The Journal of Space Syntax

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Pages: 154-179

The Journal of Space Syntax
ISSN: 2044-7507
Year: 2011. Volume:2, Issue: 2
Online Publication Date: 15 December 2011

http://www.journalofspacesyntax.org/

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Synchronic and Diachronic Aspects (of a personal case)

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This paper deals with formal order in architecture. It stems from a personal view that sees architecture both as innovative, intuitive activity and as analytic and theoretical study; as such, it attempts to bring together formal analysis and theory building on the one hand and active involvement in design on the other. It asks how architecture is conceived in the abstract realm and focuses on the conceptual structure of architecture. What are, however, the distinctive features of this structure? The notion of relations is discussed as being central to its analysis, while ordering principles, seen as formal rules, are defined as having a logical nature (Hillier, 1985). The paper consists of two parts. In the first, conceptual order present in the personal idiom of an architect is analysed both in *synchronic* and *diachronic* terms. Based on this analysis, a proposition for the way formal structures are ordered is made, for *the logic*, that is, *of composition*. Two such modes, the *intensional* and the *extensional* one, are identified. In the second part, the paper opens up the discussion in order to explore what relevance such issues have in exploring variation in architects' idioms. Finally, reflecting on actual design practice, it attempts to identify instances of innovation within structured set of rules.

Keywords: Composition, Formal Order, Conceptual Structure, Personal Idiom, Creativity

1. Issues of architectural order

Doing architecture and thinking about architecture is what architects do. We do, we think and, sometimes, we talk about architecture. Being involved in doing architecture, either in practice or in teaching design studio, and thinking about architecture, involves oscillating between going deep into the creative realm and attempting to develop a discursive thinking about it. It requires doing and, at the same time, understanding what this doing entails. How do we design, how do we understand architecture, what is, after all, this 'architecture' that we think with and find so difficult to talk analytically about? In an early paper Hillier (1974) addresses the issue of design and puts forward the notion of the designer's pre-structures, of structures, that is, which shape architects' understanding and make design possible. How do structures as such come about? Do they have any relevance to what we generate during design? This kind of conceptual structures is the focus of this paper.

My approach has been shaped over the years by an early attempt to understand designers' pre-structures through the notion of architectural codes that relate different parts of the architectural object, (Lindsay et. al., 1981; Sakellaridou, 1982; 1985) and, later on, by focusing analytically on the

formal structure of the architectural object (Sakellaridou, 1991; 1992a; 1992b; 1994). If, in order to elaborate on what the formal structure is, requires a *synchronic* understanding, then what takes place during design, that is, how the formal structure is structured and how it evolves over time, brings forward a *diachronic* aspect.

This paper stems from a personal view that sees architecture both as innovative, intuitive activity and as analytic and theoretical study; as such, it attempts to bring together analysis and theory building on the one hand and active involvement in design on the other. The paper has two parts. The first examines issues of morphological order by focusing analytically on conceptual structures that seem to underlie the composition of the architectural object. This formal structure is defined as a compositional structure, while formal properties are seen as abstract rules that organize it. Accepting the logical nature of these rules, it examines the synchronic and diachronic aspects of a personal idiom and identifies two different modes of order in them; a proposition, that suggests a composition logic. It asks if they also differ in the degree of variation they allow, and, thus, to the possible degree of innovation. In the second part, the discussion opens up to explore what relevance issues as such have in exploring variation in personal idioms. Being also a practicing architect, I attempt in the last part to reflect on what is taking place during design by discussing instances of our own design.

The paper presents instances of a personal process to understand formal order in architecture. Like any attempt to understand though, this is not a continuous process; sometimes it accelerates in one direction, only later on to diverge or bring to the foreground another. However, some things remain constant: one common thread that leads from order and its various degrees in the formal structure, to the search for understanding creativity and innovation.

2. The logical nature of ordering principles

Notions of composition and architectural order are central to architecture. Composition refers traditionally to 'how to put things together'. It is seen as referring to an *act,* that of combining to form a whole, to a *manner* in which something is 'brought together', and to a *product*. Indeed, composition can be understood in everyday architectural discourse as referring both to a process, to the 'putting together' of the architectural object, as well as to the object itself, as a property to be identified in it. In the latter, it can be seen as including the notion of architectural order. But, while architectural order refers to abstract underlying principles of form, composition may also refer to a wider spectrum of aspects of the 'synthesis' of the architectural object, to its formal and material nature at the same time, even to the distribution of its functions. It might be necessary then to suggest that architectural order should be seen as a broader term in order to encompass all these properties of form which have to do with its being 'put together' to be seen as referring to the formal synthesis of the architectural object and not just to the geometrical principles of its organisation.

Considering design as a cognitive activity (Foz, 1973; Darke, 1979; Lawson, 1980; Schon, 1985; or more recently, Peponis, 2005, in discussing design formulation), previous research points to the fact that during the early stages of design a general conjecture is formed about the design-to-be which

brings together the spatial and the formal aspects of the design. This design conception constitutes a formal structure that relates elements and principles as parts to a whole. On the other hand, analysis of form and order has occupied extensive ground in architectural theory. Normative theories of the past have since given way to analytical approaches such as that exemplified by the work of March (1976) and March and Steadman (1974), or Rowe (1984) who, despite focusing on the mathematical aspect of form, nevertheless points to the internal order that brings together different aspects of building. Another example is Eisenman (1984; 1999), who emphasises the underlying notion of interrelation and structure inherent in the notion of composition. Tzonis and Lefaivre (1986) search for an underlying formal structure in classical architecture, while work on shape grammars (Stiny, 1980; 1985; Mitchel, 1990) offers generative descriptions of shape generation in various formal systems. More recently, Peponis (2003; 2005) and Psarra (2009; 2010) have searched for the relationship between spatial, conceptual and perceptual formal structures.

What is however the nature of these ordering principles that seem to underlie composition and to order the relation of parts to themselves and to the whole? Hillier (1985) proposes that architectural ordering principles have a *logical nature* in that they establish relations of similarity and/or spatial relations. They are logical notions, which relate parts to other parts and to the whole, by effecting *relations* of similarity and difference on the one hand, and/or spatial relations on the other. By seeing ordering principles as logical relations, we can get at a logical description of form, at something like its 'genetic construction' (Hillier, 1985, p.71). The logical ideas can be seen as permutable and combined in such a way as to form logically more complex forms. Furthermore, different combinations of logical relations would create different types of order. Standard terms used to describe architectural form can be seen to be quite systematic in this way, and their relation to each other can become amenable to analysis, while, at the same time, order ceases to be of a numerical or geometrical nature, and we are dealing with what could be defined as a kind of *logic in architectural form*.

A number of propositions can be made. First, an architectural formal structure can be seen as being comprised of logical ordering principles, which relate parts to the whole. Second, analysis would focus not on the elements as such, or on their geometric properties, but on these logical relations which order elements and exist in different interrelations to each other, forming a complex structure of varying degrees of order, forming what can be defined as a '*compositional structure'*. Different ways of 'interrelation' of these logical notions will have as a result different 'compositional structures'.

3. On synchronic and diachronic aspects of a personal idiom

Aiming to approach this formal structure analytically, I focused on a particular architect with a very clearly identifiable structure; namely Mario Botta, analysing nineteen of his single-family houses, [Figure 1]. The aim of the study was to offer an analytic understanding of the formal structure of a series of buildings, *(synchronic aspect)* and an understanding of how these formal structures change over time *(diachronic aspect)*. The following analysis is a summary of the study, which can be read in full in Sakellaridou (1994).

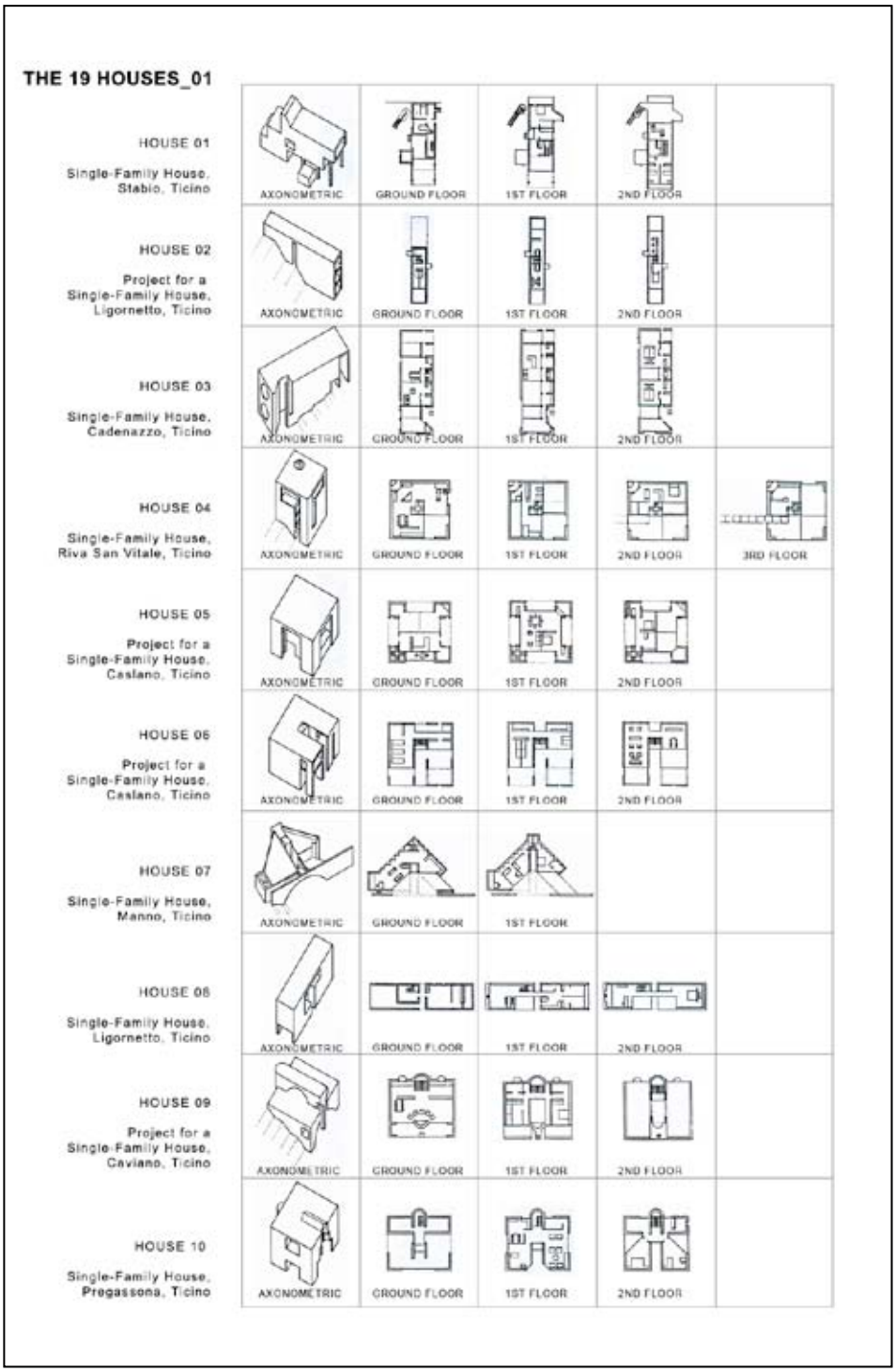


Figure 1a. The 19 houses analysed.

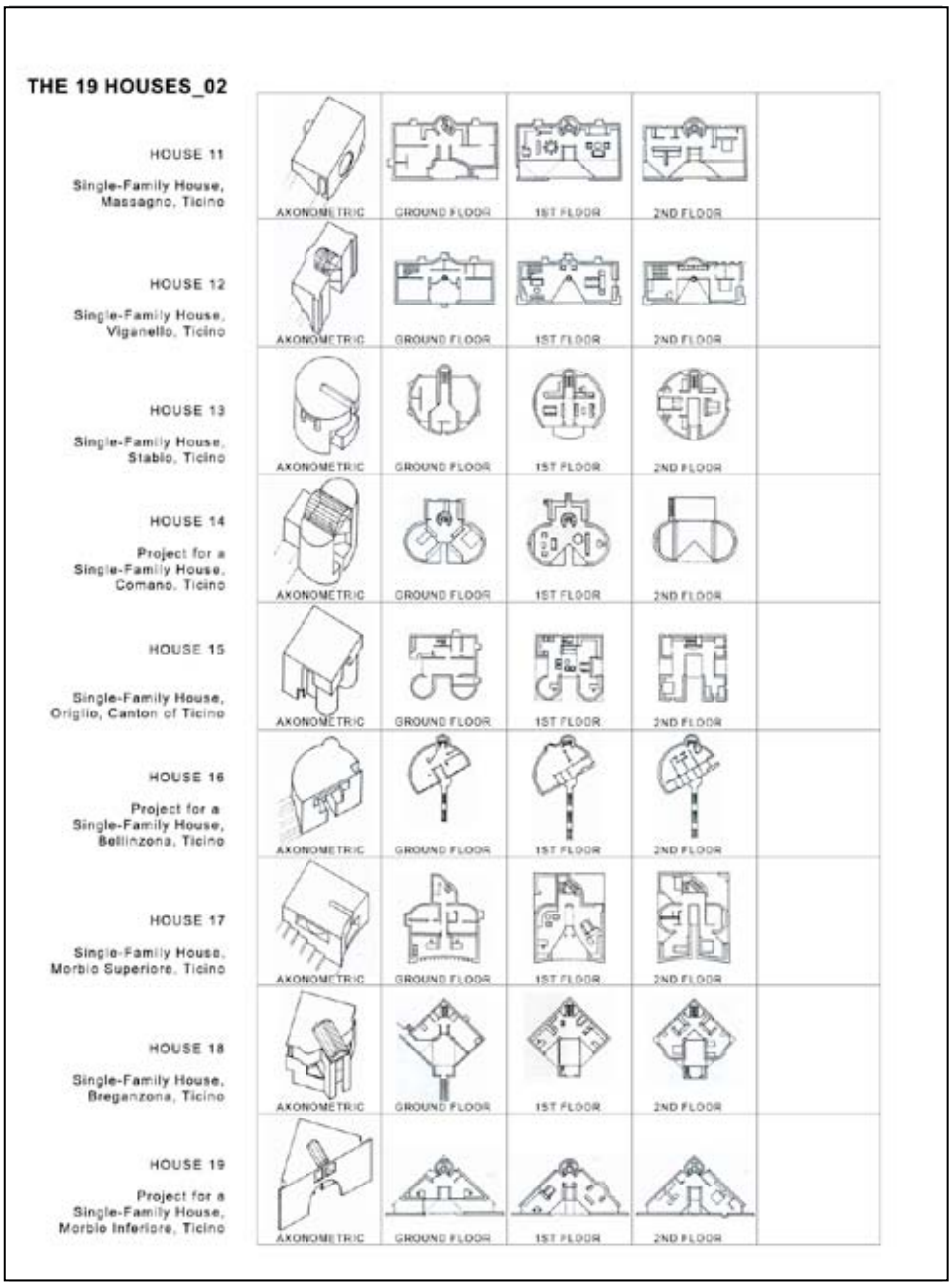


Figure 1b. The 19 houses analysed.

For analytic reasons, formal ordering principles were defined as rules, which, of a common nature as logical properties, describe, or 'rule', different aspects of the object. Rules are primarily what we call order. They are the relational structure of the architectural object. The logical relation established by the rule represents the nature of the rule, while the different aspects of the object ordered by this rule would be the domains of realisation of the rule. What we see is the realisation of the rule in different domains, which are various aspects of *the mass, the elevation and the plan.* There are three aspects of a rule: *what, how* and *where*: *what* would be referring to its nature, *how* to the restrictions, the degree of order, or the variety that it allows, and *where* to the domains of its realisation. Thus, I distinguish between the nature of the rule (what it is), the degree of realisation of the rule (how it is realised), and the domains of realisation of the rule (where it is realised).

The purpose of the exercise was to explore how far it was possible to produce an analytic construction of the conceptual structure. Observation and description of the houses suggested a number of ordering principles, namely primary solid, subtraction, frontality, symmetry and zone formation, which seemed to underlie different parts of the building. Similarities were evident as well as differences, as most houses had a number of common compositional features. Furthermore, as houses progressed in chronological order, it seemed that *the evolution of the formal structure had to do with the degree of the realisation of the different principles and with their interdependence.*

After the description of the houses a formal analysis of the identified themes took place, which measured properties of the mass, the elevations and the plan. To proceed with the different measures, I analysed a series of analytic diagrams: First, *mass* in terms of: a. the regularity of the volume, and the realisation of edges and surface, and b. the constitution of the volume of the building, the degree to which it is articulated by small volumes, the constitution of these volumes in terms of symmetry, and the constitution of the subtractions in terms of symmetry to themselves and to the whole. Second, *elevations* in terms of: a. the degree of individuation of the different elevations by various means, and b. the degree of correspondence of the different aspects of frontality, that is, how many aspects of frontality, intrinsic and extrinsic, each elevation has. Third, *plans* in terms of: a. symmetry of spaces to themselves and to the whole, and b. organisation of spaces according to labels in terms of forming continuous zones and of depth. Figures 2, 3 and 4 present the analytic diagrams for three such houses, the House in Riva San Vitale, the House in Pregassona, and the House in Morbio Superiore, respectively houses H4, H10 and H17 in my list. To measure order and to reach at as few and as general rules as possible, ordering relations were seen as establishing groups of entities which by virtue of being ordered by a relation (a spatial relation or one of similarity), they belong to a group. The analytical procedure adopted was as follows: First, measures of the degree of realisation of the different ordering principles of the mass, the elevations and the plan were made. These included various measures of the mass, (the regularity and the constitution of the volume and subtraction); measures of the elevations, (individuation of an elevation); measures of the plan (sysmmetry of the plan and zone formation in terms of labels – inhabitants/visitors and parents/children - and depth). A detailed list of the different measures is given in the appendix. Second, correlations among the different measures and the size and time order of the houses took place, in order to trace significant relationships between certain properties and either the size or the chronological order of the houses. Third, correlations among the different variables (measures of the properties) also took place, so that interrelations between the different variables are traced.

Attempting to classify the houses in terms of the rules they exhibited, the following pattern appeared. Even though it was obvious that most houses shared the same rules, and these rules evolved, it seemed quite difficult to isolate the ones that mainly influenced variation. What the analysis showed was that a great number of houses shared not one, but a number of rules, all related to each other. As time progressed, there was *change to the degree of realisation of the rules, and change to the interrelations of the rules*. What seemed to take place was the *interrelation of different parts of the house,* namely the mass, the elevations and the plan. This focused attention to the type of relation-

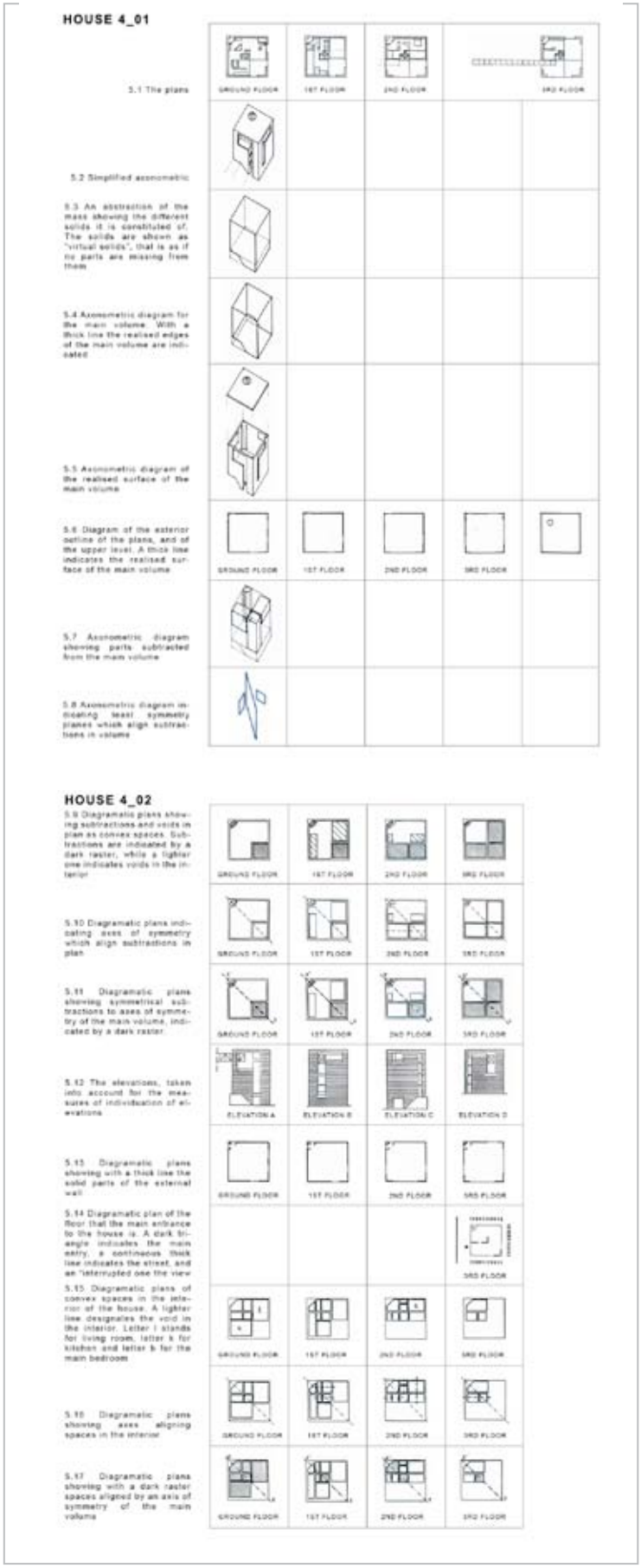
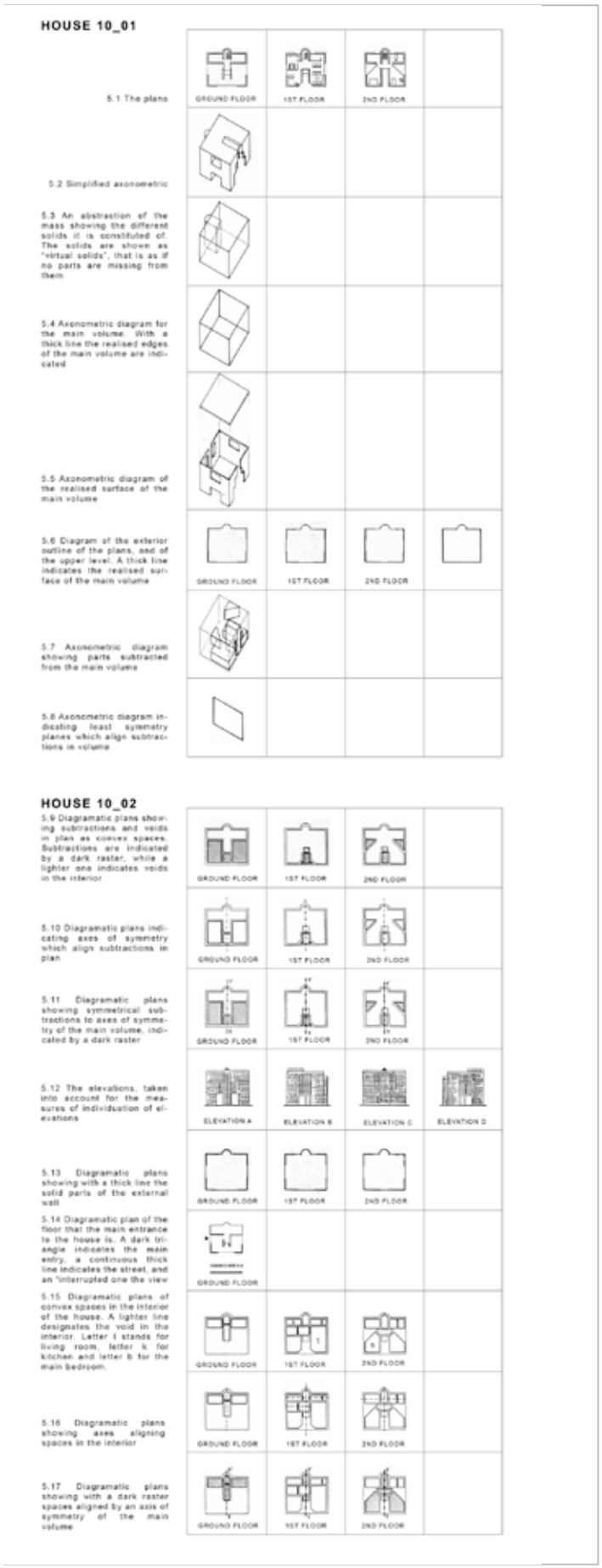


Figure 2a and 2b. Analytic diagrams of House 4: Single-Family House, Riva San Vitale, Ticino
(design 1971, construction 1972-73, site: approx. 850 sq.m, area: approx. 220 sq.m, volume: approx. 1000 c.m).



Figures 3a and 3b. Analytic diagrams of House 10: Single-Family House, Pregassona, Ticino

(design 1979, construction 1979-80 site: approx. 600 sq.m, area: approx. 260 sq.m, volume: approx. 1100 c.m)

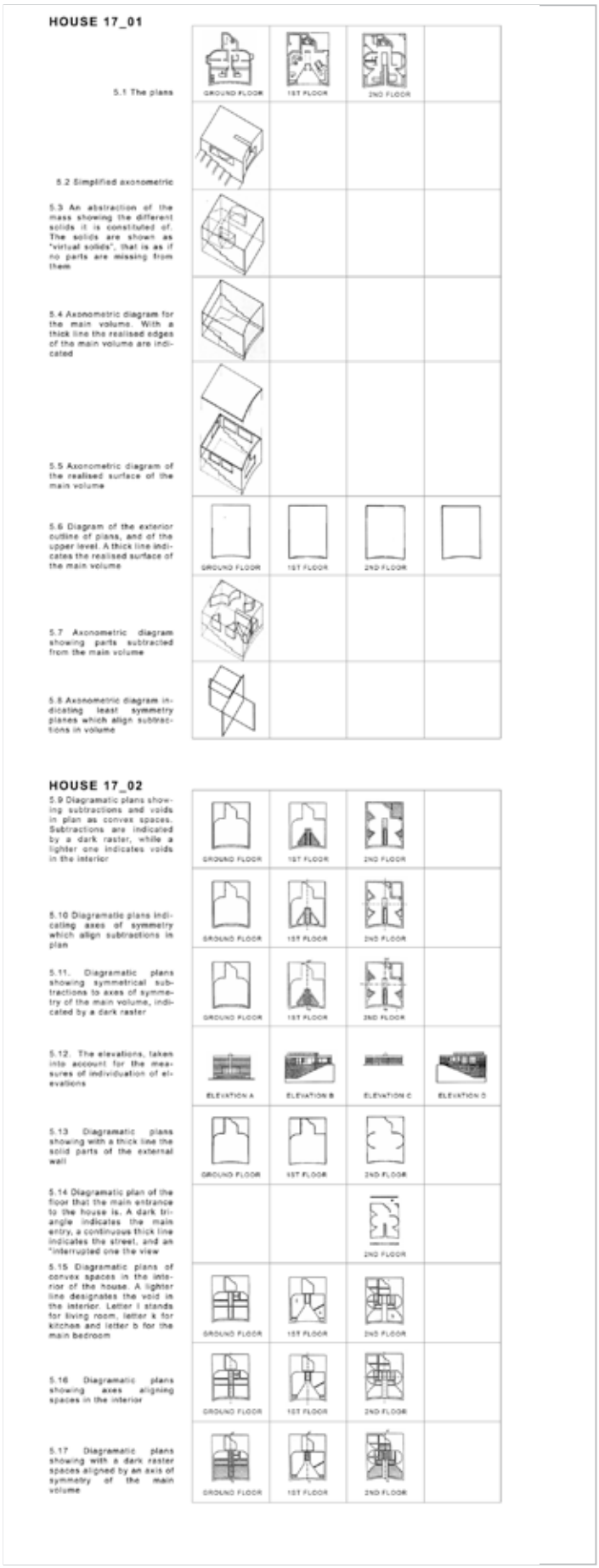


Figure 4a and 4b. Analytic diagrams of House 17: Single-Family House, Morbio Superiore, Ticino
(design 1983, construction 1983-84, site: approx. 2500 sq.m, area: approx. 300 sq.m, volume: approx. 1300 c.m).

ship that existed among rules themselves. In this way, two important differences were found: *i) the way complexity was being built up in the rules by means of relating them to each other, and ii) the way spatial patterns became embedded in formal composition.* It was possible then to identify two distinct phases in the development of the formal structure of the houses that related to their compositional logic. These phases differed not so much by the type of rules they employed, but mainly in terms of the complexity of the rules and the relationship of rules themselves. That is, what in the first phase seemed as mere combinations among different rules, in the second one it had already become a recognisable, and stable structure on which transformations could take place later on. The first phase was defined as *a pre-canonic phase*, and the second as a *canonic* one. A third phase, seen as a further elaboration, or transformation of the canonic phase, a *post-canonic phase*, was also identified. However, these phases would not have strict limits; what was going to become the distinctive formal compositional logic of the canonic phase was developed gradually in a series of houses.

Houses in the pre-canonic phase (H1, H2, H3, H4, H5, H6, H7, H8) exhibited a lot of variation. Even though most of the rules to be found in the later phase had already been introduced, what was to become the formal structure, the distinct characteristic of the second phase had not been formed yet. Rules were introduced in a *piecemeal way*. Furthermore, they were not interrelated to each other as they did in the next phase. A combinatorial logic was evident, which became more and more elaborate from the early houses to the later ones. If R1, R2, R3, ... were the formal rules, R1,1, R1,2, ... their variations, and r1, r2, r3, ... the rules when they were not properly formed yet, then this phase could be described as [R1, R2,...r3,...], which later on became [(R1 R2), R3, (R1 R4),..., r5]. In the first case rules existed almost in 'parathesis', while in the second, more close to reality, some groupings and interrelations developed. The type of interrelations within the same domain, as well the low degree of interrelations within the different domains had as a result a less ordered structure.

What distinguished the canonic phase (H9, H10, H11, H12, H13, and H19) from the previous one was: first, the embeding of spatial in formal; what before was a formal order, now was both formal and spatial. Thus, in this phase, a symmetrical ordering of the plan might distinguish for example between 'parents and children', and formal order was seen as mediating, or enhancing the spatial one. Second, all rules were mapped to each other at the same time, brought together by what had the characteristics of a structure. This structure became more and more complex in terms of interrelations within the rules. In a simplified diagrammatic form this type of logic would be: [R1, (((R2) R3) R4),...]. The plan, the elevations and the mass moved to a unified expression giving the impression of the house as an object totally controlled by design. The following figure, [Figure 5], presents an abstraction of the canonic structure.

In the post-canonic phase, (H14, H15, H16, H17, H18) rules present in houses belonging to the canonic phase became *foregrounded* [the term, borrowed from Mukarovsky (1970) is used to denote the mental act of bringing something into prominence] and brought relative disorder to the system by creating transformations of the formal structure.

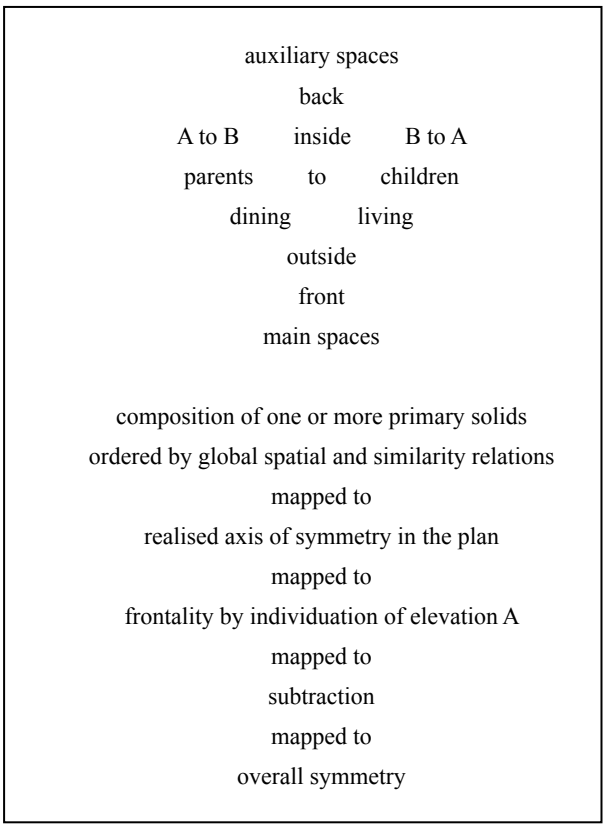


Figure 5: An abstraction of the canonic structure in Botta's houses.

Thus, during the first phase the formation of the rules took place. These rules were combined in a more and more structured way. While at the beginning what imposed order was the system of formal rules, later on, a formal and spatial conceptual order was evident. This evolution from the first to the second phase was like moving *from combinations to structure*. The structure became more and more complex, with more elements and rules embedded to each other. At any point however, the rules could become *reshuffled* and elements or rules, which were previously part of another relation, could move to the foreground. Furthermore, elements or rules that became combined could be, later on, used as such. In this way the architect was seen as operating on *already combined elements* of various degrees of complexity. It seemed, however, that the most creative period was the phase during which the architect was discovering the transition from pre-canonic to the canonic phase, defining what was to become the compositional structure with its rules and interrelations. In the later phase, the architect had developed his vocabulary into some kind of meta-language, operating with already codified, or structured elements. *Evidently the logic of the composition was to find the lowest common denominator of the formal structure, elements and rules and then to use these as a basis for the design.* Observations as such led me to an attempt to elaborate further on the synchronic aspect of formal structuring in architecture.

4. On the logic of composition

I propose that formal rules have the following property: *by defining and effecting a relation among elements, they define groups, categories, or classes of elements, which belong together, and conversely, those, which do not.* Thus, relations are seen as creating patterns of possible similarity among the

different elements. In this way, the relation will be the *intension* of the rule, while the class itself will be the *extension* of it, two terms borrowed from logic (Carnap, 1988, p.iii).

Relations define properties, and by virtue of their existence, an element takes part in different classes. Thus, for example, 'being transparent' is a property that brings an element in conceptual affinity to other transparent elements, and it distinguishes it from non-transparent ones. Or by identifying 'frontality' as a basic theme in Botta's houses, all elements that acknowledge this property, seem to be treated in a similar way. However, every element in the building might potentially take part in a number of relations, which belong to different domains. The interesting point is when relations in these domains are intentionally acknowledged. This could mean that there is an intention in identifying a class of elements, which by virtue of their similarity, are differentiated from other elements. As Eisenman (1979, p.122) observes, 'In order to distinguish any one class of objects from any other, it must be possible not only to signal the difference of that class from all others (a negative signal) but to signal or identify the presence of the particular class itself (a positive signal)'.

What has been discussed so far places the notion of 'relation' in affinity to that of similarity, not in a literal sense of course. Similarity is not to be found necessarily in the elements themselves, but in the relation that defines the category in which the elements belong to. It is a kind of *logical similarity.* Thus, elements can be directly similar in one of their aspects, or related to each other by taking part in a recognisable spatial relation. The different domains define areas in which relations can take place among the elements. In this way, the domains offer possibilities for different patterns of similarity. These patterns can either be within the limits of one domain, or they may extend, and thus bring together, a number of different domains, effecting therefore a relation of 'mapping'.

Let me attempt a basic description of the possibilities, assuming, for the sake of the argument, that there is a limited number of elements, As, Bs, and Cs. It is possible to identify two cases. First, *distinct categories* in which case, all As are defined through the relation R1, which means that, by virtue of this relation, they belong to the category 1, all Bs through relation R2 belong to the category 2, and finally, all Cs belong to the category 3, by virtue of the relation R3. In this case the categories of related elements are distinct, and understandable. One can further define relations within the categories, increasing in this way the complexity of the scheme. In any case however, the relation that forms each category is distinct and is intensified by the fact that the elements are already similar to each other. Second, *multiple categories,* in which case, as previously, As, by virtue of a relation R1, belong to a category 1. Some As however, by virtue of another relation R2, belong to a category 2. Very few As, which already belong to the first and the second category, belong also to a category 3, which has as its elements some Bs and a lot of Cs, and so forth. This scheme is more complicated than the previous one.

Both cases share the same characteristic of defining categories for the elements by virtue of different relations. In the first case however, not only all As belong to the same category by virtue of a relation, but they already together belong to another one by virtue of the fact that they are As. On

top of this real similarity a relation is applied, which defines some further similarity. This relation has in effect a definition of the following kind: *'all As are...'*. The relation does not define that 'all As are As', which is of course a tautology, but *'what type of As they are'*. In the second case however, the rule is somewhat different. It assigns a common property not to similar, but to dissimilar elements, which again, by virtue of the existence of the common property, become associated with each other, and thus form a class.

For example, the 'voids' in Botta's canonic phase were subject to the rule that stated that voids create a visibility pattern between the second and the third floor, (property of being As) and were centrally placed along the axis of symmetry, (relation R1 which creates a category of similar elements by virtue of its existence). Thus, the rule stated what kind of voids they are. However in an earlier house, H4, [Figure 2b], although the different voids allow for visibility within the floors, (property of As) they followed different patterns in terms of where they were placed, or what shape they had. One void would be placed by the external wall of the house, another would be placed above the living room, while another would enhance the visibility from inside to outside. In this way, even though they were all 'voids', by virtue of taking part in different relations, they could be associated with other elements which were also taking part in relations; for example, of the type: 'enhancing the spatial quality of the living room' and so forth. Whilst in the first case elements were related on the basis of their similarity, the second case created new grounds for similarity.

However, it is relations relating to each other that constitute the formal structure. Let me introduce the term *compositional mode* in order to refer to the specific way, to the particular logic of relating relations to each other in such a way as to arrive at the compositional structure. First, it would be possible to identify a relation as attributing a property not just to an element, but also to *'the element as being already structured by a previous relation'*. In this way, *what would stand for extension in the second rule would not be simply elements, but elements and relations already structured together*. *Second*, in order to identify *how relations relate to each other*, one would have to examine issues of the following type: *whether they share the same extensions, if one is applied 'on top of the other', whether they are restricting, co-existing, intensifying, or contradicting each other, and so forth.*

In the Botta houses, for example, it seemed that, by virtue of subtraction taking place in the way it did, the primary solid rule could be understood as such. This imposed a limitation on the type of subtraction possible, and it was suggested as a case of the primary solid rule restricting the possible variations of the subtraction rule. At the same time, the subtraction rule was indirectly attributing a property to the primary solid one. Analysing both rules in terms of their intension and extension, it seemed that subtraction could have been operating on the same elements, or on the same extension, on which the primary solid rule did. Furthermore, the subtraction rule, by operating on the same extension, intensified the other rule, instead of, for example, contradicting it.

The two patterns identified earlier on, could then be used in order to identify different types of relating. The first pattern, *distinct categories*, was based on the intensification of the already given

similarity. It was thus based on a type of 'all As are ...' formula. The second pattern, of *multiple categories*, was based on re-defining each time the elements forming the class, not by virtue of their prior similarity, but on similarity as 'acted upon' the elements. If these two patterns are applied not to elements but to relations, or to elements as already structured by relations, it is possible to identify two different patterns of relating. The first will be referring to relations being built *'one on top of the other'*, in such a way as to have a relation of the type: 'all that is R1 is also R2'. This pattern, leading to a state of all-at-once, as if *'intensions are being built on top of the same extension'*, will be called *embedding*, and it is suggested as the distinctive feature of the *intensional* type of compositional mode. The second pattern will be based on a 'part of what is R1 is also R2' formula, or a *'part-at-a-time'* logic. This means that *every time a new relation is applied, its extension is also re-defined.* This pattern can be seen as generating a *lattice of relations*, in contrast to the previous one, which produces more of a *hierarchical type* of structure. It is defined as *overlapping*, and it is suggested as the distinctive feature of the *extensional* type of compositional mode. Notions as such attempt to outline a stream of thoughts, that allows the opening up of the discussion regarding the implications of a logic of a formal architectural structure.

5. Opening up the discussion

Searching for the synchronic aspect I came up with two types of order: the *intensional* and the *extensional* one. On the other hand, diachronic analysis pointed to two notions: first, to *moving from combinations to structure*, which refers to the process of building up order in a formal structure, and second, to *transformations taking place within a formal structure by foregrounding elements,* which brings forward the issue of innovation.

However, Botta is a rather extreme case. What gives his architecture its strong identity is an internal logic that brings everything together, a logic of '*oneness'*. His first buildings had already introduced his themes. How these themes combine, interweave, and influence all aspects of the building, how they set architectural rules that order the formation of the volume, the elevations, and the plan, that define the way the building will be looked from afar, and will face the world, is what defines this logic. Rules in interrelation create an *intensive* compositional structure, by virtue of which everything relates to the other and everything obeys the overall order. It is possible though for a formal system to remain unstable, either never reaching a phase of distinguishable compositional structure, which in Botta's case represents the canonic phase, or continuously oscillating between 'pre' and 'post' canonic phases, adding complexity and variety. Arguably, the nature of architectural composition is such that rules exist not only to order possible combinations, but also to be disobeyed, allowing in this way for transformations and creativity.

An analysis of thirteen houses by Richard Meier undertaken to test whether the 'from combinations to structure' hypothesis would hold, pointed to some interesting results: patterns of use, spatial order, formal composition in terms of mass and plan, structural system and treatment of elevations, - in terms of materials, type and size of openings, - were ordered synchronously by means of *binary oppositions*. Even though one could discern phases in the evolution of the architect's idiom, and the

canonic hypothesis would hold as such, it was evident that a great number of *transformations* were taking place at the same time, by means of foregrounding certain themes, or by using one aspect of the relation established by a theme, the most prominent one, while before the whole relation was necessary in establishing order.

There are therefore some cases where personal idioms are structured through a strong set of rules that underlie the major corpus of work. On the other hand there are idioms that recursively emphasise a new element of design. In the first category, the formal structure remains basically the same and what changes is the degree to which the different rules are present and in relation to each other. In the second category a new element is introduced each time and, thus, a new formal structure is formed. In both cases, the personal idiom creates an internal system of rules that evolves from one work to the other. The degree of what remains constant and what changes from one work to the other represent properties of the internal structure. The question remains as to what degree a strong idiom allows for creativity and change.

Tracing what remains constant through the evolution of a personal idiom, or even a style, is a way of identifying the underlying formal order set by relations and modes that operate in a rather tacit *genotypical* way that establishes the design norms for an individual architect. An analysis of the ongoing, stable and constant themes, of *what main themes appear and how they are structured together*, would see them as rules of a genotypical nature, which restrict possible variation on the phenotypical level, (the terms genotypical and phenotypical borrowed from Hillier et. al., 1984). The following section considers whether the notion of an *intensional or an extensional* mode - as discussed previously - might be useful in understanding order as being built within the different instances of an idiom. Whilst this holds true for architectural theory and analysis, in the case of practice and design, notions of conceptual structure or personal idiom need to be evaluated against intuitive understanding. Design practice is both an intuitive and a discursive process; it is then a kind of circular process, that moves from the intuitive to the analytic and back, which we need to take in order to understand composition, formal order or concept formation.

6. Practice: or from thinking to doing

Moving back from research to design practice presented for me an opportunity to test whether analytic understanding had any relevance to the actual design process. Being involved in full time practice places design in a close relationship to a reality set by professional and cultural norms, socio-economic aspects as well as architectural discourse. No wonder it leaves little space for analytic contemplation. Yet this may not be entirely true; as Hillier (1993) suggests, theory is built into design and is by definition what architecture is.

My involvement with practice followed a strange route: having analysed the compositional idiom of Mario Botta, (Sakellaridou, 2000) we ended up as an office, namely sparch / Sakellaridou/ Papanikolaou Architects, to design two buildings in Athens in collaboration with him. The story went like this: we invited Botta to work with us in a competition; after we were awarded the first prize, we

collaborated in the design of the new headquarters of the NBG Bank. Following the completion of this building, we were commissioned by the same client to design - together with Botta - the headquarters of an insurance company. In both cases, the synchronicity of being both the project architect and the observer of the design process provided feedback on the generation of concepts within an ordered set of pre-structured rules.

In the subsequent ten years, architectural practice took priority. Considerations of whether to operate within the limits of an established idiom or to cut across them were constant underlying questions, despite the fact they were not in the foreground of our thinking. The underlying theme in architecture is, indeed, creativity and innovation. A common challenge is how to remain creative whilst operating within the limits of an established idiom: or, contrariwise, how to move beyond it. Design is a constant oscillation between the known and the new. Being involved in the design process, means to be continuously involved in a process of '*I do, I undo, I redo'*, as the artist Louise Bourgeois describes for her work, a process that 'evokes the dialectical rhythm of making, reflecting and remaking', (Morris, 2007, p.11).

Doing and thinking about what we were doing, brought forward the need for a personal understanding of what 'going deeper' into architecture requires, exemplified sometimes in terms of order as a difference between *complex and complicated structure*. A definition is given for this by Abraham Moles (1988), who proposes that a product is complicated when the elements that compose it belong to different classes, whereas it is complex if it contains a *large* number of elements that can be grouped into a *few* classes. This distinction about order building, together with the intuition that going deeper into the creative realm requires a more 'silent' understanding, gave me some directions to consider. Such issues are pertinent to all creative activities, but architecture, based on configuration, has to face the particularities of how to move from the complicated to the complex. I will discuss two different cases as possible instances of exploring aspects of rule-governed creativity in design: *first*, as operating within the limits of an idiom, and *second*, as cutting across set order.

I will start by discussing briefly the case of three buildings designed by our office: the NBG Bank New Headquarters (1999-2002), the National Insurance Company Headquarters (2001-2006), both in Athens, and the NBG Bank New Building (2002-2003), in Thessaloniki. The three buildings represented three different ways of operating within the limits set by a formal system..

Figure 6. NBG Bank New Headquarters, Athens.
(Architects: M.Botta, consultant, I. Sakellaridou, M. Papanikolaou, M.Pollani)

Soon after we were commissioned to design the bank headquarters [Figure 6], we faced a serious problem that upset the whole design: the archaeologists re-evaluated the ancient ruins existing on site. It all started as an external problem: the existence of underground ruins and the need to preserve them intact [Figure 7]. This generated a strong need for meaning: we decided to create an 'open-air museum', a concept that was resolved through the operation of formal rules [Figure 8]. The design was changed to allow for a free ground floor with glass bridges so that the ruins remain visible and accessible. As a consequent design move, the transparency of the ground floor brought forth the design of an internal void with skylights. The problem generated - in effect - a 'cascade' of transformational moves in different domains or cutting across domains: a formal rule of subtraction of mass in order to create a void in the interior, of opening it up through skylights to bring natural light, of creating public space in order to enhance intelligibility of the whole and awareness of others. At the same time, ground, ruins, the hidden past and the ancient road, were all *translated* through the use of a formal rule, i.e. *transparency*: notional in terms of unveiling the history, and literal in terms of using glass floors for visibility of the ancient road. The concept changed in order to relate to changes in conditions, through a move that had strong consequences on the spatial aspect in terms of creating public space and intelligibility. By giving primacy to a new rule, the formal structure was re-organised. Two types of design moves were evident: *the first*, of an overall *intuitive* nature that brought together several different domains, and *the second*, of a *formal* nature that integrated intuitive thinking with formal structure by acknowledging formal and spatial aspects at the same time.

Figures 7a and 7b. NBG Bank New Headquarters, Athens: views of the site during excavations.
A forepoling construction method was used to keep the ancient road intact. (photos and collage by architects)

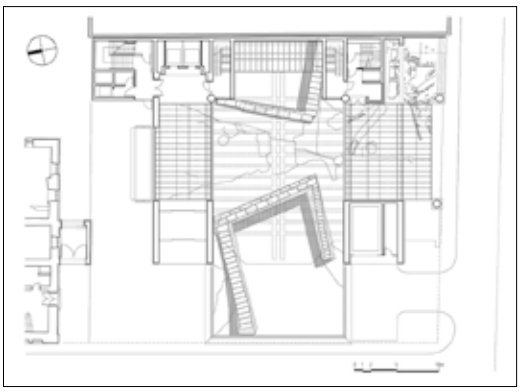


Figure 8: NBG Bank New Headquarters, Athens

(Architects: M.Botta, consultant, I. Sakellaridou, M. Papanikolaou, M.Pollani)

Drawings_Starting from the top:

8a. Ground floor plan;

8b. Section along the axis of symmetry

Photos (left)_Starting from the top:

8c. The ground floor as an open-air museum;

8d. The foyer on the 1st floor: transparency through the glass floor;

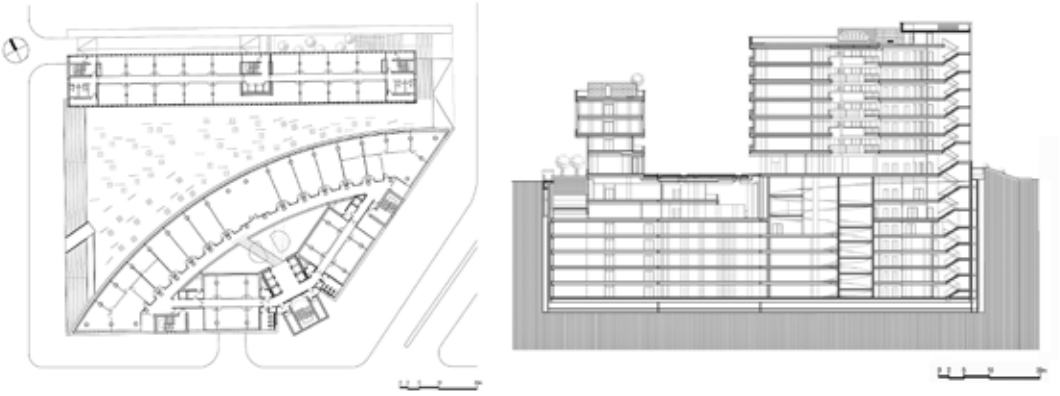
8e. The atrium in the interior

(Photos by P. Musi, architects' archive)

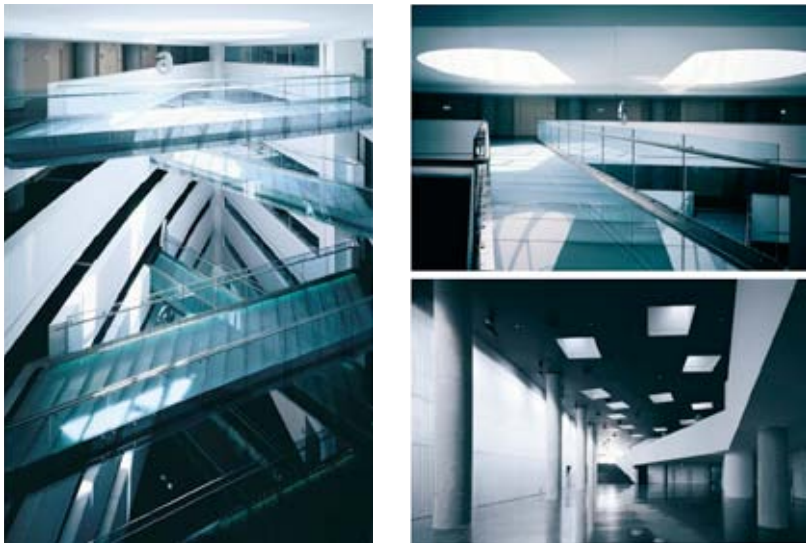
Figure 9. National Insurance Company Headquarters, Athens

(Architects: M.Botta, I. Sakellaridou, M. Papanikolaou)

The insurance company headquarters present a contrasting case [Figures 9, 10], where design was set within the limits of the idiom: exploring aspects of the notion of public space - either in terms of the internal square, the atrium crossed by glass-floored bridges or the underground foyer - through spatial and formal transformations of the formal structure.



Figures 10a, 10b: National Insurance Company Headquarters, Athens
(Architects: M.Botta, I. Sakellaridou, M. Papanikolaou)
10a. Typical floor plan; b. Section



Figures 10c, 10d, 10e: National Insurance Company Headquarters, Athens
10c. Glass floor bridges cross the atrium (on the left);
10d. The skylights and the bridge on the 6th floor (on the right and above);
10e. The foyer of the underground conference centre (on the right, bellow)
(Photos by P. Musi, architects' archive)

In the case of the new bank building [Figure 11] the design explored how variations of spatial and formal order, together with materiality, introduce innovation within a system of prerequisites: the client brief asked that the design should follow the steps of the two buildings discussed previously, in order to create a corporate identity and 'mark the era'. On the other hand, it had to creatively differentiate and simultaneously set an identifiable formal system that could be reproduced later on - with a limited set of prerequisites, which prescribed the acceptable degree of variation.

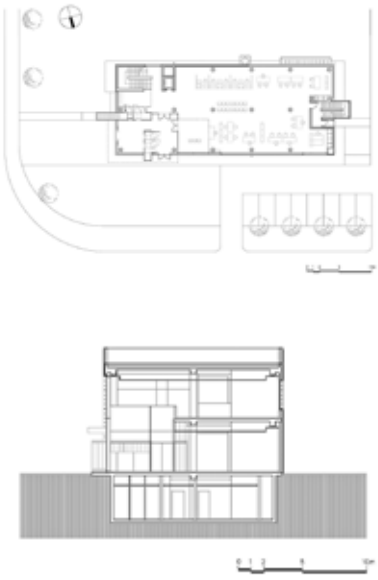


Figure 11. NBG Drawings:
11a. Ground floor plan;
11b. Section along the void

Figure 11. NBG Bank New Building, Thessaloniki
(Architects: I. Sakellaridou, M. Papanikolaou)

Photos_Starting from the top:
11c. Night view
11d. The internal void
11e: View of the ground floor offices

(Photos by P. Musi, architects' archive)

Looking at the three buildings together it appears that the first building was enriching the order in its spatial and formal aspects by *a significant transformation generating innovation within the system*. In the second, *variation was within the limits set by the formal idiom,* while in the third, *by introducing a lattice type of interconnectedness between relations and within relations themselves*, a different order was introduced, instead of the familiar '*all at once'* of symmetry. Removing symmetry as the overall rule and allowing for a more horizontal ordering of elements, even though still operating within the limits of a given overall formal structure, we could have *a variation that was a new genotype*. Thus the third building introduced the search for a new genotype by allowing variation on the order established by the main relations and their interrelations.

What, however, takes place when an intuitive move considerably upsets the set order? Oscillating between the known and experimenting with the unknown is like going deeper into the creative realm. To do that requires that we operate outside the limits of a canonical formal order, if 'upsetting the underlying order' is a basic prerequisite for creativity and innovation. In such cases to what degree is established order being interrogated or destabilised?

When we chose the notion of *porous borders* as the concept for the Pavilion of Cyprus for the 10th Biennale for Architecture in Venice (Papanikolaou, Sakellaridou and Filippidis, 2006), we used white paper pleated surfaces, folded in such a way as to generate little round 'islands', for the formal and spatial setup of the exhibition [Figure 12]. When, immediately after, we were asked to design an Entrance Gate for the seaside Astir Palace Hotel (2006-2008) [Figure 13], issues set by the programme - such as visibility and control - together with notions about a 50's Riviera, gave the opportunity for a narrative that brought together issues of meaning, both referential and intrinsic, with formal and spatial order. The white, round, semi-transparent surfaces used for the Biennale exhibition were to be translated to the curved forms of white metal grids, which had the formal and spatial properties of an order that was distinct from the volumetric one we were working with up to then. Addressing questions of permeability, visibility and control, which were metaphorically transferred to express openness, transparency and the easy-going feeling of a long-gone modernity, called for a metaphoric leap of the kind of 'this-is-that', to borrow Bernstein's term (1976) in order to express them with form and space; a metaphoric leap that arguably allowed for an innovative instance of concept structuring.

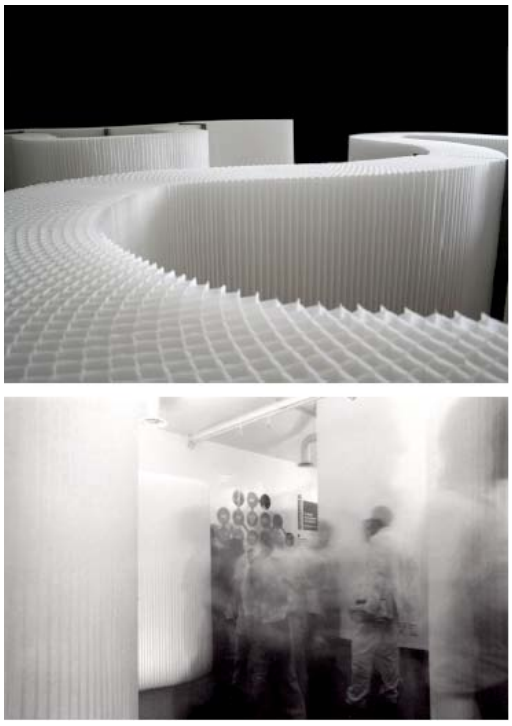


Figure 12: Cyprus Pavilion 10th Biennale, Venice
(Curators: M. Papanikolaou, I. Sakellaridou, guest curator: M. Filippidis)

12a. The pleated curved surfaces used for the exhibition
12b. View of the exhibition
(Photos by K. Pappas, architects' archive)

Figure 13: Astir Palace Gate, Athens
(Architects: I. Sakellaridou, M. Papanikolaou)

Starting from the top:
13a. Model and drawings;
13b. View upon entering
13c. View upon exiting
13d. General view
(Photos by E. Attali, architects' archive)

7. Conclusion

The notion of the architect's pre-structures set up a beginning for what I tried to understand by analytical and theoretical work on order and the formal structure. But it is through the actual involvement in design that I came to understand how pre-structures are formed; or how, through a constant oscillation, a new order is established.

The analysis of a personal idiom - or even a style - based on the identification of the underlying themes that structure 'a stylistic genotype', could benefit from an approach that looks at the synchronic and the diachronic aspects of the compositional structure. Bringing it all together, however, it seems that what we need is a better synchronic understanding. Architecture is a complex design proposition, in which all aspects, formal/spatial, and social interact and interrelate. We need, indeed, a broader view to properly understand the multiple facets of the architectural formal structure. After all, what we are hoping for is an understanding of the tools of composition; what we are looking for, though, are tools for understanding creativity.

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Appendix

Measures of the 19 Houses

Measures of the mass

The regularity of the volume

Real edges 1, 2: realisation of edges, which is the proportion of edges that exist in reality to the total length of the edges of the 'virtual solid'

real surface: realisation of surface, which is the proportion of external surface that exists in reality to the whole external surface of the 'virtual solid'

The constitution of the volume

solids: no of aux: the number of auxiliary solids that exist apart from the main solid

solids: no: the number of different solids

solids: types: the number of types of solids

solids: sym of aux: the number of auxiliary solids which are on the axis of symmetry of the main volume

Subtraction

s/v: no: the number of subtractions on the volume

s/v: 0, 1, 2: no: the number of subtractions on the different floors

s/v: least sym planes: the least number of symmetry planes that align subtractions divided by the total of subtractions of the volume

s/v: sym: the number of symmetrical subtractions over the total of subtractions

s/v: sym to vol.: the number of subtractions that are symmetrical to a plane of symmetry of the main volume over the total of subtractions

s/v: aligned by xx': the number of subtractions that are aligned by the xx' plane of symmetry of the main volume over the total of subtractions

s/v: tr.sym over xx': the number of subtractions that have a tripartite symmetry over the xx' plane of symmetry of the main volume divided by the number of subtractions

s/v: types: the number of types of subtractions in the volume over the number of subtractions

s/p0, 1, 2: no: the number of subtractions on the different floors

s/p0, 1, 2, all: aligned: the number of subtractions on a floor that are aligned divided by the total of subtractions of this floor

s/p0, 1, 2, all: sym: the number of symmetrical subtractions on a floor, over the total of subtractions on this floor

s/p0, 1, 2, all: sym vol.: the number of subtractions on a floor that are symmetrical to an axis of symmetry of the main volume over the total of subtractions on this floor

s/p0, 1, 2, all: sym xx': the number of symmetrical subtractions over the xx' axis of symmetry of the main volume over the total of subtractions

s/p0, 1, 2, all: types: the number of types of subtractions on a floor over the total number of subtractions on this floor

Measures of the elevations

Individuation of an elevation

A-1, B-1, C-1, and D-1: the proportion of void of each elevation over the total surface of the elevation, (absolute void percentages)

A-2, B-2, C-2, D-2: the relative void percentages, that is, the proportion of void of each elevation over the void of all elevations

ind-1 A, B, C, D: the individuation of an elevation with results on individuation by solid to void taken from absolute percentages

ind-1 diff: the difference of the individuation value of the most individuated elevation from the elevation next in order in terms of this value

ind-2 A, B, C, D: the individuation of each elevation as previously, but with results on individuation by solid to void taken from relative void percentages

ind-2 diff: the difference of the individuation value of the most individuated elevation from the elevation next in order in terms of this value, but with results on individuation by solid to open taken from relative void percentages

front-1 A, B, C, D: how many of the four aspects of 'frontality' each elevation has

front-2 A, B, C, D: how many of the four aspects of 'frontality' each elevation has, but in this case we take the sum of individuation properties identified for the measure of ind-2 as the value of individuation, whereas the value of the other aspects of 'frontality' is 1

Measures of the plan

Symmetry of the plan

Sp 0, 1, 2: no: the number of spaces in the interior of the house on each floor

Sp 0, 1, 2, all: aligned: how many spaces on a floor are aligned by an axis over the total of spaces on this floor

Sp 0, 1, 2, all: sym: how many symmetrical spaces on a floor over the total of spaces on this floor

Sp 0, 1, 2, all: sym vol: how many spaces on a floor are aligned by an axis of symmetry of the main volume over the total of spaces on this floor

Sp 0, 1, 2, all: sym xx': how many spaces on a floor are symmetrical over the xx' axis of symmetry of the main volume divided by the number of spaces on this floor

Sp 0, 1, 2, all: tr.sym xx': how many spaces on a floor have a tripartite symmetry over the xx' axis of symmetry of the main volume divided by the number of spaces on this floor

Sp 0, 1, 2, all: types: how many shapes of spaces on a floor over the number of spaces

Labels

V-area: the proportion of space allocated to Visitors to the whole interior space of the main floors

I-area: the proportion of space allocated to Inhabitants to the whole interior space of the main floors

Depth living: the depth of the living room

Depth kitchen: the depth of the kitchen

Depth bedroom: the depth of the master bedroom

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