannot see a theory, only its consequences, so you cannot verify a theory, only phenomena that are consistent with it. When we test a theory we do not simply look at the theory to see if all the parts are in working order and properly related, though we do also do this. We check the theory by seeing how far the phenomena available in the real world are consistent with the theory, and preferably with no other. To check a theory, in effect, we look away from the theory. Theories are in themselves unobservable and unexperiencable, and this is why in the end even the best and the most durable remain in some sense speculative.

But even when we accept the abstract and speculative nature of theories, we have not yet exhausted the apparent indeterminacy of the idea. No set of concepts which become part of a theory can exist in isolation. On the contrary, concepts can only exist as part of conceptual schemes through which we interpret our experience of the world and turn information into knowledge. No concept or set of concepts can exist in a vacuum. Each must be embedded in a broader range of propositions or assumptions about what the world is like and how it works. These broader frameworks have been known as paradigms since Thomas Kuhn first drew attention to their existence.[14]

With all this indeterminacy in what we mean by theory, how is it that they can be so important and so useful. To answer this we must understand the circumstances in which theories arise and what purposes they serve. Theorisation begins when we note a certain type of phenomenon and make a certain type of presupposition. The phenomenon we note is that of surface regularity in the world as we experience it. The presupposition we make is that *surface regularity* implies *underlying invariance* in the processes that give rise to the phenomena we see.

The first of these – the noting of regularities – theorisation shares with language. The fact that language has words for classes of things rather than simply for individual things assumes that we know the difference between order and chaos, that is, that we can discern in the objective world 'structural stabilities'[15] which are sufficiently well defined and repetitious to support the assignment of names. These names are, as philosophers have endlessly noted, abstract terms for classes in the guise of names for things, with the consequence that even such a simple apparently concrete act of pointing at a thing and naming it depends on the prior existence not only of the abstract universal constituted by that class name, but also of the scheme of such abstractions of which that particular abstraction forms a part. These schemes, as we have known since de Saussure,[16] differ from one language to another so that we are compelled to acknowledge that names are not

The need for an analytic theory of architecture

neutral, simple handles on things, but conceptual instruments by which we create an organised picture of the world. Names create understanding, and it is against the background of the organised picture of the world already given to us by language and culture that theorisation begins.

Theory begins in the same place as language where we note, in the flux of experience, regularities, but adds a further presupposition: that since regularity is unlikely to be the product of chance, there must be some kind of order not only in the regular phenomena that we observe but also in the processes that give rise to the phenomena. Why we should make this presupposition is not clear. But it seems plausible that just as language seems intimately bound up with how we cognise the world so theorisation is bound up with how we act in the world. When, for example, we strike stones to make sparks and then fire, the sequence of events from one to the other is not inscribed on the surface of things but implies some interior process which is set in motion by our actions. Just as the world responds to our actions on it by producing regularities, so we presuppose that the existence of regularities which do not result from our actions must be the result of invariant processes analogous to our actions. If then language arises from our being in the world and needing to know its objective persistences, so theorisation seems to arise from our acting in the world and on the world and needing to know the interior processes by which outcome reliably follows from action.

We thus see that regularities are the starting point of theory, but they are not the theory itself. Regularities initiate the process of theorisation since we infer from the existence of regularities that there must be some invariant structure in whatever process it is that produces these surface regularities. Theories are concerned with the nature of that process, more precisely they are attempts to model the invariant structure of processes which are thought to exist for there to be surface regularities. A theory, then, is not a list of regularities. Regularities are what theory seeks to explain, but are not in themselves theory. They initiate the search for theory but are not and cannot be its end point. A theory which seeks to 'explain' regularities is an entity of an altogether different kind from a list of regularities.

Moreover, although theorisation moves on from language by seeking to identify the hidden processes that give rise to surface regularities, it does not begin in a conceptual or linguistic void. It begins in the only place it can, in the evolution of thought and language, and their relation to the space-time phenomena that we experience 'without trying'. Because thought and language already give us a picture of the world which, at some level at least, seems to reflect its order and therefore to explain it, we are compelled to acknowledge that when we begin the process of theorisation we are already in possession of a view of the world which in many ways is very like a theory, in that it makes the world seem a more or less coherent and organised place. The difference is that the theory-like understanding we acquire from culture and language reflects not an interior order which gives rise to the surface regularities but an order in those surface regularities themselves. When for example language tells us that 'the sun rises', it reflects the regularities

The need for an analytic theory of architecture

that we note on the surface of things, not a hidden process which gives rise to this surface regularity. We might usefully then think of such everyday constructions as ‘theory in the weak sense’. Analytic, or scientific theories, are ‘theories in the strong sense’. They aim at a greater truth because they seek not to bring order to surface regularities but to show how those surface regularities arise from invariant necessities buried deep in the nature of things.

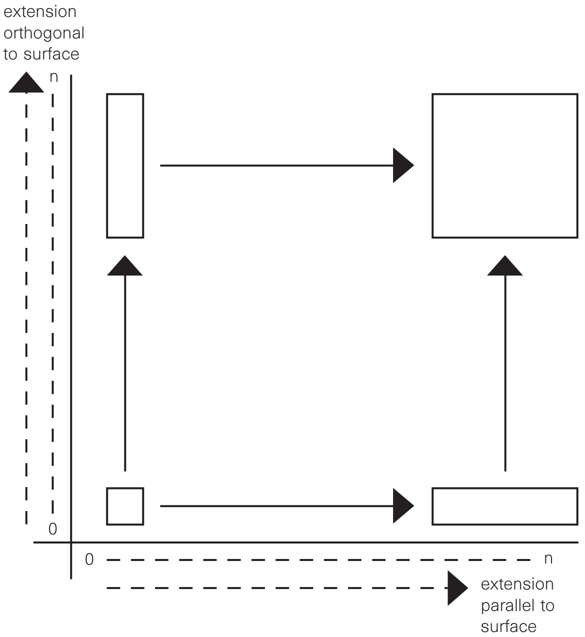
Formally defining simple regularities

Because surface regularities are the object of theory, the first step in theorisation is to formalise the idea. In fact, there is a beautifully simple way to extract the idea of regularity from phenomena and represent it as pure regularity, independent of the overall qualitative nature of things. The idea is that of translating the properties of objects in the world as we see them in real space into an abstract space which allows us to be quite clear about what these properties are. This is done by the familiar technique of replacing the space within which the object exists with an abstract co-ordinate system in which the axes represent those properties of the object that seem to be of interest as regularities. Thus one co-ordinate might represent the height of the object, another the length and another the breadth. We may then represent any object which has these properties as a single point in the ‘property space’.

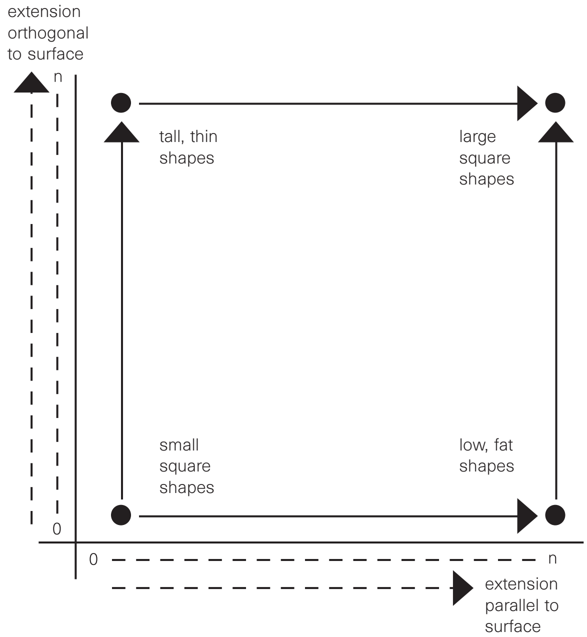
Once we can represent the properties of an object as a point in a property space rather than as that set of actual properties in real space, we can easily represent exactly what we mean by a regularity as far as these properties are concerned. For example, to the extent that things are comparable to each other in more that one property in the property space, the points representing them in the property space will cluster in a particular region of the space. Clusters in the property space give a formal meaning to the idea of a type or class of things, in so far as those properties are concerned. If things when represented as points in the property space are randomly distributed throughout the space, that is, if there are no clusters, then we would say either that there were no types, but only individuals, or that we had selected the wrong properties for analysis. If on the other hand we see clusters, we infer that things tend to fall into types, by which we mean that variation on one property tends to be associated with variation on at least one other, or perhaps many others. This is shown graphically in the top two diagrams of figure 2.1. We may equally use the property space to formalise the idea that the regularity we see lies not in apparent classes or types of things but sequences of states of things. In this case we ask: when an entity changes on one dimension, does it change in any other? It it does, then the regularity will show itself as a regular pattern in the distribution of entities in the property space. This is shown in the bottom two diagrams in figure 2.1. When we see such a pattern, we would infer that some process if not of cause and effect then at least of regular co-variation was in operation, since each time one variable was changed a change in another variable regularly appeared.

The need for an analytic theory of architecture

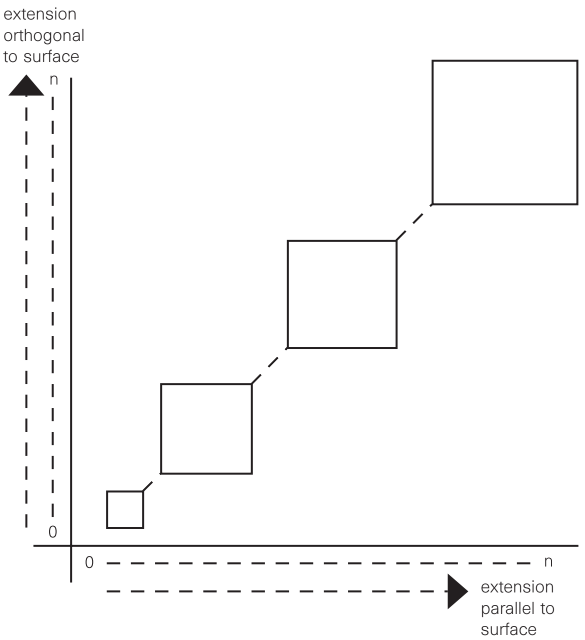
Figure 2.1



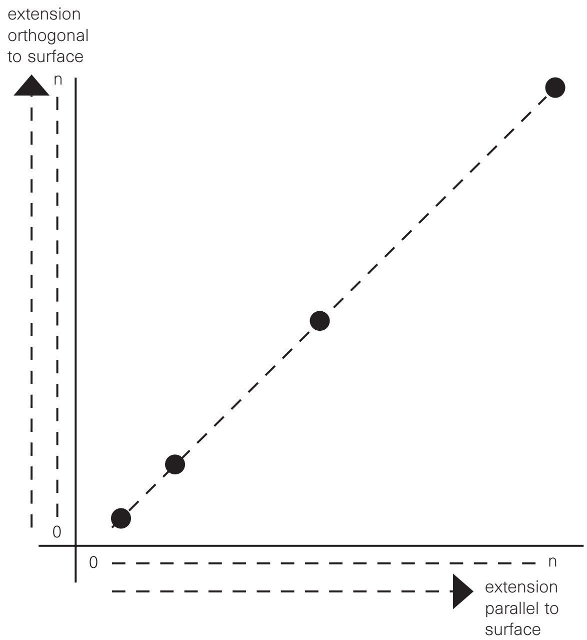
We first create a coordinate system in which vertical axis represents increasing size orthogonal to the surface and the horizontal axis increasing size parallel to the surface. We then draw in the space shapes conforming to the coordinates. In the bottom left corner we start with an initial square shape. This becomes extended vertically as we move upwards, laterally as we move horizontally and in both dimensions if we move in both directions.



Because the properties of lateral and vertical expansion are represented inthe axes, then the points in the property space represent the changes in spape in the left figure no less than the actual shapes themselves. Other properties not in the coordinate system would of course be omitted. The points represent only the properties selected for representation in the property space. The idea of types or classes of shapes can thus be shownby point clusters.



In the above case, the shapes drawn in the coordinate space show that an increase on one dimension is always related to an increase in the other. This type of regular association between changes is the surface phenomenon we associate with 'cause and effect'-one change seems to bring aboiut another. But what is shown in the figure is not 'cause andeffect', merely the regular association of changes. To 'explain' these regularities we would need to show why they are necessary.



Associated changes can also be represented as points in the property space. The position of points indicates that a change in one dimension is always associated with a change in the other. This representation is also known as a 'scatergram'. The degree to which points fomr a line from bottom left to top right can be indexes by a 'correlation coefficient', a value between 0 and 1 which indicates how strongly one change implies the other.

The need for an analytic theory of architecture

We might then reasonably say that questions about types, that is, about similarities and differences, are questions of the form: do entities cluster in particular regions of the property space?; while questions about cause and effect are of the form: when entities move in one dimension of the property space do they move in another?[17] Both of these describe the apparent regularities of surface phenomena, that is, the appearance of types and the appearance of cause and effect, in an abstract way. The property space is a means of controlling the attributes that are to be accounted for in the pattern of similarities and differences. Where the real object is present, all its properties are manifest. In the property space, only selected properties are present. Of course, everything depends on our selecting the right properties for the property space in the first place. For this reason we can never be sure from the absence of a regularity that no regularities are present in these phenomena.

But even if we go through a long process of experimenting with different properties until we eventually find the clusters or covariations that indicate the presence of regularities, it will always still be the surface phenomena that are represented regardless of the degree of abstraction. We are still seeing the surface of things, that is, apparent regularities of things as presented to our experience. We are not seeing the theory that purports to account for those regularities, that is, we are not seeing the model of the structures of the process which might account for these regularities. What we are doing is recording phenomena in such a way as to be able to see clearly what we mean by regularities, by translating properties into the dimensions of a coordinate space and locating objects as points within this space so that only the regular properties are represented in what we see. This both seems to be and is a fundamental way – maybe the fundamental way – of rigorously recording similarities and differences, and constant associations between things, within an objective and independent framework.

The meaning of the word theory can then be made precise. As we have said, just as the *a priori* given for the noting of regularities is that we know the difference between order and randomness, the *a priori* given for taking this into theorisation is that regularity on the surface implies some systemic process below the surface, such that the structure of that system is in some sense invariant. A theory is an attempt to model these invariants in a system of interdependent concepts. A theory is a model because it deals with the way in which things must be interrelated in order to produce the surface phenomena, and abstract because it represents the system by some means other than that of the system itself. A theory is a model, but not in the sense that a physical model is a model, that is, a small copy of the thing itself, but in the contrary sense of a model taking as abstract a form as possible, uncommitted to any particular kind of representation or embodiment. In its purest form, a theory is a kind of abstract machine, since it is an attempt to create an abstract representation of the working of processes which give rise to what we see.

Now the enormous power of theories arises from one very specific property of such 'abstract machines', a property we have already touched upon. Because theories are abstract working models of processes which give rise to the actual,

The need for an analytic theory of architecture

they also give a basis for conjecturing about the possible. Theories in effect allow us to go beyond the accumulated experience of reality and conjecture possible states of reality that are compatible with the model. It is this link between the actual and the possible that makes theories so useful for prediction. To 'apply' a theory is essentially to pose the question: is what is proposed a possible case?

It is too limiting then to call theories 'explanations' of how the world is. A theory defines the invariants that underlie many different states of reality. It is in principle unlikely that all possible states of a particular set of phenomena already exist or are already known. It is likely then that the theory will also predict possible states that do not exist but could according to the model. It is this property above all others that imparts to theory its immense power as a tool of thought and as an agent of human creativity, and also its practical usefulness. However, it is clear that these virtues will arise only to the degree that the theory captures invariants that really are 'out there'. But how can this be? How can an abstraction capture what is really 'out there'. To take this next step, we must know a little more about how theories are put together, how they work, and what they are made of.

What are theories made of?

The first thing we must note is that theories are made of concepts, usually in the form of a system of interdependent concepts with two forms of expression: words, and formal expression, usually mathematical. Since everyday life and language is also run on concepts we must know the difference between a scientific concept and an unscientific one. What then is the difference? We can do no better than to discuss the concepts on which both language and science seem to be founded, that is, the difference between order and randomness.

Order and randomness are both concepts which have a powerful intuitive meaning. Both are very broad indeed in their application, so much so that it is very hard to pin down what the two terms mean with any real clarity. Both terms, and even more the way they are related, express complex intuitions about the way the world is. Each term can be used in a wide range of situations, and the meaning only becomes clear enough to feel understood in the spoken or written context. This is common enough. The intuitive concepts that pervade and give sense to our languages have this richness and imprecision, so they can be used in a great variety of situations, and indeed it is only in the context in which a concept is used that its meaning becomes unambiguous.

In science, it is exactly this richness and imprecision that is restricted. Scientific concepts, although expressed in language, are much narrower in their potential application than normal linguistic concepts. But they are also more systemic, in that they compress and express more interrelationships between concepts. They express more connection between things, but at the cost of a narrowing of the range of application. The concept of 'entropy' is a good example of this because it relates both order and chaos in a systemic way, and in doing so restricts the range of application of the new synthetic concept to those situations

The need for an analytic theory of architecture

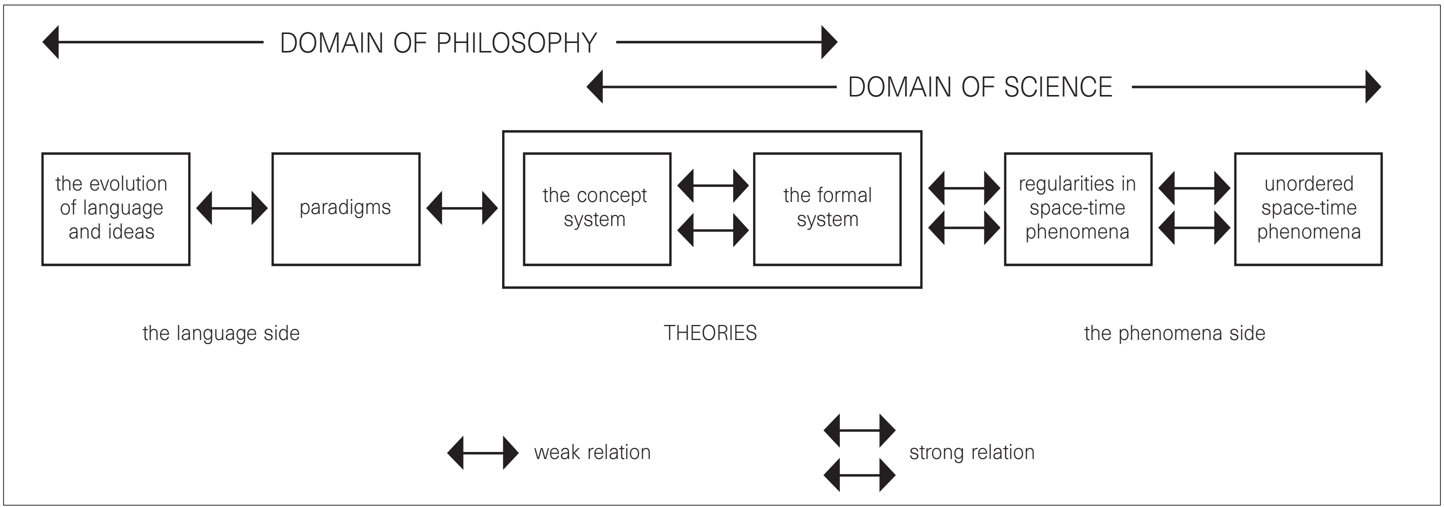
where precisely these systemic relations hold. The degree of entropy in a system describes that system's position in a continuum from order to chaos. Like many scientific concepts of great profundity and generality it can be explained simply, though not through words but through a simple model.[18] Imagine two jars, *a* and *b*, with *a* containing 100 balls numbered 1–100, and *b* empty, and some system for selecting a random number between 1 and 100 – say, a pointer on a spindle which can be spun so that it lands with equal likelihood on the numbers set out in a circle. Spin the pointer and when the point rests on a number, find the ball with that number and transfer it from whichever jar it is in to the other one. Then repeat this operation as many times as necessary. What happens? Intuitively – and correctly – we say that the process will settle down to about half the balls in each jar. Why? The answer tells us what entropy is and how it can be measured. The first time the pointer selects a number, the probability that the ball selected will go from *a* to *b* is 1, that is, it is certain, because all the balls are in *a*. The second time, there is one chance in 100 that the single ball in *b* will return to *a*, but 99 chances out of 100, that is, a probability of .99, that another ball will go from *a* to *b*. The next time there is one chance in 50 that one of the balls in *b* will return to *a*, but 98 chances out of 100 that another ball will go from *a* to *b*. Clearly, as the process goes on, the chances of balls going back from *b* to *a* gradually increase and the chances of balls going from *a* to *b* diminish correspondingly.

When about half the balls are in each jar, the probabilities are about equal, so the system tends to settle down to small variations about this state. To see why this happens let us define a microstate of the system as a particular distribution of individual balls in jars and a macrostate as a particular number of balls in each jar. There are, clearly, only 200 possible microstates of the system for the macrostate in which one ball is in one jar and the rest are in the other, that is, one for each of the hundred balls in each jar. For the macrostate with two balls in one jar and 98 in the other there are all possible combination of two balls for each jar, that is, 200 × 200. For the macrostate with three in one and 97 in the other there are all combinations of three balls. In other words, the number of microstates for the macrostate is maximised when the largest possible number are in the least full jar – that is, when half the balls are in each – because beyond that point there will be fewer balls in the other jar and everything happens in reverse.

This is why the system tends to the half and half state. There are far more microstates corresponding to the half and half (or near half and half) macrostates than for those in which a few balls are in one jar and many in the other. In other words all the system does is to tend to its most probable state. This is also the definition of the state of maximum entropy. Entropy is maximal in a system when the system is in one of the macrostates for which there are the largest number of microstates. An example of this, is where two gases are each randomly distributed in a container, without regions where one or other gas predominates. There are far more microstates with random distribution than microstates with concentrations of one or other gas in a certain region. Our model of jars and balls is then a statistical

The need for an analytic theory of architecture

Figure 2.2



representation of the mixing of two gases in a closed compartment – or for the gradual heat death of the universe as the universe tends from its current improbable state to its most probable state, that is, one in which heat is more or less evenly dispersed throughout the universe.[19]

In other words, entropy relates the notions of order and chaos into a single concept, but at the same time gives it a much more precise and limited reference to the world. However, it also does something else of no less importance. It permits the concept to be captured in a formal mathematical expression as well as through words. It is through this formal expression that the link between the concept and the observable world is made. This two-way emancipation of concepts, on the one hand reorganising concepts into more precise systems of interdependence and on the other relating them to the real world by associating them with formal expressions is the essence of what theories are.

Theories are therefore made of two things: words and formal expressions. But both represent concepts. A theory is a system of concepts with one type of expression, the verbal, which links the concepts back into our understanding, necessarily with some imprecision; and another, mathematical form which links the concepts forward into phenomena, necessarily with great exactness. Theories thus link our understanding to the world, connected to our understanding by linguistic concepts and connected to phenomena by formal expressions corresponding to the concepts.

This two-way relation using language and formalism to link concepts to our understanding on the one hand and to the real world on the other is the heart of what theories are. We may clarify all these complex relations in a diagram, see figure 2.2. This figure shows not only how theories intervene between language and the world, but also how science relates to philosophy, which overlaps with science in part of this overall scheme. The overall form of the diagram sets the evolution of language and ideas on the left and the phenomena of space-time on the right. Theories are in the centre, defined as a relation between a system of concepts and a system of formal expressions which looks two ways: through the concepts it looks

The need for an analytic theory of architecture

back first into the broader conceptual schemes we call paradigms, then into the evolving structure of language and ideas which are both an inevitable context and an inevitable constraint on theorisation; and through the formalism it looks forward towards the regularities in space-time phenomena which theories seek to account for, and then onwards into the general foreground of space-time phenomena which do not form part of the regularities but which may at any stage arbitrarily engage the theory by offering phenomena which are inconsistent with the 'abstract machine' for generating phenomena proposed by the theory.

The earliest ancestors of what we would recognise as 'scientific' theories, such as those of the Pythagoreans who are said to have first noted the relation between numerical ratios and forms occurring in nature, are probably best seen as paradigms rather than as fully fledged theories, although in their preoccupation with the relation between space-time regularities and formal expression they certainly prefigure theories in the modern sense.[20] Pythagoreanism (as we earlier noted as influencing Alberti) is a generalisation of a single concept which generated a way of looking at the world on the basis of a few results. This is legitimately a precursor to theory but not in itself what we ought to be calling a theory. However the attraction of such over-generalisation remains, as is seen in the prevalence of variants on Pythagoreanism in the mystical substitutes for theory which have continued to occupy the fringes of architectural thought throughout the twentieth century.[21]

Theories in the scientific sense are one step in from both paradigms on the one side and regularities on the other in that they are composed of concepts which are focused and related to each other to form a system, with precise relations between each concept and formal techniques or expressions which are used to check how far the regularities implied by the system of concepts are detectable in space time phenomena. Scientific theories thus require three relations to be particularly strong: the relations among concepts which form the conceptual system; the relations between concepts and formal techniques of measurement; and the relations between these formal techniques and space-time phenomena. In terms of the diagram, we may say then that science needs to be strong from the 'concept system' in the direction of phenomena.

Science is, and must expect to be, weaker in the other direction, that is, in the passage back through paradigms into the more general evolution of ideas. This tends to be ground occupied by philosophy. Philosophy overlaps with science in being interested in theories, and relating them back to broader families of concepts[22] right through to those that prevail in everyday life and social practices,[23] but does not normally preoccupy itself with the rigorous testing of theories against real space-time phenomena. Science and philosophy are rivals in the realm of theory, but only because their preoccupations reach out from theory in contrary directions with the effect that between them science and philosophy cover the ground that needs to be occupied by theoretical thought. However, it is because science moves from concepts to phenomena that its theories eventually come to have a puzzling status, because the intuitive sense that they 'explain' things comes

The need for an analytic theory of architecture

from the relation between the concepts that make up the theory and the sense we have from everyday language that our ideas 'explain' the world. Scientific theories are in this sense psychologically strongest where they are in fact weakest, that is, where the concepts that form the theory relate back into the broader conceptual systems which inform everyday life.[24]

Towards an analytic theory of architecture

Given these definitions, how then can there be an analytic theory of architecture? first, let us be completely clear about one thing. If there are no objective regularities in the real world of architectural form and space, linking the configurational aspects of form and space with behavioural and experiential outcomes, then there are no grounds whatsoever for seeking to build an analytic theory. The need for and the possibility of an analytic theory both stand or fall with the existence of such 'non-discursive regularities'.

This means that to build an analytic theory, non-discursive regularities must first be investigated and, if they exist, brought to light. How can this be done? We may first recall that an architectural theory is an attempt to render one or other of the non-discursive aspects of architecture discursive, by describing non-discursivity in concepts, words and numbers. We may say that an architectural theory seeks to create a 'non-discursive technique', that is, a technique for handling those matters of pattern and configuration of form and space that we find it hard to talk about. In research terms we could say that an architectural theory, at least in the 'narrow' aspects through which it describes and prescribes design decisions, is an attempt to control the architectural variable.

Now, as we have seen, architectural theories in the past have tended to be strongly normative and weakly analytic, because the non-discursive techniques proposed are only able to describe certain kinds of configuration. This is why in application they are partisan for that kind of configuration. For example, if a non-discursive technique describes systems of proportion in terms of numerical or geometric ratios, it is unlikely to be able to deal with configurations which lack such proportionality. It will only describe those cases where these proportions hold. In any attempt to apply such partisan techniques generally, they are more likely therefore to act as distorting mirrors than a discovery of new regularities. Likewise, if our non-discursive technique is a system of diagrams expressing spatial hierarchy, it is unlikely that those techniques can be usefully applied to the vast range of cases where such clear hierarchisation is not found. It follows again that such a technique will be useless for investigating spatial patterns in general.

We can say then that a non-discursive technique which is partisan for – usually because it is a product of a preference for – one particular kind of non-discursivity, will not be usable as an analytic tool, and cannot therefore be used for the discovery of non-discursive regularities. This deficiency, however, does point us in the direction of what is needed. To bring to light non-discursive regularities, we need non-discursive techniques for the description of either spatial patterns

The need for an analytic theory of architecture

or formal patterns (or conceivably both) which are uncommitted to any particular type of spatial or formal configuration or pattern, and which are capable of general application to describe all possible types of pattern. For example, it ought to be able to handle spatial patterns or built form patterns which lack geometric regularity as well as those which have it. Unless this can be done with rigour there there is little hope that theoretical propositions in architecture can ever be analytic in the sense that we require them to be.

The next chapter of this book will introduce such a set of non-discursive techniques for the analysis of configuration, first developed in spatial form as 'space syntax', but now being broadened to cover other aspects of configuration. These techniques have been used over several years for two principle purposes, first to discover how far it was possible to bring to light and subject to rigorous comparative analyses the configurational aspects of space and form in building through which culture is transmitted, and second, through these comparative studies to develop a corpus of material which would permit the gradual development of a general theory of architectural possibility. The remainder of this book is essentially an account of the progress that has so far been made in this project.

As we will see, what we discover through applying these techniques to the analysis of spatial and formal patterns in architecture, wherever they are found and whatever their embodiment in either buildings or urban systems, are invariants in patterns which lie not on the surface of things but which are buried in the nature of configurations themselves. These invariants we can think of as deep structures or genotypes. Each cultural manifestation through building, whether as a building 'type' for a particular purpose, or a particular architectural ethos or imprinting of culture on building, does so through such genotypes. For example, seen as systems of organised space, it turns out that towns and cities have deep structures which vary with culture. Likewise, seen as organised spaces, buildings for different function purposes also have deep structures or genotypes. These genotypes are – or embody – cultural or typological invariants. These are not of course general laws. They are at best the 'covering laws' of cultures. There are the genotypical invariants by which each society and each function in society seeks to express itself through architecture.

However, as we build our corpus of genotypes we gradually begin to see that there is another level of invariance: there are genotypes of the genotypes. Below the level of cultural variation in architecture there exist invariants across cultures and types. These 'genotypes of genotypes' are not the covering laws of cultures but the invariant laws that bind humankind in general to its artificial material world. They are the abstract raw material out of which all configurational possibility in space and form in the built world are constructed. It is at this level of invariance – and only at this level – that we can build a genuine analytic theory. These possibilities will be dealt with in Chapters 8 and 9.

The need for an analytic theory of architecture

Architecture as art and as science

If this theoretical project is eventually to succeed – and it is beyond the scope of any single book to do more than take a few faltering steps towards such a theory – then it is clear that such a theory would liberate rather than constrain design. At root, the need for architectural theory arises from the need to formulate principles from the experience of having built to inform and guide us on how we might build. This dynamic between the actual and possible is the essence of architectural theorising. Architectural theory arises from the fact that architects can neither forget the architectural tradition, nor repeat it. In architecture, theory is not simply a means to fix a picture of the world in a certain form. It is also the means by which form is destabilised and a new future is conceived. Architecture progresses by incorporating its reflection on the past into an abstract frame of possibility. This frame is theory. Without it, historical thought is sterile, and can only lead to imitation of the past. Through the intermediary of theory, reflection on the past becomes possible future. History constrains, but theory liberates, and the more general the theory, the greater the liberation.

Does this mean then that the line between architecture as science and architecture as art needs to be redrawn closer to science? I do not believe so. We can call on the beautiful ideas of Ernst Cassirer on the relation between art and science.[25] 'Language and science', he writes, 'are the two main processes by which we ascertain and determine our concepts of the external world. We must classify our sense perceptions and bring them under general notions and general rules in order to give them an objective meaning. Such classification is the result of a persistent effort towards simplification. The work of art in like manner implies such an act of condensation and concentration...But in the two cases there is a difference of stress. Language and science are abbreviations of reality; art is an intensification of reality. Language and science depend on one and the same process of abstraction; art may be described as a continuous process of concretion... art does not admit of...conceptual simplification and deductive generalisation. It does not inquire into the qualities or causes of things; it gives the intuition of the form of things...The artist is just as much the discoverer of the forms of nature as the scientist is the discoverer of facts or natural laws.'

Those of us who believe that science is on the whole a good thing, accept that science is in one sense an impoverishment – though in others an enhancement – of our experience of the world in that it cannot cope with the density of situational experience. It has to be so. It is not in the nature of science to seek to explain the richness of particular realities, since these are, as wholes, invariably so diverse as to be beyond the useful grasp of theoretical simplifications. What science is about is the dimensions of structure and order that underlie complexity. Here the abstract simplifications of science can be the most powerful source of greater insight. Every moment of our experience is dense and, as such, unanalysable as a complete experience. But this does not mean to say that some of its constituent dimensions are not analysable, and that deeper insight may not be gained from such analysis.

The need for an analytic theory of architecture

This distinction is crucial to our understanding of architecture. That architectural realities are dense and, as wholes, unanalysable does not mean to say that the role of spatial configuration (for example) in architectural realities cannot be analysed and even generalised. The idea that science is to be rejected because it does not give an account of the richness of experience is a persistent but elementary error. Science gives us quite a different kind of experience of reality, one that is partial and analytic rather than whole and intuitive. As such it is in itself that it is valuable. It needs to be accepted or rejected on its own terms, not in terms of its failure to be like life or like art.

It is in any case clear that the dependence of architecture on theories, covert or explicit, does not diminish its participation in Cassirer's definition of art. This is true both in the sense that architecture is, like art, a continuous process of concretion, and also in the sense that, like art, 'its aspects are innumerable'. But there are also differences. The thing 'whose aspects are innumerable' is not a representation but a reality, and a very special kind of reality, one through which our forms of social being are transformed and put at risk. The pervasive involvement of theory in architecture, and the fact that architecture's 'continuous concretion' involves our social existence, defines the peculiar status and nature of 'systematic intent of the architectural kind': architecture is theoretical concretion. Architects are enjoined both to create the new, since that is the nature of their task, but also to render the theories that tie their creation to our social existence better and clearer. It is this that makes architecture distinct and unique. It is as impossible to reduce architecture to theory as it is to eliminate theory from it.

Architecture is thus both art and science not in that it has both technical and aesthetic aspects but in that it requires both the processes of abstraction by which we know science and the processes of concretion by which we know art. The difficulty and the glory of architecture lie in the realisation of both: in the creation of a theoretical realm through building, and in the creation of an experienced reality 'whose aspects are innumerable'. This is the difficulty of architecture and this is why we acclaim it.

Notes

1 Roger Scruton, *The Aesthetics of Architecture*, Methuen, 1977.
2 Ibid., p. 4.
3 L. B. Alberti, *De Re Aedificatoria*, 1486; translation referred to: Rykwert et al. (1988), MIT Press, 1991.
4 O. Newman, *Defensible Space*; Architectural Press, 1972.
5 Alberti, Chapter 9.
6 Newman, pp. 3–9.
7 How this happens as a cognitive process is the subject of Chapter 11: 'The reasoning art'.
8 Chapter 11 includes a case study in the dangers of bad theory.
9 Alberti, for example, Book 9.

The need for an analytic theory of architecture

10 Scruton's fundamental error is to confuse these two aspects, and in effect to believe that the narrow propositions of architectural theory are intended to be universalistic. See Scruton, *The Aesthetics of Architecture*, p. 4.

11 Alberti, Book 9.

12 Newman, pp. 3–9.

13 F. Bacon, *The New Organon* (1620), Bobbs Merrill, 1960, Aphorisms Book 1, Aphorism cxv, p. 105.

14 T. Kuhn, *The Structure of Scientific Revolutions*, University of Chicago Press, 1962.

15 To use Rene Thom's admirable expression for what we observe – see *Structural Stability and Morphogenesis*, Benjamin, New York, 1975 – originally in French, 1972, as *Stabilite Structurelle et Morphogenese*. See for example p. 320.

16 F. De Saussure, (originally in French 1915) version used *Course in General Linguistics*, McGraw Hill, 1966, translated by C. Bally and A. Sechahaye with A. Riedlinger - see for example pp. 103–12.

17 These examples of course deal with linear variation, but the basic arguments also apply to non-linear variation.

18 This model, the 'Ehrenfest game', is taken from M. Kac and S. Ulam, *Mathematics and Logic*, Pelican Books, 1971, p. 168. Originally Praeger, 1968.

19 For a further discussion see H. Reichenbach, *The Direction of Time*, University of California Press, 1971, particularly Chapter 4.

20 See K. Popper K, *Conjectures and Refutations*, Routledge and Kegan Paul, 1963, Chapter 5: 'Back to the presocratics'.

21 See for example M. Ghyka M, *Geometrical Composition and Design*, Tiranti, London, 1956.

22 For example in the work of Alexander Koyre, e.g. *Metaphysics and Measurement*, Chapman and Hall, 1968 (originally in French) and *Newtonian Studies*, Chapman and Hall, 1965 or Georges Canguilhem e.g. *La Connaissance de la Vie*, Librairie Philosophique J.Vrin, Paris, 1971.

23 As pioneered in the work of Michel Foucault.

24 In the past, this has led to a quite rapid permeation by new scientific concepts of the conceptual schemes of everyday life, bringing changes in consciousness which may seem entirely progressive, as for example with the theories of Newton or Darwin. It may indeed be the loss of this illusory strength that has bought about much of the alienation from science in the late twentieth century. As science has progressed farther into micro and macro phenomena and discovered patterns which are utterly remote from everyday intuition the concepts that make up scientific theories become so strange that they cannot even be formulated so as to interface effectively with the established conceptual system of linguistic normality. This has happened with quantum theory. But what has happened with quantum theory confirms our model as set out in the diagram: science intervenes through formalisms between concepts and phenomena. It is no part of its function or its morality that these concepts should 'fall within the lighted circle of intuition' (to use Herman Weyl's admirable phrase – see his *Philosophy of Mathematics and Natural*

Science, Atheneum, New York, 1963, p. 66) and so be translatable into the available concepts of everyday life and language. There is no greater arrogance than that we should expect them to be, except perhaps the belief that the world itself in its deepest operations should conform itself to the apparatus of our intuitions.

25 Ernst Cassirer, *An Essay on Man*, Yale University Press, 1944.
Edition used: Bantam Matrix, 1970. Chapter 9, 'On art', pp. 152–88.