

## A note on the intuiting of form: three issues in the theory of design

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### Three issues in the theory of design

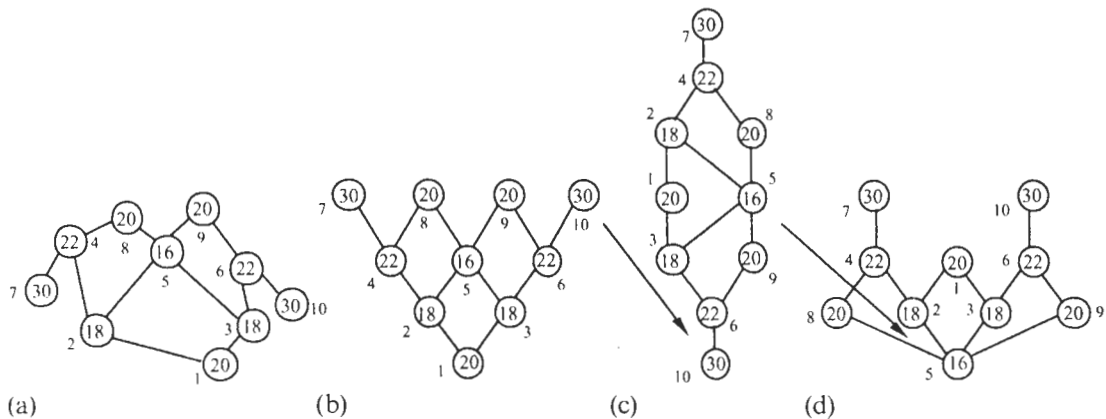
Space syntax is a method with a theory attached. The method is the 'configurational' analysis of space which seeks to analyse spatial complexes in such a way as to identify structure at the level of the whole 'configuration'. The theory proposes that, in general, the form–function relation in buildings and cities passes through the structural properties of whole configurations. If the theory is correct, it would follow that, because architects design form–function systems (given a functional specification, find a suitable form), knowledge of spatial configuration must, implicitly or explicitly, be a key dimension of knowledge in the design domain of architecture.

My aim in this note is not to reargue the proposition but to explore its implications, if true, for three issues in the theory of design. The first is how far design should be regarded as a legitimately intuitive process, as opposed to one which is intuitive by default, and awaiting emancipation to a systematic procedure. The second is how far design is, or should be, a top-down or bottom-up process. The third is how far there can be a domain-independent theory of design which includes architecture.

### Defining spatial configuration

First, we must define 'spatial configuration'. Configuration, in the sense in which it is used in space syntax, means not simply relations in a complex, but relations which take into account other relations, for example, by calculating the total topological depth from each element to all others in a complex (the basis for the various syntactic measures of spatial 'integration'). The reason this is a necessary strategy is that complexes of relations have two key 'properties of the whole' which are critical for space. The first is that a complex is different—not just seems different—when looked at from different points of view. Figure 1 shows a graph of a hypothetical relational complex [figure 1 (a)] justified (take a node as root and align all other nodes in layers according to their 'depth' from the root) from three different nodes [figures 1(b), 1(c), 1(d)]. The three 'j graphs' are hardly recognisable as the same graph. Each has in effect distinct structural properties as a point of view within the graph. Exactly this property is exploited in, for example, differentiating activities spatially in a house or differentiating streets in a network.

The second property of the whole is that when you change a part of a spatial complex, the structural properties of the whole are also likely to change. For example, in figure 1(e) we moved a link from one pair of nodes to another and then rejustified the graph from the same three nodes as before in figures 1(f), 1(g), and 1(h). The new j graphs have quite different structural properties to the previous three, including the conversion of the most integrated node into a cut node.



A graph, (a), justified from three different positions, (b), (c), and (d). The number inside each node is the total depth of the graph from that node; those outside, the numbers of the nodes. The sums of the total depths for each version of the graph are of course the same at 216. Exactly these kinds of difference are exploited in, for example, differentiating functions spatially in a house or differentiating streets in a network. Suppose we then remove the link from 1–3, replace it with a link from 4–5, and recalculate. Six of the values change, and four remain the same. The total reduces to 208, meaning an overall more integrated complex. However, the real differences show when the graph is rejustified from the same three nodes. The most important effect is that node 5, the most integrated node, has become a cut node: if it were removed, the complex would decompose into two separate subcomplexes, often a critical property in domestic space. The 'structural' properties of the graphs are altered by quite simple local changes.

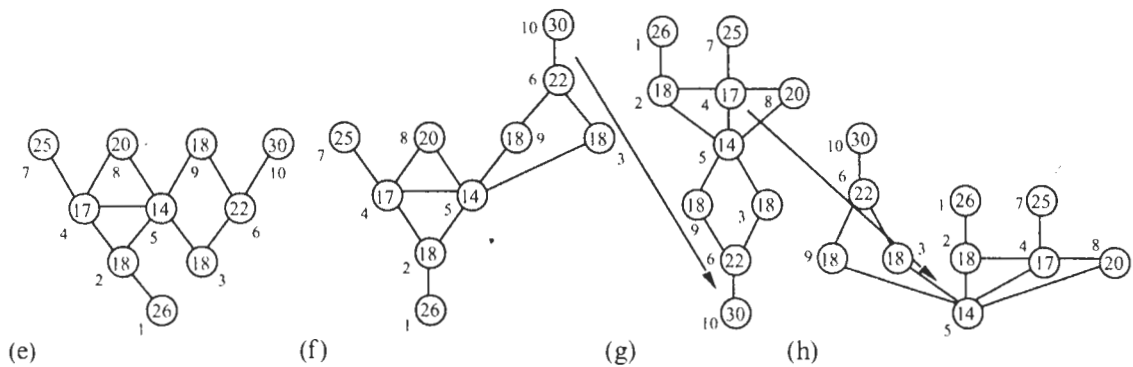


Figure 1.

### Identifying and testing structures

It is these two properties of the whole that space syntax seeks to express in a numerically consistent way, in the belief that buildings and cities use them as the principle means of adapting form to function. How they do this, however, varies spatially with the type of function. For example, for movement purposes, space becomes essentially a matrix of lines and can be represented as such for the analysis and prediction of movement by using space syntax. Space is not simply a geometric shape but a set of geometric potentials each of which has its own natural geometry and relates to some aspect of how human beings function. For example, people move in lines, interact in convex spaces, and experience space as a series of 'isovists'.

These potentials all coexist at once but any or all can be isolated and analysed 'configurationally' to show structure in the complex as a whole. These structures can then be tested against observed function by correlating numbers representing functional outcomes—for example, movement rates—against numbers representing some aspect of configuration in that location. In this way, an objective check can be provided on how far the form–function relation really does pass through spatial configuration.

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**Configuration is nondiscursive**

If this does turn out to be the case—and a good deal of evidence suggests that it is (Hillier, 1996)—then there are implications for the three issues in design theory. Let us first consider configuration in general. On reflection, configuration seems very fundamental in human affairs but we tend to handle it without thinking about it. As a consequence, we find it very difficult to talk about, or even to understand, what it is that we do. In language, for example, we are aware of using words and phrases but we are not aware of the syntactic and semantic structures which configure these into meaningful patterns. The difficulty we have in understanding the configurational aspects of things reflects perhaps the simple fact that the human mind in general deals with configuration without conscious attention. Configuration is, we might say, nondiscursive: we have no words and concepts which describe it at anything like the level of complexity at which we create it and experience it in the real world. If this is so, then the difficulty we have with architecture becomes clearer. We have no terms or concepts for configurations in general, and certainly not for the partially ordered configuration of space we find in buildings or cities.

**Is design intuition or reason?**

This has obvious implications for the relation between intuition and reason in architectural design. One of the two main products of the design process is a spatial configuration (the other is a configuration of form) and this is the key to the form–function link, which is the main stated object of the design. This means that the key feature of what the architect designs is in the realm of the nondiscursive. To say that much of the creative activity which leads to the generation of a possible configuration happens ‘intuitively’ is, in light of this, no more than to state the obvious. The nature of human cognitive activity should lead us to expect that the act of configurational creation will be anchored in processes which occur below the level of conscious thought. Spatial design is configurational, therefore nondiscursive, and nondiscursive reasoning is probably what we call intuition.

If we do, however, acknowledge the primacy of intuition in design, it must be qualified in three ways. First, the primacy of intuition holds only for the phases of design in which design ‘conjectures’ are generated. The process of testing those conjectures is a discursive process involving reasoning and this is likely to feed back into the next phase of conjecture. We might then characterise architectural design as something like the reasoned deployment of intuition. Second, this does not mean that architects do not try to render space discursive. To some extent, their remit compels them to attempt to do exactly this. But they do not often succeed and configurational analysis suggests why. The concepts needed are too complex to be resolved linguistically. They require more formal resolution. The third qualification follows. Architectural theories are usually attempts to bring the nondiscursive aspects of architecture (form as well as space) into the realm of reason and formal calculation by rendering the nondiscursive discursive. It is easy then to see why theory is a necessary adjunct to architecture and why, historically, architecture and architectural theory arise and evolve together.

**Is design top down or bottom up?**

A possible answer to this question follows from the first. A spatial design is a system of configurational differences and it is these differences that relate to function. We know that a characteristic of configurations is that, when you change a part, you change the whole. This means that you cannot deal fully with the form–function relation other than at the level of the whole configuration. It follows that in an important—though

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not an exclusive—sense spatial design is likely to be a top-down process. You cannot know if you are likely to achieve your form–function aims until you have a notion of the whole configuration, at least in its essentials. A solution cannot be evolved bottom up from the parts, because how the parts fit together is the critical factor, and the addition of a new part at any stage may change the structural characteristics of the whole. The form–function relation, we must conclude, is emergent at the top level. This is not a new proposition. It is acknowledged in the urtext of architectural design theory, Christopher Alexander’s *Notes on the Synthesis of Form* (Alexander, 1964), although in general the aim of that text was of course to show the contrary.

**A domain independent theory of design which includes architecture?**

Again, a possible answer to this question follows from the previous two. Any theory of design in architecture, it seems, must give an account of configuration. In the brief account of design we have offered, it is clear that configuration is an aspect of the *product* of design which is so central that it structures the *process*. If a theory of design in general is to include architecture, then it is clear that it cannot be committed to a process which is structured in some other way. Architecture will be part of a domain-independent theory of design to the extent that other domains share the necessary preoccupation of architecture with configuration. Do they? It seems likely that they do, but as yet matters are not formulated in this way. We must await developments.

**References**

- Alexander C, 1964 *Notes on the Synthesis of Form* (Harvard University Press, Cambridge, MA)  
Hillier B, 1996 *Space is the Machine* (Cambridge University Press, Cambridge)