# TWO EVOLUTIONARY MODELS FOR RECONCEPTUALIZING ARCHITECTURAL IDEAS AND THE ARCHITECTURAL DESIGN PROCESS

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# ABSTRACT

TWO EVOLUTIONARY MODELS FOR RECONCEPTUALIZING ARCHITECTURAL IDEAS AND THE ARCHITECTURAL DESIGN PROCESS

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This study puts forward two complementary evolutionary models and explores the potential of the proposed models and the related theses by employing two case studies. The theoretical/conceptual framework of the study refers to architectural theory, design research, and evolutionary epistemology. The study mainly involves application of some key ideas from evolutionary epistemology, Popper's three-world ontology, and the theory of evolution to the field of architecture.

The first model is about the nature of the architectural ideas or "thought contents" and it introduces the idea of "conceptual inheritance" and an "evolutionary conception of architectural ideas." The model proposes a framework that offers an understanding of the life and existence of architectural ideas and their inheritance. It also puts forward an expanded view of architectural ideas that conceives all the "thought contents," which architectural designs (or works) and the architectural design process might concern, as architectural ideas. In order to illustrate and discuss the model, some of the architectural ideas carried by Mario Botta's single-family house in

Breganzona are selected and the evolutionary lineage of these ideas have been identified and examined in their instances in some of Botta’s own designs and in some designs from architectural tradition.

The second model is an “evolutionary model of the architectural design process.” While emphasizing the evolutionary or “selectionist” character of architectural design in terms of process and inner dynamics, the model conceives architectural design as a process consisting of the two stages of “forming/making,” and “evaluation/selection” where in the first stage formative ideas, in the second, selective conditions are operational. In order to illustrate the potentialities of the model, the sketches and the drawings produced during the design process of Mario Botta’s single-family house in Breganzona are examined.

Keywords: Architectural idea, Architectural design process, Conceptual inheritance, Three-world ontology, Evolutionary epistemology

# ÖZ

MİMARİ DÜŞÜNCELERİN VE MİMARİ TASARIM SÜRECİNİN YENİDEN KAVRAMSALLAŞTIRILMASINA YÖNELİK İKİ EVRİMSEL MODEL

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Bu çalışma, birbirini tamamlayan iki evrimsel model önerir ve önerilen model ve ilgili tezlerin potansiyellerini iki örnek bağlamında araştırır. Çalışmanın kuramsal/kavramsal çerçevesi Mimarlık Teorisi, Tasarım Araştırması, ve Evrimsel Epistemoloji'ye dayanmaktadır. Çalışma, evrimsel epistemoloji, Karl R. Popper'in "üç-dünya ontolojisi" ve evrim teorisi'nden bazı temel düşüncelerin mimarlık alanına uygulanmasını içerir.

İlk model mimari düşüncelerin (ideaların) ya da "düşünce içeriklerinin" doğasına ilişkindir ve "kavramsal kalıtım" düşüncesinin yanı sıra mimari düşüncelerin evrimsel bir kavrayışını ortaya koyar. Model, mimari düşüncelerin yaşamlarını ve varlıklarını anlamaya yönelik bir çerçeve, ve mimari tasarımlarla ve mimari tasarım süreciyle ilgili olan ve olabilecek tüm düşünce içeriklerini mimari düşünceler olarak nitelendiren, mimari düşüncelere ilişkin kapsayıcı bir kavram sunar. Modeli örneklemek ve tartışmak için, Mario Botta'nın Breganzona'daki ev tasarımının taşıdığı bazı mimari düşünceler seçilmiş ve bu düşüncelerin evrimsel "nesli" gerek Botta'nın kendi tasarımlarında gerekse mimarlık geleneğinden bazı tasarımlarda belirlenmiş ve izlenmiştir.

İkinci model ise mimari tasarım sürecinin evrimsel bir modelini önerir. Model, mimari tasarımın, hem süreç hem de iç dinamikleri bağlamında evrimsel ve seçmeci niteliğini vurgular ve mimari tasarım sürecini "biçimlendirme/yapma" ve "değerlendirme/seçme" olarak adlandırılan, biçimlendirici düşüncelerin ve seçmeci şartların operasyonel olduğu, iki aşamalı bir süreç olarak kavramsallaştırır. Modelin potansiyellerini örneklemek için, Mario Botta'nın Breganzona'daki ev tasarımının tasarım süreci boyunca üretilmiş eskiz ve çizimleri incelenmiştir.

Anahtar Kelimeler: Mimari düşünce, Mimari tasarım süreci, Kavramsal kalıtım, Üç dünya ontolojisi, Evrimsel epistemoloji

To Meltem

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Finally, I should note that during my thesis study, I had the opportunity to study various issues that took place in the present study earlier in some occasions, and presented and published them as conference/symposium proceedings. These studies helped me to clarify my ideas and to develop my thesis.

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# INTRODUCTION

*...Man is born with the power of original thought, and everywhere this originality is constrained within a particular conceptual inheritance; yet on closer inspection, these concepts too turn out to be the necessary instruments of effective thought.*

*—Stephen Toulmin, Human Understanding*

In his book titled *Objective Knowledge: An Evolutionary Approach,* Karl Popper (1972a) proposes a pluralist view of the world in place of the conventional monist and dualist views that recognizes three distinct but interacting sub-worlds. The physical world, or in Popper's terms "world 1" is the world of "physical objects or the physical states." The mental world, or in Popper's terms "world 2," is the world of "states of consciousness, or of mental states or perhaps of behavioral dispositions to act." Finally, the world of "objective contents of thought," or "world three," is the world of the products of the human mind such as theories and conjectures, tools, social institutions, works of engineering, works of art and works of architecture.[1] World 3 has its roots in Plato's original conception of world of "forms or ideas," although it differs from it in some essential aspects (Popper 1972a, 106).[2] That is to say, in Plato's original conception, "world of forms or ideas" is divine and unchanging

[1] Karl Popper discusses and elaborates his three-world ontology and related issues in various works such as *Objective Knowledge* (1972a, 32-105, 106-152, 153-190) , *The Philosophy of Karl Popper* (1974, 3-181), *The Self and Its Brain* (1977, 36-50), "Three Worlds" (1980, 142-167), *Open Universe: An* Argument *for Indeterminism* (1988, 113-130), *In Search of a Better World* (1996b, 20-29, 161-170).
[2] World 3 also has much in common with Georg Wilhelm Friedrich Hegel's "objective spirit," Bernard Bolzano's "theory of a universe of propositions themselves and of truths in themselves," and Gottlob Frege's "objective contents of thought" (Popper 1972a).

and contains absolute, timeless and universal ideas, Popper's world three, on the other hand, is a product of the human mind, it changes by time, and contains conjectural and temporal ideas. Within world three, ideas have a life of their own; they come into existence, they last and change; they transform into new ideas, live together with other ideas or give way to them; and they might cease to exist. The life of ideas has its own specificities, and it can be characterized as "evolutionary."[3] That is to say, the pattern of "variation and selective perpetuation," is fundamental to the life (and existence) of the products of the human mind.

At any particular time, world 3 contains and provides a body of ideas (or traditions if we prefer) that are the necessary instruments of effective thought, and consequently of judgment, understanding, interpretation and problem solving and design. Yet from another point of view, such "conceptual inheritance," is the basis, or the starting point for all subsequent (conceptual) innovations and transformations, and it is a means of evaluation and judgment of them.

As its constituents, world 3 itself is a standalone and (partially) autonomous construct that has its own life: In Popper's (1972a, 118) words "… it creates … its own *domain of autonomy*." However, this autonomy is only partial: on the one hand, as it was already stated, world 3 is a creation of the human mind, and it changes and can be changed, on the other, it has a strong feedback affect upon its creator. In Popper's (1980, 167) words, "our minds are the creators of world 3; but world 3 in its turn not only informs our minds, but largely creates them." What is particularly important is that through this feedback relation, world 3 is instrumental in the (re)construction and transformation of the

[3] Here and onwards the terms "evolution," "evolving" and "evolutionary change," refer to a phenomenon of change, which is based on Darwinian Theory of evolution, or "selection paradigm," unless otherwise stated. This reminder and emphasis is essential since, as it was emphasize by John Langrish (2004) in design and design research, the idea of evolution generally refers to its pre-Darwinian or Lamarckian conceptions.

(physical) world.[4] In Popper's (1980, 156) terms, “it is the grasp of the world 3 object which gives world 2 the power to change world 1.”

Actually, these are some essential ideas of three-world ontology and evolutionary epistemology.[5] The point in putting them in the very introduction of a thesis that is specifically about architecture is that three-world ontology and evolutionary epistemology provide a rigorous conceptual framework, which can readily be transferred to architecture and used for addressing various issues.

From a certain point of view, architecture is about concepts or ideas, if it is not the manifestation of them at the first place. As some would say, “… there is no architecture without a concept or idea,” and it is the concept or idea “… what distinguishes architecture from mere building” (Tschumi 2003, 64). However, the present framework implies and demands a broader and an expanded conception of (architectural) idea. With reference to three-world ontology, the term “idea” refers to and represents (or should refer to and represent) all the actual and possible “thought contents” which architectural design process and architectural designs might involve. Consequently, apart from being the foundation of architectural thinking and making, ideas might be the source and instrument of that “change” that architecture calls for, whether these ideas are about the betterment of the environment, of the city, of the human life, or of the architecture itself.

The “Modern Movement”[6] in architecture, too, views itself as an ever-changing entity, often a “permanent revolution,” continuously renewing itself by creating

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4 In his Arthur Holly Compton Memorial Lecture titled “Of Clouds and Clocks,” presented at Washington University on 21 April 1965, and later published in *Objective Knowledge* (1972a, 206-255) Popper makes a comprehensive account of this issue. It is a seminal text with valuable implications for the present study where Popper argues how and in what sense ideas or theoretical constructs can play a part in the changes or achievements in the physical world. Within the context of the present study, I dwell on this issue in detail in Chapter 2.

5 Here, my framework concerning evolutionary epistemology particularly refers to works of Popper (1972a, 1974, 1977), Campbell (1956a, 1960, 1974), and Toulmin (1972).

6 As it was stated by Colquhoun (2002, 9) “the term 'modern architecture' is ambiguous. It can be understood to refer to all the buildings of the modern period regardless of their ideological basis, or it can be understood more specifically as an architecture *conscious of its own*

new forms and ideas, and it conceives architecture as a device or an instrument of change, of betterment and promotion of the human life. In Modern Architecture, these ideas constitute architecture's essential content, if not its reason for existence at the first place. These ideas evolve and find various interpretations during the 20$^{th}$ century, and survived to the present day, still viewed as important components of architecture and architectural thought, at least in some circles (Tschumi and Cheng 2003, Vidler 2003). Common to these interpretations is their demand for recasting the urban and social concerns and the goal of promoting human life back into the agenda of architecture, and alongside it, a respectable complementary proposition that architects must question what the good city and architecture was, and what the good life that architects should advocate (Stern 2003, Pasquarelli 2003). However, as the primary origin of such valuable and important thoughts, the essential problem with Modern Architecture was not exactly that the architectural ideas it posed were implausible or that it ran out of such ideas or failed to create new ones and solidified into a style. It was essentially related with its view of these matters, the theories and models conceptualized to address them, and behind all these, its positivistic, determinist, historicist, and utopian worldviews, indicating that the success of the former category is always highly dependent upon the latter. That is to say, demanding "good" architecture, questioning what it was, and aiming better human life through architecture is something that can only be a part of a wider view of architecture and architectural design, related theories and models, and a conceptual framework addressing issues such as the nature of (such and other) contents of thought (or if we prefer, ideas), how they relate to the design of an architectural artifact, and how and in what sense architectural ideas and artifacts built upon these ideas might be influential in bringing about changes in the world.

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*modernity* and *striving for change*." The present thesis follows the second tradition, and throughout the study, "Modern Architecture" and "Modern Movement" refers to the latter sense. Chronologically, these concepts refer to "progressive movements" of early 20$^{th}$ century in Architecture.

I conceived my thesis primarily as a response to these issues. Within the context of the second category, it proposes an "evolutionary" conception of architectural ideas, and an "evolutionary" model of architectural design towards providing that "wider" view.

### 1.1 The Context of the Study

At first sight, the idea of evolution and an evolutionary model or conception of architectural design might seem to be incompatible with the Modern Movement in architecture. This is related with Modern Architecture's prevalent (and often taken as granted) emphasis on a "permanent revolution," (rather than evolution,) and the belief that architecture can or should operate without any received tradition; within a conceptual and ideational (or if one prefers, in a cultural) void. However, this incompatibility is only on the surface and it only refers to a certain interpretation of Modern Architecture. Not only there is an inherent evolutionary aspect in the modern movement, but also an evolutionary argument resides at the very center of the modern thought, in both arts and architecture that can be foregrounded and transformed into a rigorous "evolutionary" model of (architectural) design. A brief introduction at this point would be fruitful to clarify the context of the study.

One of the strong references to the evolutionary aspect of arts and artistic creation, although not stated explicitly, is Alan Colquhoun's (1981b, 49-50) identification of the "process of exclusion" in the work of Vassily Kandinsky and Arnold Schoenberg. For Colquhoun, the "process of exclusion" is the primary constructive operation which concerns transformation and foregrounding of the "traditional formal devices by the exclusion of ideologically repulsive iconic elements," rather than total abandonment of these elements. He argues that "in the case of Kandinsky it is the representational element which is excluded; in the case of Schoenberg it is the diatonic system of harmony" (Colquhoun 1981b, 50). The operation involves critical reconsideration of various "formal devices" descendant from the tradition, with respect to some "ideological" criteria, for filtering out the undesirable ones, while retaining the others.

Likewise, in literary criticism, Russian Formalists[7] conceptualize and elaborate notions such as "making strange,"[8] "creative deformation," "foregrounding,"[9] and "deautomatization" as creative devices contributing to the creation of a work, all have inherent evolutionary aspects and all imply a change or transformation of what exists, what is conventional, and what is habitual. Another notion advanced by Russian Formalists (and within the formalist tradition in literature, art and architecture), which follows the evolutionary pattern, is the "opacity of a work of art." The notion is originally conceptualized in the works of Philippe Junod with reference to his principal theoretician Konrad Fiedler, which Colquhoun (1983, 89) interprets as one of the important "ingredient of the twentieth-century avant-garde." For Colquhoun (1983, 90)

> … opacity denies that the work of art is merely a reflection or imitation of some model, whether this model is thought of as a platonic form or as consisting of the 'real' world. In this sense it resists both realist idealism and naturalism. But it is not inconsistent with the idea of historical memory. By giving priority to the autonomy of artistic disciplines, it allows, even demands, the

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[7] "Russian Formalism", In Victor Erlich's (1981) words, is "… a school in Russian literary scholarship that challenged two approaches —social and religiophilosophical— which dominated the discussion of literature in Russia … and placed the work of literary art in the center of attention," developed in Russia between the years 1915-16 to 1930. For a more detailed discussion on some of its key notionsof Russian Formalism, see the Chapter 3.

[8] The original Russian word "Одивлення" or *ostranenie* is translated into English as *making strange, estrangement, and defamiliarization* in various translations. It refers to transformation of the habitual into "strange" "by presenting it in a novel light, by placing it in an unexpected context" (Erlich 1981, 176). It is closely related with the notion of "creative deformation" which "restores sharpness to our perception, giving 'density' to the world around us" (Erlich 1981, 177).

[9] "Foregrounding" is Garvin's (1964, 9) translation of the Czech word *aktualisace* from Bohuslav Havranek's (1964) essay titled "The Functional Differentiation of the Standard Language." It refers to use of ". . . devices of the language in such a way that this use itself attracts attention and is perceived as uncommon, as deprived of automatization, as deautomatization, as deautomatized, such as a live poetic metaphor (as opposed to a lexicalized one, which is automatized)" (Havranek 1964, 10). As it was emphasized by Tzonis and Lefaivre (1987, 267) in Russian Formalism, it corresponds to Shklovsky's (1965) idea of "roughened form," an important counterpart to the notion of "estrangement."

persistence of tradition as something that is internalized in these disciplines.

Ernst Gombrich (1960) too, proposes a model for creative act in the visual arts[10], which has implicit evolutionary aspects. In his conception, same as Colquhoun's conception of a work of art, every new creation is seen as not merely a representation or imitation of nature through which an artist depicts or transfers what he or she sees. Such an act actually refers to an established tradition, and it is affected from earlier ideas that are coded in the earlier works. In Gombrich's (1960, 321) words, "… the artist cannot start from scratch but he can criticize his forerunners." This idea is illustrated throughout Gombrich's *Art and Illusion* by the examination of Western Art "…[to] demonstrate in particular to what extent well-known and established instances of depicting the world, say the human face or trees or buildings affect subsequent representations even when these are drawn from nature" (Brawne 1992). An evolutionary aspect can also be identified in Gombrich's conception of the process of creation, proposed as involving "schema and correction,"[11] where an artist "must have a starting point, a standard of comparison, in order to begin …" the creative process, and continue with "… making and matching and remaking …" till the process "… finally becomes embodied in the finished image" (1960, 321)

Colquhoun (1981a), while emphasizing the affect of architectural tradition on Le Corbusier's designs, identifies the succession between the ideas provided by the architectural tradition and the ideas invested in and carried by Le Corbusier's designs. He construes the process as "displacement of concepts,"

[10] Actually, in *Art and Illusion,* Gombrich's focus is artistic creation in painting. In this sense, his main references are from painting. Nonetheless, his ideas can be generalized to other forms of art, and to architecture.

[11] Gombrich's (1960) idea of "schema and correction" derives from Robert Woodworth and Harold Scholosberg's *Experimental Psychology* (1954). Interestingly, this is also one of the sources of Donald Campbell (1960) in his "Blind Variation and Selective Retention in Creative Thought as in Other Knowledge Process," where he proposes that "blind variation and selective retention" process is fundamental to "all inductive achievements … genuine increases in knowledge … increases in fit of system to environment." This shows the common epistemological foundations of both studies and the positions.

which “indicates a process of reinterpretation, rather than one of creation in a cultural void.” Following his conceptual framework which is derived from the artistic avant-garde and Modern Architecture, Colquhoun proposes “the study of architecture as an autonomous discipline –a discipline which incorporates into itself a set of aesthetic norms that is the result of historical and cultural accumulation” as a valid basis for approaching the problem of tradition. In this conception, tradition is considered as a body of “objective facts” –as in world 3 forms or ideas– that operates as one of the primary sources of a creative act. At the same time, tradition is regarded as an open system with temporal and transitory values that are subject to a critical appraisal and change (Colquhoun 1983, 90). Following their epistemological references in Popper (1965, 1972a, 1972b), Colin Rowe and Fred Koetter (1978), too, emphasize the importance of tradition, and propose that “criticism” should be an indispensable complementary component of any concern for tradition and it was one of the primary sources of development and change. In this conception, tradition in turn provides established explanations, solutions, structures and an order, which furnish a basis for investigation, something to be criticized and transformed. Stanford Anderson (1965) distinguishes between “blind traditionalism” and critical approach to tradition and proposes that in architecture, one must seek for “… interpretation of tradition that will recognize our debt to the past without establishing the past as an authority.” Common to all these studies is an evolutionary aspect inherent in their conception of architectural design and their placement of tradition and criticism in this conception.

As it would seem, both in arts and in architecture, the evolutionary aspect often resides in the discussions concerning the issue of tradition and criticism. In architecture, this becomes more obvious. From the evolutionary point of view, tradition represents an inherited body of ideas, namely a “conceptual inheritance,” and criticism refers to a type of selection or filtering mechanism that has its own specificities. Architecture and architectural design is bounded up with the tradition, or with a “conceptual inheritance,” in two ways: First, tradition provides a set of forms and ideas to be used in the new designs, or to be used as a basis of new creations. Second, tradition provides most of the criteria operational in evaluation and filtering, without which criticism cannot exist.

I suggest that, pertaining to their common philosophical, epistemological, and architectural foundations, above-mentioned studies of Anderson (1965), Rowe and Koetter (1978), and Colquhoun (1983, 1981a, 1981b), can be interpreted as representatives of a paradigmatic position. Apart from its emphasis on tradition and criticism, this position can also be characterized by its critique of Modern Architecture's rejection of tradition, and the positivistic, historicist, determinist, and utopian content in its thought and general doctrine, and to-the-date survival of this content in some of the studies and mainstream approaches in the practice and theory of architecture. To state a few, for example, Rowe and Koetter (1978, 95-96) identify the positivist and historicist content in Christopher Alexander's *Notes on the Synthesis of Form* of 1964 and interpret his studies as an illustrative case of these ideas surviving in architectural thought. Anthony O'Hear (1983) emphasizes the historicist tone in Nikolaus Pevsner's "defence of architectural modernism" in his *An Outline of European Architecture.* Anderson's (1965) critique addresses the determinism in Banham's (1957, 1989, 1961) theorizing and in his reinterpretation of Modern Architecture from this point of view.

Actually, Banham's position is a representative of a different viewpoint that is likely to be interpreted as a representative of an opposing paradigm. Beside Banham, scholars such as Pevsner (1961) and John Summerson (1957), put an emphasis on the "utopian" and "teleological" aspects of architecture while demoting tradition as something that should be left behind while creating the new. In the process of change, emphasis is on the continuous revolutionary shifts or ruptures from "what exists." This identifies a search for a permanent revolution, rather than an evolutionary transformation that is closely tied to tradition. An important ingredient of this paradigmatic position is the issue of architectural program: The revolutionary shift would be possible by the help of a scientific "architectural program," and particularly in Banham's case, by technology. For example, in his essay titled "The Science Side: Weapons Systems, Computers, Human Sciences," Banham (1960c, 188-190) proposes that a scientific program

> … would take in all aspects previously left to tradition, including the aesthetics of perception, human response, (visual, psychological, biological) technologies of environment, and the like; science would simply reveal and propose the best solutions to the design of shelter.

The position illustrated in the works of Pevsner (1961) Summerson (1957), and Banham (1957, 1989, 1961), represents a line of inquiry that has a valuable content. First, it attempts to reconsider "the program" as one important ingredient of Modern Architecture, and to expand and recast the program (back) into the center of architecture. Furthermore, it provides invaluable criticisms targeting the mindless repetition of the forms or styles of the past. Finally, in doing these, it emphasizes and foregrounds an important content of architecture; "what could be" and "what is possible," or, from the evolutionary point of view, the (forward) movement and change from what exists.

Both groups of studies can be interpreted as two distinct, yet complementary interpretations of the tradition of Modern Architecture. In the present study, I utilize the material provided by them as the conceptual basis of my study. In this sense, I conceive my thesis as a continuation of the line of inquiry represented by these studies, and as a contribution to the tradition represented by them.

## 1.2 The Problem Situation

The introductory chapter of the book titled *The State of Architecture at the Beginning of the 21st Century*[12] begins with the following description of the present condition in architecture:

> It might be argued that those of us engaged in the *practice of architecture* today find ourselves in unusually blissful circumstances. Never has the field been more celebrated. Titanium temples of culture and translucent masterpieces *appear ubiquitous*, while architects have become successful media demigods, busy revitalizing the *image of cities* in a *global economy.*
>
> Or the situation the opposite? In the twenty-first century, will we come to criticize buildings that are *famous* more what they *look like* than for *what they do*, and architects concerned more with constructing their autobiographies than with developing the art of construction? Will we mourn the *death of public space* and the *disappearance of progressive social programs*? (Tschumi and Cheng 2003, 7)

The questions posed in the second paragraph actually point to a present condition in architecture. In the same volume, Gregg Pasquarelli (2003, 24) identifies a tendency in architecture "… toward the market-driven production of fashion objects, removed from wider urban and social concerns." He rightly asks the question "if formalism does not lead to invention, then how does the next generation of architects begin to think about a new kind of operative architectural or urban design practice that leads us closer to the goal of promoting human life over form" (Pasquarelli 2003, 24) ? Robert Stern (2003, 21) suggests that instead of architects "compete to leave their mark on the city through form," they should have the "vision of good," and ask the questions "what is a good city," and "what is the good life that … architects should advocate," and try to provide answers to these questions through architecture.

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[12] Proceedings of the conference which took place at Columbia University on March 28th and 29th 2007 where architectural designers, historians, theorists and critics come together to discuss the present state of architecture.

In his recent essay titled "Toward a Theory of the Architectural Program," Anthony Vidler (2003), too, underlines the same condition by viewing it from a wider and historical perspective. He describes the present condition as follows:

> Recent proposals and debates over the architectural redevelopment of Ground Zero have highlighted the way in which, over the last two decades, the public role of architecture has been gradually reduced to the symbolic and the emblematic. Its forms of expression are no longer closely tied back to the urban issues and physical planning questions that, from Congres Internationaux d'Architecture Moderne (CIAM) to Team X, Neo-Realism to Neo-Rationalism, Rotterdam to Internationale Bauausstellung Berlin (IBA), once energized and mediated the practice of urban architecture (Vidler 2003).

Clearly, the issue is the "architectural program" that, for Vidler (2003, 59), was thrown away "… in the high days of postmodernism and deemed irrelevant to architectural 'meaning' since the discrediting of the seemingly narrow functionalism of the modern movement." However, Vidler also identifies a recent "tendency," in the idea and practice of design, at least in some circles, "toward the critical development of the idea of program …," although, for him, the studies, which are the representatives of this tendency, do not yet constitute a movement, and they do not have a unified theory. In Vidler's (2003, 60) words,

> many architects are bringing together their exploration of the formal potentials of the digital media and an equally radical approach toward the program by exploiting all the possibilities of animation and rendering programs to combine and represent information and thus overcoming one of the fundamental blocks to modern functionalism –the 'translation' of data into meaningful form.

While valuing these "exploratory," studies as a part of an emergent "new sensibility" to the architectural program, Vidler (2003, 60) warns for a danger of "digital determinism," in the absence of a "theorization of the new program." As a response to this issue, from a wider perspective, he calls for an expanded conception of the program, a "contemporary" sense of it which will neither "… invoke program in the limited functionalist or political approaches of early modernism …" nor "… in the revived typological and diagrammatic forms of late modernism" (Vidler 2003, 59). Such a reconsideration involves, or should involve program as "… the radical interrogation of the ethical and environmental conditions of specific sites, which are programs in themselves" (Vidler 2003, 60). He calls this approach as "new environmentalism,"

> … [which] would not imply a subservience to 'green' building mired in the static response of existing economies and primitive technology, nor would it follow the static contextualism of the new urbanism mired in the nostalgic response to a false sense of the 'good' historical past, nor finally would it accept the premises of global late modernism mired in the false confidence of technological universalism." Instead it would be flexible and adaptive, inventive and mobile in its response to environmental conditions and technological possibilities (Vidler 2003, 59-60)

This concluding argument brings the discussion back to the arguments that are made at very beginning of the present thesis. On his way, which leads towards a "new environmentalism," Vidler too starts from architecture's recent withdrawal from its urban and social concerns and its responsibility from promoting human life. He proceeds by formulating an outline of a theory of the architectural program, and in doing this move; he implicitly comes very close to the point of the present study. The point is that, the success of the program, once recast back into the agenda of architecture is highly dependent upon its conception. In fulfilling this task, Vidler goes for an expanded conception of the program, and he rightfully pursues a line of inquiry, a well-established tradition, descendant from Summerson and Banham, and through them, the Modern Architecture.

However, the problem seems to be lying somewhere else, and deeper and more complicated than it seems. A theory of the architectural program cannot also be a theory of architectural design. Such a theory cannot exist in the absence of a major theory or a model of architectural design, or reside outside of it. Through that major theory or model, a theory of the architectural program is always tied to an ontology and an epistemology which determine the nature of its conception. Therefore, in addressing such an undertaking without referring to that major model would be impossible without "assuming" it as something "given."

In the light of these arguments, to clarify the position of the present thesis, let me return to the issue of the "'translation' of data into meaningful form," and the present day "exploratory" studies addressing it through computational creation of architectural form. Actually, while the "computational" side of the phenomenon is relatively new for architecture, the problem, which Vidler associates it, is older. The issue of "translation of data into meaningful form," is originally formulated by Summerson in 1957 as "a problem" that arises from "preoccupation with programme." At that date, Summerson (1957) rightly determines that at some point, the "program" has to solidify or "crystallize" into a solution, or into a final form, however, neither that point nor "what happens or should happen at that point" is obvious or clear. Today, owing to their high data processing and form creating potentialities, computers, or more specifically, related computer software are often viewed as ideal devices for overcoming this problem. For example, as it was argued by Vidler (2000, 17), in "digital topographies," where "… the flows of traffic, changes in climate, orientation, existing settlement, demographic trends, and the like," "formerly" the "influences" to be taken into consideration "while preparing a 'solution' to the varied problems they posed" are now "… can be mapped synthetically as direct topographical information, weighted according to their hierarchical importance, literally transforming the shape of the ground."

However, at the first place, the question is what makes us to assume that form is something which is, or which should be achieved by the "translation" or "solidification" of some data, information, function, program, or something of similar nature? What makes us to believe that one can gather all the possible information that an architectural design might involve, or, one can predict all the possible conditions an architectural design might face? Even if one can do so, what makes us to think that an architectural form or solution is merely a simple extension of this gathering or prediction, something that emerges out of nothing but a stack of data or information?

Although perfectly relevant for the present situation, actually these and similar questions are not new, or more specifically, they are not originally formulated for addressing the present situation. Such questions were raised a time ago, for example by Colquhoun (1969) and Rowe (1996), as a criticism directed to the positivistic bias and historicism or historical determinism of the functionalist thought in Modern Architecture and to-the-date extensions of it, when the computers were not so popularized in architecture. In raising the same questions today, I suggest that, in architecture the same line of thought, together with its problems, and behind it, a certain epistemology and ontology continue to exist, at least in some circles.

Recently, Mary McLeod (2003, 51), too, recognizes such a continuity in her critical account of the neo-avant-garde tendencies in architecture. On the one hand, she identifies "a return to a kind of biotechnical determinism," an idea that is originally identified by Colquhoun (1969, 73) as a part of "the general body of doctrine in the Modern Movement." On the other hand, she also identifies “a persistent formalism, where form is seen as autonomous, whether generated by intuitive criteria, typology, or syntactic research” (2003, 51).[13]

McLeod (2003, 51) argues that,

> The biotechnical tendency, represented at its most extreme by Karl Chu’s morphogenetic model but also more generally by the persistent call for a computer-generated, objective design process, recalls the limitations of the functionalism advocated by the modern movement and of the design methodologies influenced by 1960s systems theory, notably Christopher Alexander’s pattern language. No matter how sophisticated the computer program or how comprehensive the variables to be accommodated, the resultant forms remain removed from actual needs and desires, whether material or symbolic. This is not only because these projects have not been built. What has not been acknowledged fully are the limitations of the computer software, the arbitrariness of the criteria established, the subjectivity of the process of editing form, and the banal sameness of function itself when narrowly viewed as an a priori tool or codifiable device.

In such an approach, “design seems caught between an instrumental determinism and intuitive mysticism. That which is purportedly most objective becomes most subjective and detached from collective social life” (McLeod 2003, 51).

For McLeod (2003, 51), “paradoxically, in this regard the new biotechnical determinism recalls intuitive neoexpressionist approaches, which overtly

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[13] Actually, “formalism” is an ambiguous term that may have different connotations. It has been used in different senses, in different contexts. For example, formalism here refers to “the practice or the doctrine of strict adherence to or dependence on prescribed or external forms,” or “emphatic or predominant attention to arrangement, style, or artistic means (as in graphic art, literature, or music) usually with corresponding de-emphasis of content” (Merriam-Webster Unabridged Dictionary 2000). However, for example as it was stated by Peggy Deamer (1994) , “In the German tradition, directly tied to the neo-Kantianism (and in-line with Ernst Cassirer), formalism was not a condition of the object, but one of the subject. How one organized sensual data in one’s head was the essential question; the artwork was interesting to the extent that it made evident this epistemological condition. There were no criteria – compositional or otherwise- that prescribed what proper form was. Rather, it was a discussion of where the mental province of form lay.” Russian Formalism can be interpreted as the successor of this tradition.

acknowledge their formal origins." Actually a condition with similar aspects was identified by Colquhoun (1969, 73) in "the general body of doctrine in the Modern Movement" as it "consists of a tension between two apparently contradictory ideas –biotechnical determinism on the one hand and free expression on the other." While emphasizing the "stylistic similarities between the two," McLeod (2003, 51) argues that

> Just as the idiosyncratic serial variations of biotechnical approaches have at times produced a relentless sameness –a homogeneity stemming from overwrought particularity without hierarchy– willfully intuitive designs also often result in a certain sameness of style, reminding us how small the innovative dimensions of form can be. Here, the more restrained models of form calling for a return to type and "sameness" might seem a welcome alternative, if only their realism about the limits of formal variation and invention. However, in contrast to typological investigations in the 1960s and 1970s, which were linked to a desire for communication and public legibility, these more recent theoretical models conceive variation (for example the notion of species) as occurring almost semiautomatically, without conscious intent.

McLeod (2003, 51) argues that "again the rhetoric draws on biological metaphors –breeding, proliferation, mutation, evolution– recalling the determinist strains of the first model." Actually, these arguments indicate another continuity, since a similar relation was also identified by Colquhoun (1969, 72) between the biotechnical determinism and the Spencerian evolutionary theory a time ago.

Following McLeod's arguments, we can acknowledge two dominant mainstream positions that can be identified with their emphasis on the "work on form," and the "work on function or program." Because of their tendency to split form and function (or program), these positions seem to present an irreconcilable opposition and neither of them seems to be able to incorporate the opposing paradigm's valuable content within itself. Even McLeod (2003) seems to be accepting such a split implicitly, by attributing the "potential richness” of architecture to the dialectic between the opposition between the form and the function. This is also manifest in Vidler's (2003) valuable study on program: his study, too, follows the work on “function or program,” therefore implicitly accepts, and supports the split.

So, in the present situation, we have, a “preoccupation with form” or “work on form” that tends to follow a “formalist” line, but perhaps more important, on the opposing side, we also have, a “preoccupation with programme” or “work on program,” that tends to follow a determinist line, especially when such a preoccupation is established upon a certain view of architectural design, and a certain epistemology and ontology. Apparently, in the second case, the problem is the “inductivist” view of design and a positivistic epistemology, and ontology that persist in the idea and the practice of design, and the related theoretical/conceptual framework affects almost every aspect of architecture, not only the conception of architectural design (process), but also architectural ideas, architectural program and so on. This condition, which is viewed as central to the stated problem situation, is identified and taken as the major problem of the present study. Addressing it would provide a basis for addressing not only much of the stated problems but also the potential ones.

It must be noted that these arguments do not mean, “this is all what is happening,” and “this is 'the' problem situation in architecture today.” Nonetheless, they point to a set of problems and above all, a major or central problem manifest in the recent debates, observable in both theory and practice, which have a tendency to last, and possibly by becoming more acute, therefore worth to be addressed and taken into consideration.

### 1.3 The Research

As it was already identified, McLeod’s criticisms of the two mainstream positions present continuity with the aforementioned paradigmatic positions of the late 1950s and 1960s. It seems that not only much of the problematic issues addressed (and carried) by these positions, although they might be evolved with the specificities of the contemporary conditions, still persist today, but also these positions carry much valuable content that are relevant and applicable to the present condition. For example, it is not unexpected that McLeod uses the conceptual framework derived mainly from Colquhoun (1969) to view and critically evaluate the present condition in architecture. It is also not unexpected that in his critical evaluation of the present condition and his proposal towards an expanded conception of the architectural program and the "new environmentalism," Summerson (1957), and Banham's (1957, 1989, 1961) before-mentioned studies provide an essential theoretical/conceptual basis for Vidler's arguments.

Actually, as it would seem, the problem situation of the present study has much in common with McLeod's (2003) and especially Vidler's (2003) problem situations and partially, it shares the same architectural context. However, while taking Vidler's call for a theory of the architectural program seriously, I suggest that it is actually only a part of a wider problem situation. As it was already stated, a theory of the architectural program cannot also be a theory of architectural design; such a problem situation could be successfully addressed only by a major theory or model of architectural design. Therefore, while Vidler's (2003) study moves towards a theory of the architectural program, this study aims a major theory or model of architectural design, established upon a rigorous epistemology and ontology.

This study contributes to this ultimate goal by proposing two complementary evolutionary models for reconceptualizing architectural ideas and the architectural design process.

As it was introduced earlier, like Vidler's (2003) study, the research refers to the studies of Pevsner (1961) Summerson (1957), and Banham (1957, 1989, 1961). However, it also refers to certain studies of Rowe (1996), Rowe and Koetter (1978), Colquhoun (1969, 1981a, 1983), and Anderson (1965, 1981, 1982). As it was already stated, these studies are interpreted as the representatives of two paradigmatic positions, which present two different interpretations of Modern Architecture. They are productive in themselves because of their “critical” point of view, and their foregrounding, continuation and reconsideration of different valuable aspects of the tradition of Modern Architecture. One of the starting points of the present study is the hypothesis that these positions still provide a rigorous material, which is highly relevant and rich in content in viewing the present state of architecture; for understanding and evaluating it, and also in addressing certain issues including the problem situation of the present study. Consequently, they are taken as the successors of an unfinished project, the Modern Architecture, and interpreted, and assessed as complementary positions, rather than oppositions, examined in evolutionary terms. I make a close reading of the mentioned studies to distill and constitute a conceptual framework to be used for the present study. The rationale behind this is to constitute a material, which is applicable to the present state of architecture and the present problem situation, and in doing this, offering a reinterpretation of two distinct and rigorous interpretations of Modern Architecture.

I primarily utilize the conceptual framework provided by these studies for viewing and evaluating a specific issue inherent in the present condition of architecture and identifying and formulating a problem situation out of it. Then, I critically reconsider the same conceptual framework, in the light of the ideas coming from evolutionary epistemology, three-world ontology, and the theory of evolution, to identify and foreground the evolutionary aspects inherent in it, and to use these aspects in the development of an evolutionary model of architectural design. While doing this, in turn, I bring the valuable thought content of the two paradigmatic positions together, while reconceptualizing and relocating them under the administration of this model.

The “selection theory,” particularly its advance and interpretation in evolutionary epistemology resides at the background of my whole study. Beside the “selection theory,” the ideas from the works of Popper (1965, 1972a, 1980), Toulmin (1972) and Campbell (1956a, 1960, 1974) are operational in every point of my study. I examine evolutionary epistemology and three-world ontology from two distinct, yet related viewpoints: first, I take them "as they are," as an epistemology and a complementary ontology, which are highly relevant and applicable for the present study. I utilize these ideas extensively in constructing my models. Second, I take them by focusing on their reconception and advancement of the theory of evolution, and application of the theory to the field of epistemology. With this respect, they relate to my study as a methodological model that I utilize in constructing my evolutionary models. Referring to this model, I do not resort to -forced- biological or genetic analogies that are common in architecture, but rather develop a deeper understanding of the "selection theory," and refer directly to this "pure" conception of the idea of evolution.

In examining Popper's related studies, I am well aware of the fact that the interest in Popper's ideas in the field of architecture is not a new phenomenon: as it was stated by Bruce Archer (1999, 567), "Karl Popper (spiritually, at least) was …" the father of "Design Research." His ideas were explored from various viewpoints by various scholars, including Rowe and Koetter (1978) and Anderson (1965) in architectural theory, whom I have briefly introduced. But equally important is the well-known studies in "Design Research" such as Bill Hillier, John Musgrove & Pat O'Sullivan (1972), Stefani Ledewitz (1985), and Jane Darke (1979), to state a few, who were influenced by Popper's ideas in their investigations concerning design methodology, architectural design and problem solving. This line of research has made its way down to the present day, and advanced recently by Greg Bamford (2002, 2003). My study has much in common with these studies, therefore must be considered as a part of the tradition constituted by them. As an advance, in my study, I particularly dwell on three-world ontology and focus on and explore the "evolutionary" aspects of the issue, which I believe have potentials and implications for architecture that are not yet fully explored in this field. Furthermore, it must be noted that from a certain point of view, the main object of my study is the contents of thought, (or architectural ideas in the term's widest sense). This distinction is essential in establishing the relation of my study with evolutionary epistemology and the theory of evolution as well as with other studies in architecture belonging to the same research area. In addition, my study is not limited with the works of Popper; I also introduce the studies of Toulmin and Campbell to provide a wider view.

The proposed models can be summarized as follows:

**The Evolutionary Model of Architectural Design**

My "evolutionary" model of architectural design is essentially based on Darwin's account of organic evolution, or more specifically, the natural selection paradigm. With reference to the works of Popper, Campbell, and Toulmin, it is established on the hypothesis that organic evolution is actually a special case of a general phenomenon of historical change, which follows the pattern of variation and selective retention, or a more general pattern of trial and error. As it has been stated in the very beginning of the present chapter, the application of the selection paradigm to biological evolution is in fact an instance, actually, it can be generalized to (the explanation of) epistemic activities, and activities that concern teleological achievements, and inductive gains, such as perception, learning and understanding, and also creativity, and problem solving.

It is through the works of Popper "such an epistemology" was made available to the philosophic traditions (Campbell 1974, 413), and it was expanded and advanced in the works of Campbell and Toulmin. Popper's ideas were first introduced to the agenda of art by Gombrich (1960), later to architecture, or more specifically to architectural theory, by Anderson's (1965) paper titled "Architecture and Tradition that isn't 'Trad Dad'" presented in the AIA – ACSA Teacher seminar in 1964. However, although Anderson's paper has strong evolutionary arguments, it is "Knowledge and Design" by Bill Hillier, John Musgrove and Pat O'Sullivan that Popper's studies, and through it, the selection paradigm was introduced to architecture and to architectural design.

With reference to Popper, it is presented as “conjecture/analysis” model of problem solving (Hillier, Musgrove and O'Sullivan 1972, Bamford 2002) but in various other studies the model’s variations are referred to as “conjecture/test” (Brawne 1992), “concept/test” (Ledewitz 1985) or “generator/conjecture/analysis” (Darke 1979).[14]

The evolutionary model of architectural design proposed in this study can be interpreted as a part of this tradition. As an elaboration of the conjecture/analysis, in the proposed model, the design process is conceptualized as involving the acts or processes of “formation/making,” and “evaluation/selection, which contain or involve much “conjecturing” and “trial and error,” and it is proposed that the process itself, can be explained in selectionist terms (Figure 10).

As it would be clear by now, the evolutionary model of architectural design is not established upon a form-function or form-program duality, or it does not emphasize either form or function similar to the models mentioned by McLeod (2003). Rather, in this model, these (and other such elements) are conceptualized as the “thought contents” of an architectural design with distinct characteristics that do not operate in terms of oppositions but rather in evolutionary terms. This is also related with the “expanded” conception of the architectural idea, which views all the actual and possible “thought contents” which architectural designs and the architectural design process might involve, as architectural ideas. In this conception, ideas that have a potential to contribute to the creation of a design by “forming” or “transforming” are characterized as formative ideas, or ideas with formative aspects, and the ideas that might contribute to the creation of a design by “evaluation,” or in evolutionary terms, by “selection” are characterized as selective ideas, or the ideas with selective aspects.

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[14] Different from the idea’s relatively literal application to architecture, in arts, Gombrich (1960) adapts and conceptualizes the process as “making and matching” perhaps implicitly referring to and emphasizing the dimension of “making” in artistic creation. This should also be the case for architecture.

### The Evolutionary Conception of Architectural Ideas and the Conceptual Inheritance

The evolutionary conception of architectural ideas requires a shift of focus from the design process and the product, to the architectural ideas themselves and to the world they belong, namely world three. Actually, Popper's world 3 is a uniting term, which incorporates traditions belonging to sub-worlds or domains such as the world of science and the world of fiction, the world of art, the world of engineering, and the world of architecture distinguished by their own specificities. Traditions in a particular domain represent a body of ideas, and ideational structures available to that domain. In architecture, too, we can acknowledge various traditions, which are constituted by a body of domain-specific ideas available to the related tradition. At any specific time, such traditions provide ideas or ideational structures, a "conceptual inheritance" that is a necessary instrument of architectural thinking and consequently, of architectural design. As a product of (architectural) thinking, creation of new architectural designs is actually anchored in the tradition, which in turn, if successful, each creation and the "thought contents" it possesses are embedded back into the tradition to expand, to change, or to transform it. In this conception, apart from their actual reason for existence, architectural designs are viewed as one of the possible vehicles of inheritance, and carriers of the related ideas and ideational structures. This can be evaluated as an evolutionary model or conception of architectural ideas which calls for two primary elements: The first element is the tradition, the basis of (architectural) thinking and creation, and a possible future change, which is about "what is" and "what exists," about the established ideas and ideational structures. The second element is the creative, exploratory, innovative change, which is about "what could be" and "what is possible," about the (critical) transformation (or sometimes filtering out) of "what exists." The existence of the second element is always dependent upon the existence of the first.

In this sense, in a design, an idea might be traditional, or in evolutionary terms, "inherited," or it might be transformed or reinterpreted to "survive" the "selective" specificities of the design but still carries characteristics of its inheritance. In turn, investment of an idea in the creation of a design first might mean that it "survived" the selective conditions possessed by the specificities of the design process and the design, and it might mean the survival and inheritance of the idea through this design. Alternatively, an idea might be departing from such inheritance, representing a deviation, or more specifically a change from what already existed before it. Architectural change emerges through such ideas.

### 1.4 Methodology

In the present study, I utilize the conceptual framework coming from evolutionary epistemology, three-world ontology, and the theory of evolution, primarily for critical reconsideration of two paradigmatic, often thought-to-be opposing, but actually complementary interpretations of Modern Architecture. In the light of this "reading," I propose an expanded "evolutionary" conception of architectural ideas and an evolutionary model of architectural design, as a means of reconsidering, advancing, and expanding the valuable content of the mentioned line of inquiries. This is done in the light of the ideas coming from the theory of evolution or "selection theory" and its advances in evolutionary epistemology. In doing this, methodologically, I also use the structure of the "selection theory," as a preconception, a schema that constitutes the basis of the proposed models. In turn, I bring together the valuable material of the architectural context, while reconceptualizing and relocating them under the administration of this schema.

Within the preliminary chapters, I cite the existing interpretations of certain architectural designs used as illustrative cases in the studies that constitute my architectural context. In doing this, I critically reconsider these cases to exemplify the point of the present study and to distinguish it from already existing studies. Consequently, I illustrate the proposed evolutionary models to show their potentialities, and their relevancy and applicability. To do this, first, I examine the material produced during the design process of Botta's Single-family house in Breganzona, in evolutionary terms, or more specifically, by following the structure and conceptual framework of the evolutionary model of architectural design. In parallel, for the evolutionary conception of the architectural ideas, I select some ideas from the examined design and follow their evolutionary lineage in their instances both in Botta's own designs and in architectural tradition.

### 1.5 The Structure of the Study

Apart from the introductory and concluding chapters, the thesis consists of three major parts.

The first part, which comprises Chapters 2 and 3, involves the statement and elaboration of the epistemological, philosophical, and architectural conceptual framework of the study. The Chapter 3 also sets and elaborates the architectural context of the study.

The second part mainly refers to and established upon the two traditions summarized in the previous two chapters, one from architecture and the other from epistemology. It mainly involves the construction of the evolutionary models "evolutionary model of architectural design," and the "evolutionary conception of architectural ideas" and related theses.

The third and final part, as it was stated previously, is about the illustration of the evolutionary models put forward in the study.

# CHAPTER 2

## CONCEPTUAL FRAMEWORK OF THE STUDY, PART I

In this chapter, I mainly set the epistemological and ontological foundation of the present study.

As it was stated in the introduction, the "selection theory," resides at the background of the whole study, particularly its interpretation in the works of Popper (1965, 1972a, 1980), Toulmin (1972) and Campbell (1956a, 1960, 1974). In this chapter, I examine evolutionary epistemology and three-world ontology as an epistemology and a complementary ontology that are highly relevant and applicable to the major problem of the present study. I utilize these frameworks extensively in constructing my models.

I also focus on "the way" the theory of evolution is reconceptualized and advanced in evolutionary epistemology, and "the way" it is applied to the domain of epistemology. With this respect, I would be utilizing these works as a methodological model for constructing my evolutionary models. Such a methodology helps the study to avoid biological or genetic analogies, and to develop a deeper and better understanding of the "selection theory," and refer directly to this specific conception of evolution.

Methodologically, this chapter intends to make a critical investigation of the relevant themes in the above-mentioned studies while carrying the discussion to the main concerns of the study as much as possible.

## 2.1 Karl Popper: Evolutionary Epistemology and Three-World Ontology

Campbell was the one who first coined the term “evolutionary epistemology,” and made valuable contributions to the model, yet it was developed primarily in the works of Popper. Actually, Popper’s works provide most of the essentials of the evolutionary epistemology. In this section, I introduce some of the key ideas, which are particularly relevant for the present study.

### 2.1.1 Evolutionary Epistemology

Popper’s three-world ontology and his evolutionary approach to world 3 are two essential components of evolutionary epistemology (Popper 1996a, 2) Actually, in evolutionary epistemology, the term “evolutionary” mainly refers to the selection theory or in Campbell’s (1974) words, “selective elimination model.” This distinction is particularly important in understanding evolutionary epistemology and its implications.

As it was identified by Campbell (1974) Popper’s contribution to evolutionary epistemology begins with his *Logic of Scientific Discovery* where he recognizes “the process of succession of theories in science” following the pattern of an evolutionary process. For example, in *Logic of Scientific Discovery* Popper (1972b, 42) makes the following arguments:

> … *empirical method* shall be characterized as a method that excludes precisely those ways of evading falsification which are … logically possible. According to my proposal, what characterizes the empirical method is its manner of exposing to falsification, in every conceivable way, the system to be tested. Its aim is not to save the lives of untenable systems but, on the contrary, to select the one which is by comparison the fittest, by exposing them all to the fiercest struggle for survival.

The inherent evolutionary argument in these sentences is clear. In the same volume, Popper proposes that acceptance of one theory in preference to others is not "… due to a logical reduction of the theory to experience." On the contrary, one chooses the theory

> … which best holds its own in competition with other theories; the one which, by natural selection, proves itself the fittest to survive. This will be the one which not only has hitherto stood up to severe tests, but the one which is also testable in the most rigorous way. A theory is a tool which we test by applying it, and which we judge as to its fitness by the results of its applications (Popper 1972b, 108).

As it is stated by Campbell (1974), fuller expression of Popper's evolutionary epistemology takes place particularly in *Conjectures and Refutations*, where the idea or the "theme" is more explicitly presented and elaborated. As it is also cited and emphasized by Campbell (1974), in *Conjectures and Refutations,* against "psychological theory of induction" Popper (1965, 46) proposes the following view:

> … Without waiting, passively, for repetitions to impress or impose regularities upon us, we actively try to impose regularities upon the world. We try to discover similarities in it, and to interpret it in terms of laws invented by us. Without waiting for premises, we jump to conclusions. These may have to be discarded later, should observation show that they are wrong.
>
> This was a theory of trial and error *–of conjectures and refutations*. It made it possible to understand why our attempts to force interpretations upon the world were logically prior to observation of similarities. Since there were logical reasons behind this procedure, I thought that it would apply in the field of science also; that scientific theories were not the digest of observations, but that they were inventions –conjectures boldly put forward for trial, to be eliminated if they clashed with observations; with observations which were rarely accidental but as a rule undertaken with the definite intention of testing a theory by obtaining, if possible, a decisive refutation.

One always has such needs, expectations, interests, problems, conjectures, anticipations, and theories that operate as “a kind of background,” in Popper’s terms, a “frame of reference,” or a “horizon of expectations.” The argument goes as follows:

> …It is true that any particular hypothesis we choose will have been preceded by observations –the observations, for example, which it is designed to explain. But, these observations, in their turn, presupposed the adoption of a frame of reference: a frame of expectations: a frame of theories. If they were significant, if they created a need for explanation and thus gave rise to the invention of a hypothesis, it was because they could not be explained within the old theoretical framework, the old horizon of expectations… (Popper 1965, 47).

A “frame of reference” or a “horizon of expectations” implies a certain dogmatism or a dogmatic thinking that makes us to stick to our expectations, and, it is required. However, such adherence must be to a certain extent, one must always be in doubt and ready for a change. Such an attitude points to what we call the critical attitude, which shares with the dogmatic attitude “…the quick adoption of a schema of expectations –a myth perhaps, or a conjecture or hypothesis” (Popper 1965, 49). But distinct from the dogmatic attitude, the critical attitude has an incorporated readiness “...to modify … to correct … and even give … up” such schemata. Popper (1965, 50) argues that

> For the dogmatic attitude is clearly related to the tendency to *verify* our laws and schemata by seeking to apply them and to confirm them, even to the point of neglecting refutations, whereas, critical attitude is one of readiness to change them –to test them; to refute them; to *falsify* them, if possible.

In evolutionary terms, criticism stands for “selecting” or “filtering” the unsuccessful trials, perhaps singling out the successful one(s). Popper (1965,

52) distinguishes between pure trial and error with critical approach although the latter is established upon the former.

> The method of trial and error is not, of course, simply identical with the scientific or critical approach –with the method of conjecture and refutation. The method of trial and error is applied not only by Einstein but, in a more dogmatic fashion, by amoeba also. The difference lies not so much in the trials as in a critical and constructive attitude towards errors; errors which the scientist consciously and cautiously tries to uncover in order to refute his theories with searching arguments, including appeals to the most severe experimental tests which his theories and his ingenuity permit him to design.

The ideas central to Popper's evolutionary epistemology reached their mature stage in *Objective Knowledge: An Evolutionary Approach* (1972a) especially with the introduction of three-world ontology, and these ideas were further elaborated in Popper's later works such as the *Myth of the Framework* (1996a). The introduction of three-world ontology is important since it provides a rigorous basis for expanding and advancing these ideas towards fields other than science. What is more, in these works, Popper begins to discuss issues in evolutionary terms more explicitly; at least the evolutionary or selectionist schema in his discourse becomes more explicit.

Apart from the three-world ontology, two related discussions are particularly important for the present study. The first is about the "progress" and "progression," second is the "teleological achievements" and "ends-guided processes," both investigated and reconceptualized by Popper in evolutionary terms.

### 2.1.2 An Evolutionary Conception of Progress

The theory of evolution, or the "selection theory" by definition, does not include an argument of progression, and imply "a progress towards a pre-determined end." The first issue seems to be a problem in its application to scientific discovery, problem solving, and design which essentially involve progress of some type.

In “The Rationality of Scientific Revolutions,” Popper (1996c) views progress in science from an evolutionary point of view. Popper’s view provides an excellent account of how the theory of evolution is in a position to contribute understanding and explanation of progress not only for scientific discovery, but also for problem solving and design.

In the above-mentioned essay, Popper introduces and utilizes two essential ideas from the selection theory: “instruction,” and “selection.” While following the ideas of “instruction” and “selection,” Popper conceptualizes progress in science by comparing its nature with the genetic evolution, by drawing similarities as well as pointing to differences. His arguments on instruction and selection are as follows:

> Adaptation starts from an inherited structure: … the gene structure of the organism. It corresponds … on the scientific level, the dominant scientific conjectures or theories. These structures are always transmitted by instruction … by the replication of the coded genetic instruction on the genetic [level] … and by tradition and imitation … on the [scientific level]. On [both] levels, the instruction comes within the structure. If mutations, or variations, or errors occur, then these are new instructions, which also arise from within the structure, rather than from without, from the environment.
>
> These inherited structures are exposed to certain pressures, challenges, or problems: to selection pressures, to environmental challenges, to theoretical problems. In response, variations of the genetically or traditionally inherited instructions are produced by methods which are at least partly random. On the genetic level, these are mutations and recombinations of the coded instruction … On the scientific level, they are new and revolutionary tentative theories. On all … levels we get new tentative trial instructions –or, briefly, tentative trials.
>
> It is important that these tentative trials are changes that originate within the individual structure in a more or less random fashion –

on all … levels. The view that they are not due to instruction from without, from the environment, is supported (if only weakly) by the fact that very similar organisms may sometimes respond in very different ways to the same new environmental change (Popper 1996a, 3).

The next stage is that of selecting from the available mutations and variations: those of the new tentative trials which are badly adapted are eliminated. This is the stage of elimination of error. Only the more or less well adapted trial instructions survive and are inherited in their turn. Thus we may speak of adaptation by 'the method of trial and error' –or better, by 'the method of trial and the elimination of error'. The elimination of error or badly adapted trial instructions, is also called 'natural selection'. It is a kind of 'negative feedback' that operates on all … levels.

It is to be noted that in general no equilibrium state of adaptation is reached by any one application of the method of trial and the elimination of error, or by natural selection. First, because no perfect or optimal trial solutions to the problem are likely to be offered. Secondly –and this is more important– because the emergence of new structures, or of new instructions, involve a change in the environmental situation. New elements of the environment may become relevant. And in consequence, new pressures, new challenges and new problems may arise as a result of the structural changes which have arisen from within the organism.

On the genetic level, the change may be a mutation of a gene, with a consequent change of an enzyme. Now the network of enzymes forms the more intimate environment of the gene structure. Accordingly, there will be change in this intimate environment. And with it, new relationships between the organism and the more remote environment may arise –and further, new selection pressures…. On the scientific level, the tentative adoption of a new conjecture or theory may solve one or two problems. But it invariably opens up many new problems, for a new revolutionary theory functions exactly like a new and powerful sense organ. If the progress is significant then the new problems will differ from the old problems: the new problems will be on a radically different level of depth.

…Mutations on the genetic level are not only random but completely 'blind' in two senses. First, they are in no way goal directed. Secondly, the survival of a mutation cannot influence the further mutations, not even the frequencies or probabilities of their occurrence (though admittedly, the survival of a mutation may

> sometimes determine what kind of mutations may possible survive in future cases…. (Popper 1996a, 4-5)

On the scientific level, there also exists a certain degree of blindness and randomness in the trials. But, it is an active process and it is goal directed. One actively engages in the problem situation, searches and investigates, and one can learn from the mistakes, and avoid repeating them in the forthcoming trials, and from the successful trials. In Popper's words, "the experience," which "*Gestalt* psychologists call 'insight'" plays an active role in such activities.[15] Following arguments are relevant for the present purposes:

> … it must not be overlooked that even a discovery accomplished by 'insight' might be *mistaken*: every trial, even one with 'insight', is of the nature of a conjecture or a hypothesis. [Wolfgang] Köhler's apes, it will be remembered, sometimes with 'insight' on what turns out to be a mistaken attempt to solve their problem. And even great mathematicians are sometimes misled by intuition…. (Popper 1996a, 5)

On the other hand, Köhler and William Homan Thorpe were right in proposing the "trials of the problem-solving animals are in general not completely "blind." Popper (1996a, 6) argues that

> … Only in extreme cases, when the problem which confronts the animal does not yield to the making of hypotheses, will the animal resort to more or less blind and random attempts in order to get out of a disconcerting situation. Yet even these attempts, goal-directedness is usually discernible, in sharp contrast to the blind randomness of genetic mutations and recombinations.

[15] These issues are advanced and more comprehensively discussed by Campbell (1956a, 1960, 1974). I will pursue them further in the following section where I summarize and discuss Campbell's contributions on evolutionary epistemology.

In these conceptions, Popper's distinction between the biological evolution and the evolution of world 3 structures is essential. While the gene structure is the unit of heredity in biological evolution, which is specific only to biological evolution, for example in science the unit of heredity is the thought content of the "dominant scientific conjectures or theories," and the tradition is the means of their instruction. There are also two important distinctions to mention. First, human made things or world 3 constructs are the products of human imagination and creativity. For Popper (1994: 7) this aspect is connected with the human language that encourages "story telling, and thus creative imagination." Popper argues,

> It is one of the novelties of human language that it encourages story telling, and thus *creative imagination.* Scientific discovery is akin to explanatory story telling, to myth making and to poetic imagination….

Connected with this, thoughts can be externalized, or represented exosomatically. In Popper's formulation, in this sense, "… they become objects outside ourselves: objects open to investigation." Consequently, they are now open to *criticism.* This aspect substitutes actual trial and error. By criticizing representations of new structures we can "let them die in our stead," we can try much iteration, but more important, we can learn from these processes. This aspect is not only essential for evolutionary epistemology, but also for the existence of world 3 (and thus, three-world ontology) and critical or scientific method.[16]

To sum up, we can say that in evolutionary terms, progress is related with three important aspects: instruction, selection, and trial. As it would seem, instruction refers to a "conservative or traditional or historical element" while selection involves error elimination and filtering by criticism. The implicit element in Popper's model is the "trials," searches into unknown in the creative

[16] I will discuss these issues more closely in the succeeding sections.

process or in the progress, an entity that departs from what was instructed, or what already existed.[17]

Such a structure, namely "eliminationalist or selectionist approach," or in general terms "evolutionary" approach is in opposition with the "inductivist view of science," and the Lamarckian view of evolution. Popper (1996a, 7-8) argues that

> The inductivist or Lamarckian approach operates with the idea of *instruction from without,* or from the environment. But the critical or Darwinian approach allows only *instruction from within* –from within the structure itself.

Here, Popper's correspondence of "inductivism" with the "Lamarckian theory of evolution" and "critical approach" with the "Darwinian theory of evolution," and his identification of the opposition between these two dominant models, are remarkable. As I have already mentioned in the introduction, such correspondence and opposition also exists in architectural design. However, in architecture, generally the correspondence is set between architecture and science, design method and scientific method.

These considerations mainly addressing science and scientific discovery can be applicable to other fields, including architecture. Therefore, it is not unexpected that by referring to Gombrich (1960), Popper (1996a, 9) makes the following arguments:

> … Darwinism is right, even on the level of scientific discovery, and … it is right even beyond this level: that is right even on the level of artistic creation. We do not discover new facts or new effects by copying them, or by inferring them inductively from observation,

[17] This issue is further investigated by Campbell (1956a, 1960, 1974), and Popper's (1974) response to Campbell's (1974) essay "Evolutionary Epistemology" is particularly instructive. I left Popper's response for the succeeding sections where I summarize and investigate Campbell's contribution.

> or by any other method of instruction by the environment. We use, rather, the method of trial and elimination of error. As Ernst Gombrich says, 'making comes before matching': the active production of new trial structure comes before its exposure to eliminating tests.

At first sight, this reference is primarily methodological, that is to say, about the nature of the artistic creation or the creative process. Therefore, for example, its application to the design process, as it is for artistic making, would be easily possible.[18] But, the evolutionary conception of progress applies not only to the creative process, or it does not only have methodological implications for architecture. Since it is about progress, it also relates to architecture's utopian dimension, and its aforementioned responsibility for change and betterment, where such notions are viewed as implicitly carrying an argument of "progression."

This issue will be discussed and elaborated in the following chapters in architectural terms. At this point, I will pursue the inquiry by introducing Popper's "evolutionary" conception of teleological achievements and ends-guided processes. Actually, this issue is complementary with the argument of progression, and therefore must be evaluated as the continuation of the discussion initiated at the present section.

### 2.1.3 Evolutionary Conception of Teleological Achievements and Ends-Guided Processes

The theory of evolution does not include an argument of teleology and in essence, it does not refer to an ends-guided process. For this reason, evolutionary models of design often tend to follow Lamarckian lines rather than Darwin's, or sometimes misconceive or distort the original conception of evolution to adapt it to the specificities of design, but at the same time by destroying its essential and valuable content. This is not the only option, since

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[18] Actually, as I have already stated in the introduction, such investigations already exist, and they form a line of inquiry and a tradition that comes down to the present day.

the theory itself, without destroying its essence, permits purpose, and teleology. In this suggestion, my main reference is Popper's "Of Clouds and Clocks" of 1965, where, in Campbell's (1974, 420) words, Popper presents the "natural selection paradigm as the universal non-teleological explanation of teleological achievements, of ends-guided processes …." In the present section, I will briefly introduce and discuss the related parts of the essay.

In "of Clouds and Clocks," Popper (1972a) describes two systems, which represent two paradigmatic extremes: "Clouds," are the representative of the systems that are "like gases ...highly irregular, disorderly, and more or less unpredictable," while "clocks" are the representative of systems that are "very reliable ... regular, orderly, and highly predictable in their behaviour." We may place all possible systems between these two extremes.

Thinking or claiming all complex systems as "clocks" is what Popper calls "physical determinism." A world based on such a system is "totally designed" or blueprinted, and "everything that happens … is physically predetermined, including all our movements and therefore all our actions." Popper interprets this as a "deterministic nightmare," where "…all our thoughts, feelings, and efforts can have no practical influence upon what happens in the physical world: they are, if not mere illusions, at best superfluous by-products ('epiphenomena') of physical events" (1972a, 217). Such a system implies that "every physical event in the distant future (or in the distant past) is predictable with any desired degree of precision, provided we have sufficient knowledge about the present state of the physical world" (Popper 1972a, 221).

Such a determinist system is by nature "closed." In Popper's (1972a, 218-219) words,

> … the only form of the problem of determinism which is worth discussing seriously is ... the problem which arises from a physical theory which describes the world as *a physically* complete or *a physically closed system* …. a physically closed system [is] a set or

> system of physical entities, such as atoms or elementary particles or physical forces or fields of forces, which interact with each other – and *only* with each other– in accordance with definite laws of interaction that do not leave any room for interaction with, or interference by, anything outside that closed set or system of physical entities. It is this 'closure' of the system that creates the deterministic nightmare.

On the opposing side, resides indeterminism (or physical indeterminism), which can be defined as the doctrine that "not all events in the physical world are predetermined with absolute precision, an all their infinitesimal details" (Popper 1972a, 220). Referring to Charles Sanders Peirce (1960), Popper argues that in reality the physical world is an indeterminate system that is "ruled by laws of chance, or of randomness, or of disorder…" Contrary to the tendency of "physical determinism" that claims all complex systems (also clouds) are "clocks," the opposite is true: "… to some degree *all clocks are clouds;* or in other words, that only *clouds exist,* though clouds of every different degrees of cloudiness" (Popper 1972a, 213).

Therefore, "if determinism is true, then the whole world is a perfectly running flawless clock, including all clouds, all organisms, all animals, all men." On the other hand, if "… some other form of indeterminism is true, then sheer *chance* plays a major role in our physical world" (Popper 1972a, 226)

In either case the problem is, "how such non-physical things as purposes, deliberations, plans, decisions, theories, intentions and values, can play a part in bringing about physical changes in the physical world." This question is particularly relevant and important for the present study. It is often thought that architecture is primarily about (construction of) physical things and the change and transformation it offers, is only related with its physical being. This is not exactly true, it is actually the thought content invested in architecture, which leads to such changes and transformations. That is to say, when we talk about either "progressive social programs," or an architectural program as an "instrument of philanthropy and greater good," we actually operate in terms of such non-physical entities. As it would seem, the issue is directly related with the problem described at the beginning of the present study. As it is stated by Popper (1972a, 229), "it is clearly untrue that all those tremendous physical changes brought about hourly by our pens, or pencils, or bulldozers, can be explained in purely physical terms, either by a deterministic physical theory, or (by a stochastic theory) as due to chance."

I have already stated the reservations about the determinist alternative, so the only option that is available is the indeterminism. Still if we accept mere indeterminism, then we have to accept that the only possibility of change can be attributed to sheer randomness or chance, and inner relations and forces. Even if we reconsider indeterminism with the introduction of "openness," where outer interventions to the system are possible, still such interventions would be like any intervention or change free from their actual purposes, deliberations, plans, decisions, theories, intentions and values. Popper (1972a, 229-230) refers to Arthur Holly Compton (1969) for his formulation of the problem as follows:

> It was some time ago when I wrote to the secretary of Yale University agreeing to give a lecture on November 10 at 5 p.m. He had such faith in me that it was not announced publicly that I should be there, and the audience had such confidence in his word that they come to the hall at the specified time. But consider the great physical improbability that their confidence in his word that they came to the hall at the specified time. But consider the great physical improbability that their confidence was justified. In the meanwhile my work called me to the Rocky Mountains and across the ocean to sunny Italy. A phototropic organism (such as I happen to be, would not easily) ... tear himself away from there to go chilly New Haven. The possibilities of my being elsewhere at this moment were infinite in number. Considered as a physical event, the probability of meeting my engagement would have been fantastically small. Why then was the audience's belief justified? They knew my purpose, and it was my purpose [which] determined that I should be there.

Popper argues that “there are such things as letters accepting a proposal to lecture, and public announcements of intentions; publicly declared aims and purposes; general moral rules.” These have “a certain content, or meaning, which remains invariant if we translate it, or reformulate it. Thus *this content or meaning is something quite abstract.”* Yet they can control “… the physical movements of a man in such a way as to steer him back from Italy to Connecticut.” The question “how this can be” is the main problem that Popper calls “Compton's problem.” For Compton, solution of the problem “would have to comply with the postulate,” which is stated as follows:

> the solution must explain freedom; and it must also explain how freedom is not just chance but, rather, the result of a subtle interplay between *something almost random or haphazard,* and *something like a restrictive or selective control* –such as an aim or a standard–though certainly not a cast-iron control (Popper 1972a, 232).

An answer to this general problem would be also relevant for other areas including architecture. Popper (1972a, 240) provides the following solution:

> The higher levels of language have evolved under the pressure of a need for the *better control* of two things: of our levels of language, and our adaptation to the environment, by the method of growing not only new tools, but also, for example, new scientific theories, and new standards of selection.
>
> Now in developing its higher functions, our language has also grown abstract meanings and contents; that is to say, we have learned how to abstract from the various modes of formulating or expressing a theory, and how to pay attention to its *invariant content of meaning* (Upon which its truth depends). And this holds not only for theories and other descriptive statements, but also for proposals, or aims, or whatever else may be submitted to critical discussion.

The point is that one is not forced to submit oneself to the control of the theories, but review them critically to see if it meets one's standards to accept or reject it. In this sense, the control is two-sided, or “plastic.” That is to say,

> … not only our theories control us, but we can control our theories (and even our standards): there is a kind of feed-back …. And if we submit to our theories, then we do so freely, after deliberation; that is after critical discussion of alternatives, and after freely choosing between the competing theories, in the light of that critical discussion (Popper 1972a, 240-241).

Just after this formulation, Popper (1972a, 242) goes on to reconceptualize the theory of evolution itself by “restating” it as follows:

> My theory may be described as an attempt to apply to the whole of evolution what we learned when we analysed the evolution from animal language to human language. And it consists of a certain *view of evolution* as a growing hierarchical system of plastic controls. The Neo-Darwinist theory of evolution is assumed; but it is restated by pointing out that its ‘mutations’ may be interpreted as more or less accidental trial-and-error gambits, and ‘natural selection’ as one way of controlling them by error-elimination.

Such an evolutionary relation and a consequent plastic control also exist between, say, an artist’s intention and the work. Popper (1972a, 253-254) argues that

> Just as, in a system with plastic controls, the controlling and controlled subsystems interact, so our tentative solutions interact with our *problems* and also with our *aims*. This means that our aims can change and that *the choice of an aim may become a problem*; different aims may compete, and new aims may be invented and controlled by the method of trial and error-elimination.

> It is perhaps not uninteresting to see that artists, like scientists, actually use this trial-and-error method. A painter may put down, tentatively, a speck of colour, and step back for a critical assessment of its effect in order to alter if it does not solve the problem he wants to solve. And it may happen that an unexpected or accidental effect of his tentative trial –a colour speck or brush stroke– may change his problem, or create a new subproblem, or a new aim: the evolution of artistic aims and standards (which, like rules of logic, may be exosomatic systems of control) proceeds also by the trial-and-error method.

This is also true for architectural design, where an architect's problem is to design a building as a response to certain needs and a certain program, but also when he or she aims for a better human life. In the first case plastic controls exists between the aims, programs, intentions, and the designed object, in the second, through the designed object, between designer's program and the world he or she intends to make better.

### 2.1.4 Three Worlds

Popper's three-world ontology is not only one of the essential ideas of his evolutionary epistemology and the basis of his definition of the concept of "objective knowledge," but also it is a rigorous basis for expanding and advancing these ideas towards other fields. For the present study, on the one hand, as a part of the evolutionary epistemology it provides a conceptual framework, on the other, it helps to establish the link between these ideas and adapt them for the specificities of architecture and the present problem situation.

As it was stated in the very beginning of the present study, Popper's pluralist view of the world, namely his three-world ontology recognizes three distinct but interacting sub-worlds: the physical world, the mental world, and the world of the products of the human mind, of forms or ideas. Popper (1980, 143-144) describes this proposition as follows:

> There is, first, the world that consists of physical bodies: of stones and of stars; of plants and of animals; but also of radiation, and other forms of physical energy. I will call this physical world 'world 1'.
>
> So, we so wish, we can subdivide the physical world 1 into the world of non-living physical objects and the *world of living things,* of *biological* objects; though the distinction is not sharp.
>
> There is, secondly, the mental or psychological world, the world of our feelings of pain and of pleasure, of our thoughts, of our decisions, of our perceptions and our observations; in other words, the world of mental or psychological states or processes, or of subjective experiences. I will call it 'world 2'. World 2 is immensely important, especially from a human point of view or from a moral point of view. Human suffering belongs to world 2; and suffering, especially avoidable suffering, is the central moral problem for all those can help.
>
> World 2 could be subdivided in various ways. We can distinguish, if we wish, fully conscious experiences from dreams, or from subconscious experiences. Or we can distinguish human consciousness from animal consciousness.
>
> My main argument will be devoted to the defence of the reality of what I propose to call 'world 3'. By world 3 I mean the world of the products of the human mind, such as languages; tales and stories and religious myths; scientific conjectures or theories, and mathematical constructions; songs and symphonies; paintings and sculptures. But also airplanes and airports and other feats of engineering.
>
> It would be easy to distinguish a number of different worlds within what I call world 3. We could distinguish the world of science from the world of fiction; and the world of music and the world of art from the world of engineering. For simplicity's sake I shall speak about *one* world 3; that is, the world of the products of the human mind.

About world 3 Popper (Popper and Eccles 1977, 449) makes the following arguments:

> World three is the world of the products of the human mind. These products, in the course of evolution, were first probably encoded only in the human brain and even there only in a fleeting way. That is to say, if an early man told a story of a hunt, or something like that, then the story would be both encoded in his brain and in the brains of his listeners, but it would soon be forgotten and in a sense disappear. The more characteristic objects of World 3 are objects which are more lasting. They are for example, early works of art, cave paintings, decorated instruments, decorated tools, boats, and similar World 1 objects.

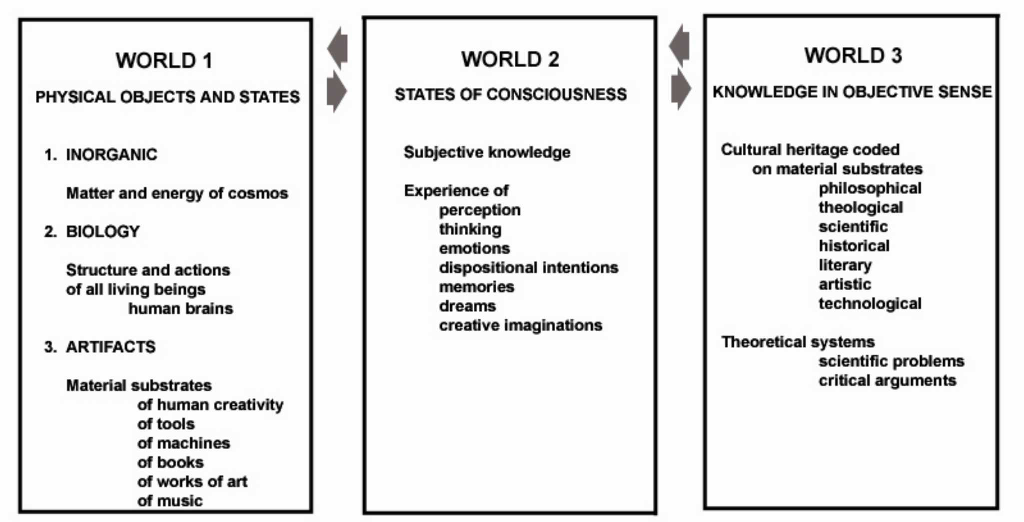


Figure 1 Popper's Three-world Ontology (Redrawn by the author after Eccles) (Popper and Eccles 1977, 359).

As it would seem, "many of the objects belonging to world 3 belong at the same time also the physical world 1." For example, "Michelangelo's sculpture *The Dying Slave* is both a block of marble, belonging to the world 1 of physical objects," but also it is a creation of Michelangelo's mind, and in this sense belonging to world 3 (Popper 1980, 144). It is same for, say, paintings, and also architectural designs. In Popper's words, "this situation can be seen most clearly in the case of the books." The argument goes as follows:

> A book, say volume one of my own set of Shakespeare's *Works,* is a physical object, and as such it belongs to world 1. All the individual books belonging to same edition are, as we know, physically very similar. But what we call 'one and the same book' - say, the Bible- may have published in various editions which physically are vastly different. Let us assume that all these editions contain the same text; that is, the same sequence of sentences. In so far as they do, they are all editions, or copies, of *one and the same* book, one and the same world 3 object, however dissimilar they may be from a physical point of view. Obviously, this *one* book in the world 2 sense is not *one* book in the physical sense (Popper 1980, 144-145).

If we refer to Figure 1, world 3 is about "knowledge in the objective sense," that is to say, either "cultural heritage," philosophical, theological, scientific, historical, literary, artistic, technological, architectural, and "theoretical systems," scientific problems, critical arguments, "coded on material substrates." World 1, on the other hand, refers to "matter and energy of cosmos," "structure and actions of all living beings and human brains," but more important, to the artifacts; material substrates of human creativity, tools, machines, books, works of art, architectural designs, and music.

Since they conceptualize the problem in a higher level, these arguments are prone to hinder the true potential inherent in them: actually, they imply more than they seem to be. For example, when we think about Michelangelo's *Dying Slave, i*f the concern is the "thought contents," not the physical things, we can learn from, say, a novel, not only the idea of love, the idea of betrayal, the idea of misunderstanding, but also how to write a novel, how to structure it and how to bring things together. A book, as a physical object, might carry or possess ideas those might not be actually its reason for existence. Say, one can learn from a book the idea of binding, also, how to do it. As it would seem, the idea of "binding," too, is carried by a book, and perhaps it is more meaningful for a person who deals with, say, the binding techniques, rather than what was written in it. This is true for the *Dying Slave,* while for an art historian it possesses ideas about Renaissance Sculpture, and its place in the history of sculpture, an artist might be more interested in its techniques and the way it interprets a human body.

Popper (1972a, 122-123) argues that his “third world” has much in common with “Plato’s theory of Forms or Ideas.” He argues that

> In a sense World 3 is a kind of Platonic world of ideas, a world which exists nowhere but which does have an existence and which does interact, especially, with human minds –on the basis, of course, of human activity. It can also interact with physical things, for example, if a musical score is duplicated, or if a record is made. And a record may operate directly on a loudspeaker without human being intervening. (Popper and Eccles 1977, 451).

However, Popper (Popper and Eccles 1977, 451) also points out that although “World 3 is perhaps best conceived along Platonic lines, there are, of course very considerable differences between the Platonic world of ideas and World 3…” He describes these differences as well as the common points as follows:

> Plato’s third world was divine; it was unchanging and, of course true. Thus there is a big gap between his and my third world: my third world is man-made and changing. It contains not only true theories but also false ones, and especially open problems, conjectures, and refutations.
>
> And while Plato, the great master of dialectical argument, saw it in merely a way leading to the third world, I regard arguments as among the most important inmates of the third world; not to speak of open problems.
>
> Plato believed that the third world of Forms and Ideas would provide us with ultimate explanations … Thus, he writes for example: ‘I think that if anything else apart from the idea of absolute beauty is beautiful, then it is beautiful *for the sole reason* that it has some share in the idea of absolute beauty. *And this kind of explanation applies to everything.’*

> This is a theory of *ultimate explanation;* that is to say, of an explanation whose explicans is neither capable nor in need of further explanation. And it is a theory of *explanation by essences;* that is, by hypostasized words.
>
> As a result, Plato envisaged the objects of the third world as something like non-material things, or, perhaps, like stars of constellations –to be gazed at, and intuited, though not liable to be touched by our minds. This is why the inmates of the third world – the forms and ideas– became concepts of things, or essences or natures of things, rather than theories or arguments or problems (Popper 1972a, 123).

For Popper, “Plato’s main error,” was the “problem of universals,” which “…should be replaced by ‘the problem of theories,’ or the ‘problem of theoretical content of all human language’” (Popper 1972a, 123-124) World 3 differs from Plato’s world of forms or ideas in the following respects: Plato's world of forms or ideas is unchanging and divine. It contains absolute and timeless constructs. However, world 3 is man-made and changing. It contains temporal, open, and conjectural constructs, including theoretical and argumentative systems, problems, and problem situations.

The objects of world 3 are the products or constructs of the human mind, theories and conjectures, tools, social institutions, works of engineering, works of art, and architectural designs. World 3 constructs are the outcome of (largely subjective) mental processes of the human mind, and they may be exosomatically represented or formulated. Yet, after their mental formulation and exosomatic representation, they become autonomous constructs which may be read, apprehended, interpreted, critically evaluated, and used and reused independent from their world 1 and world 2 associations.[19]

World 3 is a standalone and (partially) autonomous construct itself, yet it is a product of the human mind and it has a strong feedback affect upon the mental

[19] Popper (1972a, 109) argues that theoretical and argumentative systems and problems in this sense are “totally independent of anybody's claim to know; [they are] also independent of anybody's belief, or disposition to assent; or to assert, or to act. Knowledge in the objective sense *is knowledge without a knower*: it *is knowledge without a knowing subject.”*

world, and through it, has an instrumental affect upon the physical world, especially upon its construction and transformation.[20] The mutual interaction of the mental world and physical world with world 3 is the source and origin of the conception or creation of every new construct, all problem solving, human understanding, and human learning. In other words, these epistemic acts are actually grounded on world three; all operate in terms of world 3 constructs.

The following citation from Popper (1972a, 107-108) illustrates the “independent existence of” world three:

> … All our machines and tools are destroyed, and all our subjective learning, including our subjective knowledge of machines and tools, and how to use them. But, *libraries and our capacity to learn from them* survive. Clearly, after much suffering, our world may get going again.
>
> … As before, machines and tools are destroyed, and our subjective learning, including our subjective knowledge of machines and tools, and how to use them. But this time, *all libraries are destroyed also,* so that our capacity to learn from books becomes useless.

The key here is the books are the containers of knowledge, or more specifically objective knowledge, and in evolutionary terms, they can be interpreted as the vehicles of conceptual inheritance. While, in the second case, “there will be no re-emergence of our civilization for many millennia,” in the first case it would be possible because of this possibility of inheritance.

As it would seem, these arguments are not limited to scientific knowledge, but can be generalized to all products of the human mind and all objective contents of thought.

[20] Especially see Popper’s “Of Clouds and Clocks,” in *Objective Knowledge* (1972a, 206-255).

### 2.1.5 An Evolutionary Approach to World Three

Apart from its autonomy, one essential aspect of world 3 is its evolutionary nature. Popper, (1972a, 112) in his introduction to his defense of this argument states that

> A biologist may be interested in the behaviour of animals; but he may also be interested in some of the *non-living structures* which animals produce, such as spiders' webs, or nests built by wasps or ants, the burrows of badgers, dams constructed by beavers, or paths made by animals in forests.

Popper distinguishes between two categories of problems concerning the study of these structures. The argument is as follows:

> The first category consists of problems concerned with *the methods used* by the animals, or *the ways the animals behave* when constructing these structures. This first category thus consists of *problems concerned with the acts of production*; with the behavioral dispositions of the animal; and with the relationships between the animal and the product.
>
> The second category of problems is concerned with the *structures themselves.* It is concerned with the chemistry of the materials used in the structure; with their geometrical and physical properties; with their evolutionary changes, depending upon special environmental conditions; and with their dependence upon or their adjustments to these environmental conditions. Very important also is the *feedback relation* from the properties of the structure to the behaviour of the animals.
>
> In dealing with this second category of problems –that is, with the structures themselves– we shall also have to look upon the structures from the point of view of their biological *functions*. Thus some problems of the first category will admittedly arise when we discuss problems of the second category; for example, 'How was this nest built?' and 'What aspects of its structure are typical (and thus, presumably traditional or inherited) and what aspects are variants adjusted to special conditions?' (Popper 1972a, 112-113).

The point is, “the problems concerned with the production of the structure … will sometimes be suggested by problems of the second category.” For Popper, “this must be so, since both categories of problems are dependent upon *the fact that such objective structures exist,* a fact which itself belongs to the second category.” In this sense, first, “structures themselves” may be interpreted as the source of the both categories of problems, second, in this sense, we may also say that “problems connected with the structures themselves –is more fundamental” (Popper 1972a, 113). Pursuing these ideas further, consequently, Popper (1972a, 113-114) (re)formulates his argument as follows:

> … in the present situation in philosophy, few things are as important as the awareness of the distinction between the two categories of problems -production problems on the one hand and problems connected with the produced structures themselves on the other.
>
> … we should realize that the second category of problems, those concerned with the products themselves, is in almost every respect more important than the first category, the problems of production.
>
> … the problems of the second category are basic for understanding the production problems: contrary to the first impressions, we can learn more about production behaviour by studying products themselves than we can learn about the products by studying production behaviour. This third thesis may be described as an anti-behaviouristic and anti-psychologistic thesis.

The approach proposed by these three theses is called “objective” approach, or the “world three” approach. Owing to the emphasis on the “objective product” and its evolutionary nature, the implied model is “neither teleological nor unscientific.” Actually, Popper’s introduction is just for illustrating his point, and for convenience, in Popper’s (1972a, 113) words, these considerations can be applicable to “… [the] products of human activity, such as houses, or tools, and also to works of art.” This final argument is essential for the present study;

actually, in a way the present study can be interpreted as an attempt for questioning and seeking how to accomplish such an application.

### 2.1.6 Memetics

For Dawkins (1989, 192) "*mémé*" stands for replicating units of cultural evolution, analogous to genes in biological evolution. One of the sources of the concept of *mémés is* Popper's evolutionary epistemology, and sometimes *mémés* are evaluated as corresponding to the world 3 structures. In *The Selfish Gene* prior to his conceptualization of *mémé*, Dawkins (1989, 190) refers to Karl Popper's analogy between scientific progress and genetic evolution as one of the predecessors of his study. In fact, in general, Popper's concept of world 3 and evolutionary epistemology can be evaluated as one of the roots of memetics. But the rationale behind introducing and discussing the concept of memetics at this point is not that it is an advancement on three-world ontology, but that, it has been used as a conceptual basis for the studies concerning evolutionary models of design. Actually, Popper's world 3 and world 3 objects differ from memetics and *Mémés* in some very essential aspects, and an explication of these would be helpful in clarifying the position (and difference) of the present study. Dawkins's (1989, 192) description of the roots of the word is worth to quote here:

> The new soup is the soup of human culture. We need a name for the new replicator, a noun that conveys the idea of a unit of cultural transmission, or a unit of *imitation.* 'Mimeme' comes from a suitable Greek root, but I want a mono syllable that sounds a bit like 'gene'. I hope my classicist friends will forgive me if I abbreviate mimeme to *mémé.* If it is any consolation, it could alternatively be thought of as being related to 'memory', or to the French word *mémé*.
>
> [*Mémé*s can be] tunes, ideas, catch-phrases, clothes, fashions, ways of making pots or of building arches. Just as genes propagate themselves in the gene pool by leaping from body to body via sperms or eggs, so *mémé*s propagate themselves in the *mémé* pool

> by leaping from brain to brain via a process which, in the broad sense, can be called imitation (Dawkins 1989, 190).

The transfer of a *mémé* is described as follows: “When you plant a fertile *mémé* in my mind you literally parasitize my brain, turning it into a vehicle for the *mémé*'s propagation in just the way that a virus may parasitize the genetic mechanism of a host cell” (Dawkins 1989, 192). For example, a memorable phrase of a symphony is a *mémé*:

> If a single phrase of Beethoven's ninth symphony is sufficiently distinctive and memorable to be abstracted from the context of the whole symphony, and used as a call-sign of a maddeningly intrusive European broadcasting station, then to that extent, it deserves to be called one *mémé* (Dawkins 1989, 195).

What is the difference between the conceptual frameworks of memetics and of world three? Perhaps the first thing that comes to mind is that world 3 is a part of two interrelated larger and comprehensive models or worldviews, the evolutionary epistemology and three-world ontology. Second, *mémés* are introduced as units, culture-specific correspondent of genes, while world 3 structures are ideas, thought contents or theoretical constructs. Langrish (2004, 16) argues that what Dawkins calls “unit” actually must refer to a pattern. Therefore *mémés* should actually be patterns. However, this does not equalize world 3 constructs with *mémés.* Third, Dawkins suggests imitation as one of the ways which *mémés* propagate them from brain to brain. On the contrary, world 3 structures need to be understood and interpreted and made one’s own schemata to be used and utilized in new designs, therefore transferred. Moreover, as it would seem, the transference of these structures does not occur exactly from brain to brain. The essence of Popper's evolutionary epistemology is that it requires externalization or exosomatic representation of thought contents. There is no way of transferring ideas from one brain to another.

World 3 stands for this externalization, but more important, criticism and understanding require this externalization.

In fact this externalization component was introduced to *memetics* by Dennett later on, and with his revised conception it became closer to world 3 structures. In Dennett's (1995, 384) reconception,

> *Mémé*s are invisible and "carried by *mémé* vehicles -pictures, books, sayings, (in particular languages, oral or written, on paper or magnetically encoded etc.). Tools and buildings and other inventions are also *mémé* vehicles. A wagon with spoked wheels carries not only grain or freight from place to place; it carries the brilliant idea of a wagon with spoked wheels from mind to mind. A *mémé*'s existence depends on a physical embodiment in some medium; if all such physical embodiments are destroyed, that *mémé* is extinguished ….

In this conception, *mémé* is interpreted as an "idea," a world 3 construct that is carried by some vehicle, represented, or externalized. He argues that Dawkins' new replicators are

> … roughly, ideas. Not the 'simple ideas' of Locke and Hume (the idea of red, or the idea of round or hot or cold), but the sort of complex ideas that form themselves into *distinct memorable units*-such as the ideas of "arch, wheel, wearing clothes, vendetta, right triangle, alphabet, calendar, the *Odyssey,* calculus, chess, perspective drawing, evolution by natural selection, impressionism, 'greensleeves', deconstructionism (Dennett 1995, 384).

These reconsiderations do not mean an advance of memetics over Popper's world 3 and his conception of ideas. However, in a sense, they equate *mémés* with the world 3 objects.

## 2.2 Donald Campbell: The "Blind-Variation-and-Selective-Retention" Process

One of Donald Campbell's important advances on the theory of evolution is his exploration of the applicability and relevancy of this theory in knowledge processes such as learning, problem solving, thinking, and particularly creative thought and creativity. In doing this, the main argument of Campbell (1960) is that all the inductive achievements, genuine increases in knowledge, and increases in fit of a system to environment is essentially based on blind-variation-and-selective-retention process. Any process which shortcuts blind-variation-and-selective-retention should be based on earlier knowledge or wisdom of some type, adaptable or applicable to the situation that are in fact inductive achievements themselves achieved originally by blind variation and selective retention. This is what Campbell calls "selective retention paradigm," which is fundamentally based on trial-and-error with an "evolutionary" argument. The process has following characteristics: "a mechanism for introducing variation," namely a series of –blind- trials which attempt to make a forward move which carry the process from one stage to another. A "consistent" intentional "selection process" which eliminates the unsuccessful trials while keeping the successful ones. Finally "a mechanism" for preserving the successful-so-far variations, and a "mechanism" for transferring them to the next series of trials (Campbell 1960, 1974).

Campbell's introduction of and insistence on using the term "blind" instead of usual "random" in his evolutionary model is noticeable. For him, processes which concern "systematic sweep scanning are recognized as blind," insofar as variations are produced without prior knowledge of some type which directly provide a "selectworthy encounter" (Campbell 1960, 381) In this sense they are not "random."

Campbell's (1960, 381) following presentation of the three connotations of blind are important for his conception of the evolutionary model: first, the emission of variations are independent from the environmental conditions, second, the occurrence of trials are uncorrelated with the solution, and third, variation subsequent to an incorrect trial is not a "correction" of the previous trial or makes use of the direction of error of the previous one. Any evidence against these is an indicator of an earlier knowledge or wisdom of some type either reused or adapted to the present condition.

It is often underlined that, in human problem solving and design, some sort of already achieved relevant knowledge and wisdom reduces the frequency of blind search, or trial-and-error is not random or blind at all (Simon 1969, Akın 1986, Newell, Shaw and Simon 1958). For example in the *Sciences of the Artificial,* Simon (1969, 98) argues that existence of previous knowledge or experience gained from "similar" or earlier problems affects the frequency of "trial and error" in the problem solving activity to the degree that it can be "altogether eliminated." Similarly, Newell, Shaw and Simon (1958, 161) put forward the idea of "space" of possible solutions, where "trial-and-error attempts take place." In their words,

> …To approach a problem 'meaningfully' is to have a strategy that either permits the search to be limited to a smaller sub-space, or generates elements of the space in an order that makes probable the discovery of one of the solutions early in the process (Newell, Shaw and Simon 1958, 161).

It is true that previous knowledge and wisdom provides a basis to begin with and proceed, and it provides shortcuts in creative search in various stages and levels. In fact this is required, since no problem solving starts from a *tabula rasa.* But "knowledge" cannot altogether eliminate the "blind" search since what is creative and new is what is –yet- unknown. If we reformulate, if "creativity" means going beyond what was already known and achieved, therefore it should be blind. Knowledge of earlier solutions is essential to problem solving, but even the use of earlier forms for the conception of new ones is not about basic repetition or imitation but requires interpretative/creative modification prior to their application to new conditions, which also require a type of blind-variation-and-selective-retention process.

Simon (1969, 95-96) further argues that problem solving activity "involves much trial and error," and "the more difficult and novel the problem, the greater is likely to be the amount of trial and error required to find a solution." However, "at the same time, the trial and error is not completely random or blind," as it was in biological evolution, but "…it is in fact, rather highly selective" (Simon 1969). He states that

> the new expressions that are obtained by transforming given ones are examined to see whether they represent progress toward the goal. Indications of progress spur further search in the same direction; lack of progress signals the abandonment of a line of search (Simon 1969, 95-96).

This might mean even if we do not possess any prior knowledge or experience related with the current problem situation, we could still determine the course of our search towards a goal: "problem solving requires selective trial and error" (Simon 1969, 96). However, drawing a "search" direction should also be a trial, and precede our evaluation of whether the line was progressive or not, if it was not based on an earlier wisdom of some type. In addition, a currently progressive line does not guarantee that it will remain so, or it will yield a successful solution, respectively a currently regressive line may turn into a progressive one if pursued further, and may lead to a successful solution. This discussion is particularly related with the arguments related with indeterminism, which I made in the previous sections.

The second account that seems to be conflicting with the idea of blind-variation-and-selective-retention, or evolutionary process is that design and problem solving are purpose-oriented and teleological activities. One tentative solution to this conflict presents itself as the deformation or distortion of the theory of evolution by introducing a determinist argument to the original idea.

Another solution might be rejecting the evolutionary nature of design and conceptualize the activity with inductivist and determinist tones. But, this is not necessary, as I have already discussed in the previous section, the theory of evolution does not conflict with the idea of progress, purpose, and teleology. On the contrary, it provides a theory that explains such achievements without falling into determinism.

In architecture, we may distinguish at least two main types of teleological achievements, which an architectural problem solving activity might concern: the first is intrinsic to the activity or the process itself and actually embedded in it. It concerns construction or design of an architectural design that should provide a –potential- solution to an architectural problem, which was stated in the program or the brief. In this sense, the “program” or purpose is an element that actively plays a constructive or formative role in the process. The second resides beyond the process and the design. It concerns for example an intended change in the environment through architecture; better living conditions, a livable city, more accessible environment and buildings.

However, the possibility of intentionality does not merely lies in the “making,” or in the “trials,” but equally in the “selection” process, and in the inherited elements. In other words, in architectural problem solving, or design, goals are not totally attained through foresightful moves following some type of intention, purpose or program, but also by the elements inherited from tradition or previous wisdom and also to a degree “blind” “trials,” and the selection of unsuccessful trials followed by bearing on to explore the best-so-far trial lines. Internal to the design process, program or purpose neither directly implies the solution nor prescribes the formalization of the solution, but it is rather good for selection and judgment. External to the process, they are like proposals, or conjectures. That is to say, they are not anymore used as selection, but the designed object, after its solidification, is evaluated by factors external to the process.

Teleological achievements in architectural problem solving are not attained – fully- through direct formalization process of something like the program, plan, aim, or purpose, but through formation, evaluation, and reformation process that involves blind-variation-and-selective-retention. If they are not already associated with already existing "solutions," program or aim is not good for directly "forming" the solution but for "selection" and through the selection process for guiding the course of "search" and consequently determining the "solution."

Campbell's insistence of "blindness" of the trials or variations instead of "randomness" in exploratory and creative trials is one of his important contributions to the evolutionary model. This conception structures the relation between the previous knowledge and the advance from that knowledge. Blind variations or trials set out from where the past knowledge ends or they are not applicable to the present situation. Existence of some type of relevant knowledge (such as methods and strategies, partial solutions, etc.) -although they still do not guarantee success- is what makes the difference between "blind" search and "random" search.

Before finalizing my discussion on Campbell's contribution, it would be fruitful to cite some arguments made by Popper as a response to Campbell's "Evolutionary Epistemology." While drawing attention to the great "agreement" of Campbell's contribution with his epistemology, Popper (1974, 1059) identifies an "astonishing anticipation of some things which he had not yet published." However, he draws attention to a few points, which either do not take place in Campbell's arguments or, deserve to be more emphasized. I would like to restate them at this point before ending this section.

Popper argues that "blindness" of the trials in trial and error method is one point that deserves a special mention in Campbell's theory. His arguments go as follows:

> I have sometimes compared the human situation in the quest for new knowledge with the proverbial situation of a blind man who searches in a dark room for a black hat which is –perhaps– not there. This … indicates that the searcher at least acts as if he had a problem. I have often added that the trial movements of the searcher will not be completely random. There are various reasons for this, both positive and negative. The positive ones are in the main that the searcher has a problem to solve, and that this means that he has some knowledge, however fuzzy, previously acquired by essentially the same trial-and-error method; this knowledge serves as a guide, and eliminates complete randomness. A negative argument is that randomness, and the associated idea of (probabilistic) independence in the sequence of trials, are hardly applicable: the tosses with a penny may be random, but only with respect to a definite property –heads or tails. There must be a definite, given *order* if we want to speak of randomness, such as the orderly sequences of tosses with a penny, considered from the point of view of which side comes up; here we have definite "elementary events"; we do not even know what is the maximum activity that constitutes *one* trial(event) rather than two. (Popper 1974, 1061).

These statements are clearly in congruence with Newell, Shaw and Simon's (1958) proposal: "trial-and-error attempts take place" in a "space" of possible solutions. However, like Campbell, Popper, too proposes that "… the trials are *forays into the unknown."* He argues that "Campbell, who explains why he does not call [trials] random, calls them 'blind'," in Popper's words "an excellent term." Popper reformulates this as follows: "… so far as they are trials in a trial-and-error movement –that is, so far as they are forays into unknown– they are blind; while to the degree that past knowledge enters, their blindness is only relative: it begins where the past knowledge ends" (Popper 1974, 1061-1062). This is actually an excellent remark, which clarifies the meaning and place of "blindness" in the model. Popper further pursues his arguments by introducing a point where Campbell "does not go." He proposes that

> …The blind trial stands not only under the influence of the exploratory drive or instinct, but also under the influence of the experience of error –the experience that is wrong, that this is *not* the solution. This point (which he of course would concede) seems to me so important because it becomes on the human level the basis of our *criticism* of the result of our trials (Popper 1974, 1062).

Popper also emphasizes the importance of his three-world ontology, and particularly world 3 which Campbell does not explicitly refers to.

### 2.3 Stephen Toulmin: Conceptual Inheritance and Conceptual Change

> *If the theory of human understanding is to follow the rest of twentieth-century science and history, then, it must be based not on unchanging principles and guarantees, but on developing interactions between Man, his concepts, and the world which he lives. Human variability is restricted only within the slowly changing limits of our genetic constitution and cultural experience. The problem of human understanding in the twentieth century is no longer an Aristotelian one, in which Man's epistemic task is to recognise the fixed Essences of Nature; nor is it an Hegelian one, in which Human Mind alone develops historically against a static background of Nature. Rather, it is a problem that requires us to come to terms with the developing relationship between Human Ideas and a Natural World, neither of which is invariant. Instead of Fixed Mind gaining command over Fixed Nature by Applying Fixed Principles, we should expect to find variable epistemic relationships between a variable Man and a variable Nature.*
>
> *—Stephen Toulmin, Human Understanding*

The theme of this section is the conceptual inheritance and the conceptual change, and Toulmin’s interpretation of the theory of evolution. These issues are primarily related with the evolutionary models proposed in this study, and actually, as it would seem in the following chapters, they are essential not only as the basis for the proposed models but also for the related theses.

In Toulmin's (1972) words, “We need only recognize that the conceptual abilities we exercise as adults are, primarily those that we have inherited,” either by physiologically or by enculturation. He argues that

> We may … criticize the particular forms of life and understanding into which we have grown up, seeking to improve on them and working beyond them to better forms; so our individual reflective thought may innovate on, modify and eventually replace those inherited concepts. In this case, both the original concepts and their replacements will be not merely products of a cultural process but also expressions of our native capacities. Yet that duality will make no difference to the operative questions in the case: namely what considerations play a part in conceptual innovation, and how novel conceptual variants are to be judged. For these purposes, the earlier forms of concept remain the starting-points for all subsequent innovations, and the new “reformed” concepts will be potential property of all our fellows quite as much as their predecessors. Neither old nor new concepts will be manifestations of universal genetical properties, or of our private experiences alone. So we come back to the first, inescapable point. Our personal beliefs find expression only through the use of communal concepts. The new moulds in which our individual thoughts are cast acquire a definite form only when they become -at any rate, potentially- the collective intellectual instruments of an appropriate community (Toulmin 1972, 39-40).

In the fifth chapter of his *Human Understanding*, Toulmin questions possibilities of extension of the ideas of evolutionary theory to “social, political, cultural or intellectual” development. He remarks that,

> The suggestion that cultural and intellectual change should be accounted for in evolutionary terms has had a long and chequered history. From the time of … Darwin on, there have been recurrent attempts to extend ideas from the *Origin of Species* to social or political, cultural or intellectual development (Toulmin 1972, 319).

One of such attempts is Thomas Henry Huxley's lecture titled "The Coming of Age of the Origin of Species," given at the Royal Institution in 1880, where Huxley attempted to apply "Darwinian idioms," "directly" to the history of science, although he failed to "… show what real light the phrase 'struggle for existence' could throw on the processes of intellectual change." His arguments, as they are cited in Toulmin (1972, 319) are as follows:

> The struggle for existence holds as much in the intellectual as in the physical world. A theory is a species of thinking, and its right to exist is coextensive with its power of resisting extinction by its rivals.

Much more recently, Jacques Monod declared that

> a transmittable idea constitutes an autonomous entity … capable of preserving itself, of growing, of gaining in complexity; and is therefore the object of a selective process, of which modern culture is the current but in every way evolving product (Toulmin 1972, 319).

However, Toulmin states that as Huxley, Monod, too, puts forward these as only a programme or a schema. Monod states that an "evolutionary theory of ideas" which he calls for has never been worked out in detail, and proposes, "… we shall some day have … a Natural History of the Selection of Ideas."

Ernst Mach, too, attempted for "generalizing the concept of evolution." In Toulmin's (1972, 320) words, "he was much taken by the possibility of extending Darwinian categories from the history of organic species into the history of thought." Toulmin (1972, 320) argues that Mach particularly suggested that "The 'disciplinary missions' of natural sciences … were simply one aspect of the same broader 'historical mission' that underlay organic evolution itself." For Mach,

> Expressed very briefly, the task of scientific knowledge now appears as: the adaptation of ideas to facts and the adaptation of ideas to one another. Every favourable biological process is an event of self-preservation, and as such is also a process of adaptation … All favourable cognitive processes are special cases, or parts, of biologically advantageous processes … The cognitive process may display the most varied qualities: we characterize it in the first place as biological, and as economic (Toulmin 1972, 320).

However, for Toulmin, Mach's "theory of intellectual evolution started from the wrong end of the problem." That is to say, Mach mainly focuses on the issue of "historical mission," which he believed as the "one aspect" which underlies the organic evolution. Toulmin (1972, 321) suggest that,

> Mach's account of scientific evolution shipwrecked chiefly because he equated the intellectual selection-criteria of science with the quite different criteria operative in organic change and economic development: viz., differential reproduction rate and productive efficiency. This equation misled him into believing that he must put his account of scientific knowledge on a 'biological-economic' basis, and at the same time distracted him from the possibility of giving a more general –and more valid– account of intellectual evolution in terms of other, more directly relevant criteria.

Social Darwinists' main error was similar to this. In Toulmin's (1972, 321) words they "misguidedly imported the whole range of concepts and criteria developed for explaining biological evolution into their discussion of social affairs." The result was "sequence of arguments and slogans" which is "both intellectually confused and politically obnoxious." In social Darwinists' conception,

> Phrases like 'survival of the fittest' and 'evolutionary success' were given a socio political application in a way that blurred the crucial differences between organic species and human races, nations or classes, confused economical dominance with economic domination, and ignored the unanswered question, what truly gives

> unity, continuity and common interests to a human community or society (Toulmin 1972, 321).

Therefore, “instead of being a fruitful new source of explanatory ideas, the Social Darwinism of the 1890s and 1900s ended up by generating a pack of pernicious over-simplifications” (Toulmin 1972, , 321). Above all these, “the most frequent and influential mistake, however has been at once more fundamental than those of March and the social Darwinists and also far cruder.” Toulmin (1972, 321-322) describes it as follows:

> It has resulted from confusing the 'evolutionary' approach of Charles Darwin, on the one hand, with the 'evolutionistic' ideas of Herbert Spencer and Lamarck, on the other: that is, from reading the Darwinian schema of explanation as entailing doctrines about the overall direction of organic (and even cosmic) development like those of such historicist philosophers and social theorists as Lamarck and Marx, Spencer and Teilhard. Some writers on sociology, anthropology, and linguistics have found the conception of Evolution as a doctrine of cosmic Progress -revealing a universal and irreversible direction of historical development in the natural and human worlds- a vastly appealing one.

Following these determinations, Toulmin (1972, 320) makes an excellent proposition: “Darwin's account of organic evolution” should be treated “… as one special case of a more general pattern of historical change,” namely “the pattern of 'variation and selective perpetuation,'” and in applying its notions to other fields, one should look for “corresponding patterns with different parameters.” Actually, this is one of the key propositions made by Toulmin, which is also relevant for architecture, and consequently taken as the basis in developing my evolutionary models.

Another fundamental “mistake” of Social Darwinists and Mach is their confusion of “evolutionary” approach of Darwin with “… the ‘evolutionistic’ ideas of Herbert Spencer and Lamarck.” In addition, the confusion is the interpretation of the “Darwinian schema of explanation … about the overall *direction* of organic (and even cosmic) development” in determinist and teleological tones, as seen in the approaches of Lamarck, Karl Marx, and Spencer. Toulmin (1972, 322-329) argues that

> Some writers on sociology, anthropology, and linguistics have found the conception of Evolution as a doctrine of Cosmic Progress –revealing a universal and irreversible direction of historical development in the natural and human worlds– a vastly appealing one.
>
> And from Lamarck on, the main charm of Evolution has sprung from its progressivist associations –that is, from the belief that Evolution reveals clues to the direction in which the entire Universe has developed in the past, and presumably continue to develop in the future.
>
> So understood, the idea of evolution rapidly become bound up with philosophical historicism, and shared its prophetic ambitions ….

It is striking to see both fundamental mistakes in “evolutionary” theories and models addressing architectural design, and deformations and deviations from the original conception of evolution in its interpretation and application to architecture. For example, the “objective design method,” and the “biotechnical determinism” of Modern Architecture can be interpreted as species of such thinking.

### 2.3.1 Revolution versus Evolution

One of the problems that Toulmin focuses on is what he calls “revolutionary illusion,” which he identifies and criticizes in Kuhn's distinction between “revolutionary” and “normal science” or, more specifically, the contrast between the “two alternative modes of conceptual change.” He proposes that “instead of a *revolutionary* account of intellectual change, which sets out to show how entire 'conceptual systems' succeed one another, we … need to construct *an evolutionary* account, which explains how 'conceptual populations' come to be progressively transformed" (Toulmin 1972, 122). His schema for discussing the development of collective concepts is as follows:

> … innovation– asking what factors and/or considerations lead the bearers of an intellectual tradition to propose certain ways of moving ahead from the currently accepted position …
>
> selection– asking what factors and/or considerations lead them to accept certain of these innovations as established in preference to others, and so to modify the collective conceptual tradition (Toulmin 1972, 121-122).

In other words, the development of "conceptual populations," or change and creation of concepts are "characterized ...as reflecting a balance between factors of two kinds: innovative factors, responsible for the appearance of variations in the population concerned, and selective ones, which modify it by perpetuating certain favoured variants" (Toulmin 1972, 134)) The corresponding schema can be expressed as follows:

> … the units of variation, i.e. The tentative conceptual variants circulating within a discipline at any particular time; and the units of effective modification, i.e. Conceptual changes that are actually incorporated into the collective tradition of a discipline (Toulmin 1972, 121).

Toulmin (1972, 139-141) provides the following valuable schema for conceptual development or conceptual evolution. First,

> Within any particular culture and epoch, men's intellectual enterprises do not form an unordered continuum. Instead they fall into more-or-less separate and well-defined 'disciplines', each characterized by its own body of concepts, methods and fundamental aims. Considered over a long enough period, the intellectual content of such a discipline can change quite

> drastically; and so also, though more slowly, may its intellectual methods and fundamental aims. Yet each discipline, though mutable, normally displays a recognizable continuity, particularly in the selective factors that govern in its content.

The emphasis here is on the continuity, and on the "selective factors" that govern "the intellectual content" of a discipline. Also "intellectual content" specific to a discipline not only refers to "a body of concepts," but also to methods and fundamental aims, perhaps more important the "selective factors." This is the conceptual basis of the expanded conception of the architectural ideas, which is mentioned in the introduction and elaborated further in the succeeding chapters. Second,

> These continuities and changes both involve the same dual process. In any live discipline, intellectual novelties are always entering the current pool of ideas and techniques up for discussion, but only a few of these novelties win an established place in the relevant discipline, and are transmitted to the next generation of workers. The continuing emergence of intellectual innovations is thus balanced against a continuing process of critical selection. Some conceptual variants are picked out for incorporation, others are weeded out and ignored; yet in suitable circumstances, this same process can account either for the continued stability of a well-defined discipline, or for its rapid transformation into something new and different.
>
> This dual process can produce a marked conceptual change, only given certain further conditions. We assume that, at any given time, enough men of natural inventiveness and curiosity exists to maintain a flow of intellectual innovations or 'variants'. The problematic questions then have to do with the conditions on which such novelties can prove their 'advantages', and so win a place in the relevant body of ideas. Once again, there must exist suitable 'forums of competition', within which intellectual novelties can survive for long enough to show their merits or defects; but in which they are also criticized and weeded out with enough severity to maintain the coherence of the discipline. So Karl Popper's capsule description of scientific method, as a dialectical succession of 'conjectures' and 'refutations', can at once be reinterpreted in

evolutionary terms: it lays down the ecological conditions on which alone variation and selection can lead to effective scientific change.

… an evolutionary analysis of intellectual development once again involves a set of independent notions, which between them define the 'intellectual ecology' of any particular historical and cultural situation. In any problem situation, the disciplinary selection process picks out for 'accreditation' those of the 'competing' novelties which best meet the specific 'demands' of the local 'intellectual environment'. These 'demands' comprise both the immediate issues that each conceptual variant is designed to deal with, and other entrenched concepts with which it must coexist. And, once again, terms like 'competition' and 'merits', 'demands' and 'success' express correlative notions, which can be properly understood only by seeing them as so many aspects of the entire historical process of conceptual variation and disciplinary selection. ... accordingly, historical continuity and change can be seen as alternative results of variation and selective perpetuation, reflecting the comparative success with which different variants meet the current demands to which they are exposed (1972, 139-141).

As it was in the previous paragraph, the implication of these arguments for architecture is primarily related with the issue of tradition. This was already discussed in detail in the previous sections and will be further elaborated in the following chapters within the specificities of architecture. The selectionist pattern behind the conceptual inheritance and the novelties is noticeable. Both the inheritance and the new creations are controlled by the selective conditions intrinsic to the domain. These conditions are constituted by the previous ideas, but also by the "demands" of the "intellectual environment." In turn, inherited ideas and the novel creations ensure the continuity of the tradition and its "stable" evolutionary transformation.

### 2.4 Evaluation of the Chapter

One of the major proposals of the chapter is that Darwin's account of organic evolution is actually a special case of a general phenomenon of historical change, which follows the pattern of variation and selective retention, or of trial and error, or of making and matching. Its application to biological evolution is in fact, an instance, since evolution, itself, "… –even in its biological aspects– is a knowledge process" (Campbell 1974, 413). That is to say, selection paradigm is actually can be generalized to (the explanation of) epistemic activities, and activities which concern teleological achievements, and inductive gains, such as perception, learning and understanding, and creativity, problem solving, and design.

In opposition with the conventional "inductivist" view of problem solving and design, an "eliminationalist or selectionist approach," or in general terms "evolutionary" approach is proposed. Such an evolutionary schema underlies not only the problem solving activity and design, but exists in the lower level components of these activities such as progress, teleology, or purpose.

The proposed selectionist or evolutionary approach has three important components that constitute the main structure of the model: instruction, trial and the selection. Instruction links the structure with the previous wisdom, namely the tradition. It represents what was inherited. Trial is –to a degree– a blind movement or search into the unknown, an entity that departs from what was instructed, or inherited, or more specifically trial is what deviates from the traditional. Finally, selection refers to filtering all these by criticism, not only of the new trials, but also of the inherited elements. This is the key schema or structure, which comes out of the present chapter, which would be the basis of the evolutionary models and related theses proposed in this study. Other implications of the framework will be referred to in the succeeding chapters, where required.

# CHAPTER 3

# CONCEPTUAL FRAMEWORK OF THE STUDY, PART II

This chapter mainly sets the architectural foundation of the present study, and consequently the –architectural counterpart– of the conceptual framework. The chapter refers to two groups of studies, one from architectural theory, second from design research. As an extension to the first group, some notions from Russian Formalism are introduced.

In the first section, I introduce two groups of studies from the theory of architecture. The first group includes the related works of Banham, Summerson, Pevsner, and the second group those of Anderson, Colquhoun, Rowe, and Rowe and Koetter, which represent two complementary interpretations of Modern Architecture. In critically examining the content of these studies, I particularly focus on the couples of concepts such as tradition and utopia, program and paradigm, evolutionary and revolutionary conceptions of architectural design, and connected with them, the issue of design process. I search for the traces of an evolutionary pattern within these studies, foreground such a layer, and seek for the compatibility of valuable content within these studies with such a pattern.

In the second section, I introduce the "conjecture/analysis" model of design originally conceptualized in Hillier, Musgrove and O'Sullivan's (1972) seminal essay titled "Knowledge and Design" and advanced in some studies including Stefani Ledewitz's (1985) "Models of Design Studio Teaching," and Jane Darke's (1979) "The Primary Generator and the Design Process."

## 3.1 Section One: The Two Paradigmatic Interpretations of Modern Architecture

### 3.1.1 Reyner Banham on Tradition and Program

In 1962, Reyner Banham writes an article titled "Coventry Cathedral" originally published in the *New Statesman*, later reprinted in *Architectural Forum* under a slightly modified title: "Coventry Cathedral – Strictly 'Trad, Dad'[21]." Article's focus is the new Cathedral project designed by Sir Basil Spence to "replace" the bombed out old Coventry Cathedral, which Sir Spence (1954 ,143-144) himself describes as "a *contemporary expression* of cathedral traditions" (italics added).

In his article, Banham assesses the project as "the worst set-back to English church architecture for a long time" (1962, 766). For him, Spence's entry is not a modern building designed for a modern age, but a revival, a restyled traditional cathedral.

The problem identified by Banham is the "program" itself: The building is not modern for the reason that "no radical assessments of cathedral functions were undertaken" prior to the preparation of the requirements or the brief (1962, 762). Banham states that, competition conditions are set out to achieve a project exactly like the present one, essentially a "Gothic-revival," utilizing new construction techniques, new materials (in part) and "…devotional artwork in various non-medieval styles" (1962, 766). Overall, the cathedral is "trad, Dad," trying to "give itself a new image," "a new expression," which "a true modernist, a radical functionalist, would have" never accepted (1962, 762).

Beyond Banham's apparent tone against tradition and his manifest distinction of "modern" from "traditional," lies his irreconcilable opposition of technology

[21] Banham's use of "Trad Dad" is possibly related to a musical "fad" at that date: It is 1920's traditional jazz (Trad) revived and became extremely popular all over Britain in 1960s (1961). There is also a film titled "It's Trad, Dad!" dated 1962, which his "Trad Dad" quotation probably comes from (Internet Movie Database 2007).

and science with tradition. From a certain point of view, Banham's arguments against tradition are proper if they are evaluated as a combat against traditionalism in the sense of maintaining the institutions and forms of the past without question. However, tradition, in Banham's conception does not merely refer to the "inherited patterns of architecture," or "the reserve of traditional buildings," but in a wider sense "… the stock of general knowledge, (including general scientific knowledge) which specialists," in Banham's words, "assume as the *ground of present practice and future progress*" (italics added) (1960c, 98). Technology, on the other hand, is the "converse of tradition," which, contrary to the tradition, provides potential and method for exploring, and for inventing something totally new, "… by means of the instrument of *science*," (italics added) which might "… at any moment make nonsense of *all existing general knowledge* ..." (italics added) and consequently the ideas founded on this knowledge (1960c, 98). The issue is, "… for the first time in history, the world of *what is* is suddenly torn by the discovery that *what could be*, is no longer dependent on *what was*" (italics added) (1960c, 98). As it would seem, this proposition expresses a revolutionary rupture from the past, fueled by science and technology as its instrument, as opposed to a possible evolutionary continuity based on tradition and established knowledge. In Bahham's conception, this revolutionary rupture requires architects' full devotion to science and technology, and disposal of "the whole cultural load" they possessed. At the concluding paragraph of his book, *Theory and Design in the First Machine Age* Banham (1989, 329-330) makes the following arguments:

> The architect who proposes to run with technology knows now that he will be in fast company, and that, in order to keep up, he may have to emulate the Futurists and discard his whole cultural load, including the professional garments by which he is recognised as an architect. If, on the other hand, he decides not to do this he may find that a technological culture has decided to go on without him.

In Banham's (1957, 129-139) theorizing, discarding "the whole cultural load" and rejection of the tradition is descendant from Futurism[22], which, for him, is also deeply embedded at the "subconscious" of Modern architecture and is a part of its ideology. Modern Architects had distaste for tradition as an authority, or traditionalism in the sense of preserving and repeating the "established values and institutions" of the past. As it is stated by Pevsner (1961, 230), this characteristic is attributed to a shift or a change in architecture at the end of the 19th and the beginning of the 20th century, towards "a new style of architecture e*ntirely independent of the past*" (italics added), which virtually indicated an end of "historicism."[23] In essence, the change is not merely a change in style or forms but a shift in architectural thought. In such thinking, creation of architectural form is not seen as something dependent upon past forms or past institutions or the tradition, but as something postulated as the purpose or posited at the expense of function or program. This approach in architecture is often referred to as functionalism, which, for Pevsner (1961) is "the main principle of 20th century architecture." It might be said that Modern Architecture is essentially functionalist and anti-traditional, in this sense "modern."

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[22] In the "Manifesto of Futurist Architecture," Antonio Sant'Elia (1914) makes the following arguments: "The problem posed in Futurist architecture is not one of linear rearrangement. It is not a question of finding new moldings and frames for windows and doors, of replacing columns, pilasters and corbels with caryatids, flies and frogs. Neither has it anything to do with leaving a façade in bare brick, or plastering it, or facing it with stone or in determining formal differences between the new building and the old one. It is question of tending healthy growth of the Futurist house, of constructing it with all the resources of technology and science, satisfying magisterially all the demands of our habits and our spirit, trampling down all that is grotesque and antithetical (tradition, style, aesthetics, proportion) determining new forms, new lines, a new harmony of profiles and volumes, an architecture whose reason for existence can be found solely in the unique conditions of modern life, and in its correspondence with the aesthetic values of our sensibilities. This architecture cannot be subjected to any law of historical continuity. It must be new, just as our state of mind is new."

[23] Here, Pevsner's use of the term historicism refers to "a strong or exaggerated concern with or respect for the institutions and traditions of the past," and, "the use of or undue reliance upon historical forms or styles in art especially in architectural design" (Merriam-Webster Unabridged Dictionary 2000). It is different from the term's use in the present study, which refers to "a theory of history holding that the development of human society is a process governed by inexorable laws of change operating independently of human wills or wishes" (Merriam-Webster Unabridged Dictionary 2000)

However, at the beginning of 1960s, Banham (1960b, 97) identifies a revival, this time not tied to "the great styles of the remoter past," but to "a style of our own time." Pevsner (1961, 230) later describes this change as "the return of historicism" but this time concerning the revival of not old but "much more recent styles…," the ones "which had never previously been revived." This "new tendency" is more concerned by "exterior" forms "… created not necessarily at the expense of function," (Pevsner 1961, 230) or program but at the expense of the forms themselves, in Banham's terms, by repeating the earlier forms without reference to "the original idea" in Modern Architecture. This phenomenon has two important aspects: First "reliance on the traditional lore of the operation no longer necessarily" means "relying on a tradition older than oneself …." It might be any tradition, including the "alive" ones. Second, "the revived interest in history has not come about in countries whose great architecture is all in the past," and tradition is strong therefore the "future has nothing to offer, but in countries … who appear to have a wave of great architecture ahead of them in the immediate future … " (italics added) (Banham 1960b, 95). The desire for tradition is wide enough "to span from the Neo-libertians" in Italy to "d'Olivo, from Mies van der Rohe to Bruce Goff," and their references from "Hadrian" and "Bernini," to "Le Corbusier, and Vince Scully." However, Banham puts the emphasis on "Neoliberty," which for him is a "revival" which implies "… a recognition that the allegedly anti-traditional Modern Movement has a tradition of its own" (Banham 1960b, 97).

Banham proposes a return to "the original idea" in Modern Architecture that was "recently" reversed by "those urge for tradition and revival," in terms of reconsideration and rediscovery of science as a "dynamic force" for architecture that was once an "unavoidable directive to progress and development." The source of reference is once more the Futurists: "those who have re-explored the Twenties and read the Futurists … feel, once more, the compulsions of science, the need to take a firm grip on it, and stay with it whatever the consequences" (Banham 1960b, 99). The consequence is leaving "formalism" in the sense of repetition of forms; leaving the "modern historicism" behind altogether. It is not tradition, no matter if it is the tradition of Modern Architecture or other traditions, but "science" that would imply and propose best solutions for architecture. As it is emphasized by Vidler (2003), for Banham,

> ... [a scientific program] would take in all aspects previously left to tradition, including the aesthetics of perception, human response, (visual, psychological, biological) technologies of environment, and the like; science would simply reveal and propose the best solutions to the design of shelter … Architects, armed with the precise tools offered by information and visual mapping, can only perceive and predict; their role is not inventing the program, but identifying its raw material …

As a response to M.E. Drummond's conclusion[24] in his essay titled "Computers" published in *Architectural Review*, Banham proposes that

> … not only that mathematics is part of the traditional equipment of the architect, but that aesthetics and other aspects of human psychology are no longer mysteries necessarily to be set up against 'cold, hard facts.' Insofar as psychological matters can be assigned numerical values –and statistical techniques make it increasingly feasible to quantify them- they become susceptible to mathematical manipulation… An increasing proportion of the most jealously guarded 'professional secrets' of architecture are already quantifiable (1960c, 188).

In the review of the series, titled "Propositions," this issue is discussed by J.M. Richards, Pevsner, Hugh Casson, and H. de C. Hastings (Banham 1960f). For example, Casson argues that "… science can be help of the architect –he would be foolish to ignore it– …" but it is not "… possible that aesthetics can be put

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[24] Drummond's essay takes place under the main title "The science side: weapons systems, computers, human sciences." At the end of his part, Drummond concludes that computers "... deal with cold hard facts. They have no aesthetic sense whatsoever. Furthermore, they have no imagination. So, althought I feel they may be used as aids to architecture, it is still for the human being to create that which is beautiful."

upon a fully scientific basis" (Banham 1960f, 386). Banham (1960f, 386) responses with an acceptance, stating, "Certainly, a *fully* scientific aesthetic is impossible now," but he still contents, it "… is a thousand-per-cent more possible than it was thirty years ago." By "Scientific aesthetic" Banham means

> …[the] one that uses as the basis and guide to design, observations (made according to the normal laws of scientific evidence) of the actual effect of certain colors, forms, symbols, spaces, lighting levels, acoustic qualities, textures, perspective effects (in isolation or in total 'gestalts') on human viewers (Banham 1960f, 387).

However, primarily, functionalist thought must be revised to be based upon "a truly scientific," and expanded (re)conception of "program" that would utilize "apparent intelligence," or the available information replacing the "lore of the operation" or the stock of general knowledge based on tradition. In Banham's conception, science provides the knowledge for design as a part of a certain methodology, essentially guided by the program.

In his paper titled "The History of the Immediate Future," delivered at the RIBA in 1961, Banham claims that "history is our only guide to the future," not because "it repeats itself," but we learn from it. It is "impossible to make the same mistake twice," however "that doesn't prevent anyone making progressively worse mistakes as time goes on" (1961, 252). He argues that:

> History is to the future as the observed results of an experiment are to the plotted graph. That is you plot on the graph the results of which you are sure, you seek for a line, an algebraic curve, that connects them convincingly and you produce it beyond the last certain point to see where it will lead. So too with all major works of historical philosophy; they extrapolate present trends into the future condition of men (Banham 1961, 252).

However, Banham warns us that like anyone else, historians "can get their observations wrong, or -more likely- they can pick the wrong algebraic formula for their curve" (Banham 1961, 252). It is because "real world is rarely as tidy as mathematics," but more important "history is about men," who is unpredictable, and "who collectively are unpredictably greater than the sum of their parts." It is sometimes at the last minute the observations begin to suggest something, and sometimes they "suddenly develop characteristics which you could hardly have expected from earlier results" (Banham 1961, 252).

In Banham's (1960e, 332) words, once detached from its tradition,

> architecture will have to be consciously trimmed and steered as it proceeds, and someone will have to plot its course continually. That someone is the historian: it is not for him to give orders or indicate destinations, but his plot of the track to date must be accurate.

So, if not a historian, then who is "giving orders and indicating destinations?" Anderson (1965) argues that, for Banham, it is Science: As it was cited earlier, science as a "dynamic force" for architecture which was once an "unavoidable directive to progress and development."

These arguments would be clearer if contrasted with Banham's (1989, 17) quotations from Julien Guadet (1910) at the very beginning of his *Theory and Design in the first Machine Age:*

> Fortunately, certain proud artists –our masters– saw, and made us to see, that freedom is not simply the right to change one's uniform, and our art has gradually freed itself from such archaeology. Not everything was a success, but all efforts in this direction bore fruit, and today we know and proclaim that our art has a right to liberty, that only liberty guarantees its life and fecundity; in a word, its health …

> If I insist on these considerations it is not, indeed, to wipe out the slate clean of all that went before; on the contrary, our art, like our language, like our whole civilization, is –and must be– the rich interior of an estate that has accumulated over the centuries …

### 3.1.2 John Summerson on Program

> *...architectural thought is a continuing activity sui generis in which what is new must be distinguished by criticism of the past.*
>
> *—John Summerson, The Case for a Theory of Modern Architecture*

In his article titled "The case for a theory of Modern Architecture," John Summerson (1957, 307), investigates

> … [if] there does exist any basis of principle applicable to modern architecture, different from the bases applicable to any other architecture or alternatively, whether such a basis can be abstracted out of prevailing practice and ideas.

His problem situation is mainly pedagogical: it mainly involves "a practical need for some sort of theoretical formula as a means of introducing students to the principles of modern design" (Summerson 1957, 307). Summerson takes a path that mainly addresses the possibility of a theoretical basis of Modern Architecture which is based on "prevailing practice and ideas." The actual case is as follows:

> Modern architecture exists to the extent that there are plenty of buildings which everyone in this room would immediately classify as products of the modern movement on the basis of certain recurrent *formal arrangements* and *relationships*.... Furthermore, closely associated with this architecture is a number of *ideas* -*ideas* expressing modernity in one sense or another, nearly always either by analogy with the past or by analogy with some other activity

> than architecture. The architects who design the buildings tend to *quote* and *promote* these ideas and it would be very difficult to show that this complex of architecture and ideas is anything sort of valid in relation to present-day conditions. There is indeed no other complex of forms and ideas which seriously rivals it (Italics added) (1957, 307).

Following this situation, it would be possible to construct "a theory of Modern Architecture" that would be grounded on formal arrangements, formal elements, and relationships, and a set of ideas or concepts abstracted from designs of Modern Architecture. Operationally, architectural design based on such an approach "…is simply a question of two prolonged exercises in analysis and synthesis," that consists of two stages which concern "assembling the ideas, examining their common trends of meaning and reaching a series of general concepts…," followed by "abstracting formal characteristics from a select repertory of modern buildings, eliminating merely modish elements and providing a grammar of form" (Summerson 1957, 307). What remains is "…to illustrate how the forms embody the *ideas*." For Summerson (1957, 307),

> The whole exercise would add up to something like a Palladio of modern architecture, a pedagogical reference book not in any way restricting further development but consolidating the achievements of modern architecture, clarifying them and providing a departure platform for new experiments (Italics added).

This seems to be the logical "case for a specific theory of modern architecture," a plausible one too. However, Summerson claims that, in fact it is not:

> Only imagine for a moment the task of isolating characteristically modern forms from whole buildings. Only imagine the horror of stirring around in the rag-bag of aphorisms, platitudes and fancy jargon and trying to determine their common trend and resultant meaning (Summerson 1957, 307).

To clarify his point, Summerson compares Le Corbusier's approach in *Vers une Architecture and L'Esprit Nouveau* and László Moholy-Nagy's in *The New Vision: From Material to Architecture.*“ and concludes that “...whereas Le Corbusier turns naturally to a reassessment of the past, Moholy turns his back on it altogether” (Summerson 1957, 309). However, he distinguishes between Le Corbusier's theory and his designs, where the foundations of his theory in *Vers une Architecture* lies "deep in the past," while what he sets out to do and he actually does have nothing to do with either “the past,” or the “architectural conceptions which have ... profoundly influenced the expression of modern building” (Summerson 1957, 309). These sources were mainly “…modern painters -the school of Picasso, Braque and Leger; …after they had discovered the power of converting the commonplace into pure conceptual painting…,” where “Le Corbusier discovered the power of composing the commonplaces and crude ingenuities of industrial building into equivalent architectural realities” (Summerson 1957, 309).

Summerson claims that Moholy Nagy's position is quite different. Nagy suggests “basic law of design,” as “the obligation to build up each piece of work solely from the elements which are required for its function.” His problem situation was to search for an “authority” and “absolute values,” “something” which actually occupies the space, which was once occupied by “antiquity.” This “something” is interpreted as “biological.” Summerson finds Moholy Nagy's preoccupation with “biology” and “organic” very important, which presents a valuable path to follow in search for “a modern architectural theory.” It is remarkable that Banham (1961, 257), too, finds this valuable; at the concluding paragraph of his “The History of the Immediate Future,” he made following remarks:

> …Human sciences puts modern architecture back on what appears, historically speaking, to be its true path. At the end of the first great period of adventure in the modern movement, in 1929, Moholy-Nagy, in summing up the position to date, spoke of 'The biological as the guide in everything' ….

In parallel, he argues that “if architects could hold fast to that precept for a decade or so … the history of the immediate future could make exciting reading” (Banham 1961, 257).

However, as it is stated by Summerson, in architecture, organic values are often tended to be taken as “ultimate” or “absolute” values. Summerson underlines that Nagy pushes this “biological idea” harder which in fact fruitfully revealed the idea’s inefficiencies. When Nagy insists on artist's freedom as something “determined biologically,” it led him to an inescapable determinism, which is criticized by Summerson himself.[25]

Nevertheless, Summerson pursues the idea of “organic” and “biological” further, and in Bruno Zevi's *Towards and Organic Architecture,* finds what he calls a “hit,” a “nail exactly on the head.” For Zevi, “organic conception of architecture is based 'on a social idea and not on a figurative idea.'” Summerson interprets Zevis's “figurative idea” applies to a wider scope and “figurative idea” can be equated to “formal idea.” This leads to the thought that in Modern Architecture, “the source of unity,” or the “focus at which the architectural design was realized” lies not in the forms or formal ideas, but in the “social sphere,” in “architect’s programme.” Summerson concludes that

> the program as the source of unity is … the one new principle involved in modern architecture. It seems to be the principle which can be discerned through half-truths, *aperçus* and analogies which is the theoretical effluent … of the modern movement (Italics added).

“Program” in Summerson's conception is “a description of the spatial dimensions, spatial relationships, and other physical conditions required for the convenient performance of the specific functions.” It typically requires “a certain number of architectural relationships being suggested on the way and

[25] See Alan Colquhoun's arguments on what he calls “biotechnical determinism,” cited in this chapter.

the character of these relationships may well be something different from the relationships in a predetermined stylistic discipline." He posits that

> The chief difference is that they involve a process in time. It is difficult to imagine a *programme* in which there is not some rhythmically repetitive *pattern* -whether it is a manufacturing process, the curriculum of a school, the domestic routine of a house, or simply the sense of repeated movement in a circulation system (Italics added) (Summerson 1957, 309).

These patterns, for Summerson, of course do not "dictate a corresponding pattern in the architect's plan or anything crude like that" but they do authorize "relationships which are different from those" authorized by the "static, axially grouped dominants and subordinates of the classical tradition- different, but carrying an equivalent authority." In this sense, because it is a unity of progress, the "resultant unity can … be described as a biological or organic unity."

Summerson also points to an expanded reconception of program fueled by a new phenomenon: The program "has ceased to be evaluated merely *quantitatively* and has come to be evaluated *qualitatively,*" since programmes need to be more complex and more challenging and susceptible to qualitative generalizations and evaluations. But more important, it began to bore a strong utopian dimension which addressed -big- changes, in Summerson's words, "revolutions in social sphere," and "re-orientations of our time."

In a closer inspection, as it would seem, there are two related but distinct conceptions of the programme intermingled with each other in Summerson's arguments. One refers to a more conventional understanding of program as "a description of the spatial dimensions, spatial relationships, and other physical conditions required for the convenient performance of the specific functions." The other clearly refers to a change from what exists, say, as in Summerson's specific example, "… relationships which are different from those" are authorized by the "… *dominants* and *subordinates* of the classical tradition," or "revolutions in social sphere," and "re-orientations of our time" (Italics added).

However, Summerson determines an essential problem in "the conceptions which arise from a preoccupation with the programme": At some undefined point, the "program" has to solidify or "crystallize" into a solution, or a final form.

> By the time the architect reaches that point he has to bring to his conception a weight of judgment, a sense of authority and conviction which clinches the whole design, causes the impending relationships to close into a visually comprehensible whole. He may have extracted from the programme a set of interdependent relationships adding up a unity of a biological kind, but he still has to face up the ordering of a vast number of variables … (Summerson 1957, 310).

The problem is that there is a point of leap, where "what happens or should happen at that point" is not obvious or clear.

> … There is a hiatus. One may even be justified in speaking of a 'missing architectural language'. [Walter] Gropius has stated the difficulty as the lack of an 'optical key ... as an objective common denominator of design' – something which would provide 'the impersonal basis as a prerequisite for general understanding', which would serve 'as the controlling agent within the creative act' (Summerson 1957, 310).

Summerson mentions of two possible approaches as a means of answering this problem. In his words, "the first involves an extension of the rationalist principle into the sphere of engineering, and the second involves a reconsideration of the geometrical basis and limitations of architecture" (Summerson 1957, 310).

In the first case, “the engineer is the heir to the basic tenet of the old rationalism –economy of means in construction.” He or she seeks

> … [the source of unity] within one component –even if it is a very complex component comprising the whole sectional trace of a large building. And it is a unity of interdependent calculable issues adding up a total whose criterion is performance (Summerson 1957, 310).

However, this is quite different from architecture, if we are to accept the source of unity in architecture is the programme, in the term’s widest sense. In Summerson’s (1957, 310) words,

> … [an engineer’s] search for finality and the architect’s are as wide as apart they can be. It would be altogether too facile to suggest that they are even complementary. Nevertheless, a whole view of architecture must necessarily extend to this latest metamorphosis of the rationalist process in the hands of the engineer…. The idea can be and sometimes is upheld that engineer, as a result of his enforcement of the rationalist principle, invents forms and formal arrangements which the architect then absorbs into his vocabulary of expression and uses, sometimes in a strictly engineering way –and sometimes not.

In evolutionary terms, the situation can be viewed as follows. First, actually, what Summerson refers to as “…a unity of interdependent calculable issues adding up a total,” is itself a formative idea that very well matches the creative search process in solving engineering problems, and at least in some cases it can be applicable to architectural design. Actually, from a certain point of view, architectural design process can be interpreted as always having such a layer, but not as the most important one. Second, when Summerson interprets “performance,” as a criterion, he implicitly refers to the selectionist aspect of the process. The reference implies that what is “formed” is subject to an evaluative selection, of which conditions demand a certain “performance.” If we put it in a more concrete way, say, for an engineer, a building must "stand," which is a problem to solve. Physically, the problem provides the selective condition that a structure must pass. For an engineer, this is more likely the major condition for his or her proposal to be tested, while for an architect, it is among many.

Actually, this was anticipated by Summerson himself, when he argues that programme is the source of unity in architecture (as distinguished from engineering.) With reference to the evolutionary model, this can be interpreted as Summerson's emphasis on the program as the selective condition operational in an architectural design process.

However, the problem is, "the engineer is concerned strictly with components and although he may contribute significant inventions he cannot contribute a continuously related system of inventions –i.e. a language." For Summerson, this is why the engineering issue does not "wholly" resolve the problem.

The second alternative, which Summerson thinks of, is the "topology." Actually the idea of "topology" is put forward by Banham (1955) earlier in his article titled "The new Brutalism" as follows: In topological terms, "…a brick is the same 'shape' as a billiard ball (unpenetrated solid) and a teacup is the same 'shape' as a gramophone record (continuous surface with one hole)…" Banham suggests that actually,

> as a discipline of architecture, topology has always been present in a subordinate and unrecognized way –qualities of penetration, circulation, inside out, have always been important, but elementary Platonic geometry has been the master discipline (Banham 1955, 361).

In Banham's conception, (Platonic) geometry and topology are presented as two alternative disciplines. Banham calls for topology to become a dominant where the geometry remains as the subordinate discipline for architecture. He argues that this is the case in Smithson's project in Sheffield. In the mentioned project,

> the connectivity of the circulation flourished on the exterior and no attempt is made to give a geometrical form to the total scheme; large blocks of topologically similar spaces stand about the site with the same graceless memorability as Martello towers or pit-head gear (Banham 1955, 361).

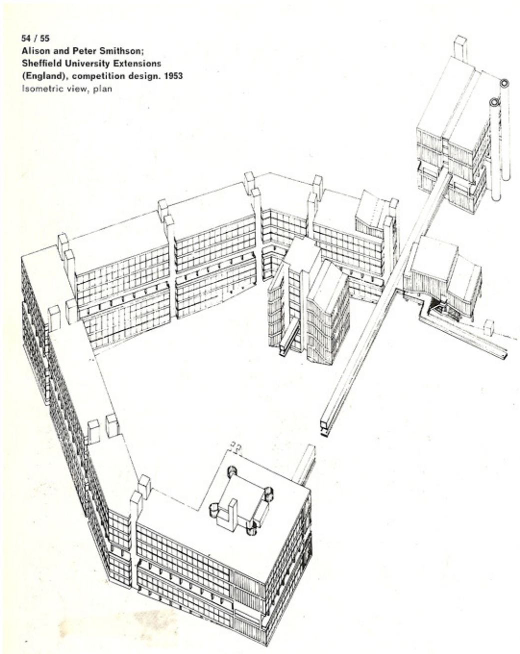


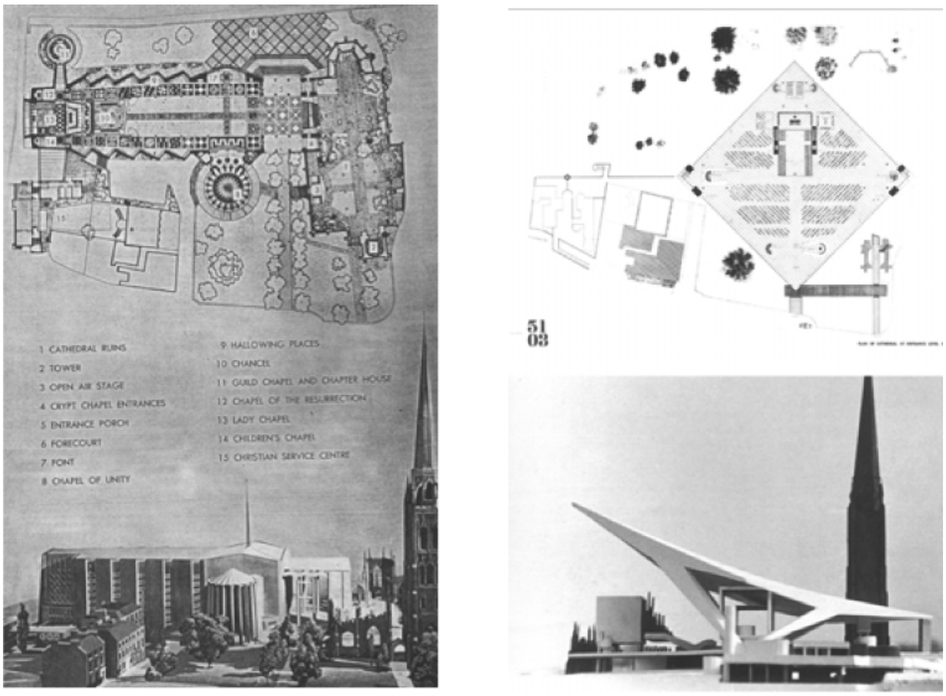

Figure 2 Sheffield University Extensions, Smithsons (Banham 1966, 52).

For Banham, this is an illustrative case of moving from formalism to a-formalism, essentially fueled by topology. However, as it was stated by Banham himself, this does not mean that the design is "unconceptual," and it does not have a composition. For example, one can easily identify the succession of repeating blocks placed one next to another, organized around an outdoor space, or defining it. This can be interpreted as the dominant formative idea behind the overall design. There is also an axis.

In Banham's interpretation, the overall design is not based on geometrical or visual compositional techniques of any pre-conceived type. Actually, this is the essential distinction, which his arguments are based on, and it is worth to mention shortly. For Banham, "formal" refers to "symmetrically composed, or ordered by some other very explicit abstract geometrical discipline." There might be two antonyms of the word, "informal" and "a-formal." Informal refers to "asymmetrical and subject to some less strict visual discipline (such as Picturesque composition)," while a-formal as it was already stated, does not deal with or concern "geometrical or visual compositional techniques of any pre-conceived type" (Banham 1966, 41). From such a viewpoint, for example, Smithson's entry for the aforementioned competition of Coventry Cathedral can also be interpreted as formalist. The project is described as follows:

> Basically, they offered a vast square space covered by a saddle-shaped 'anticlastic' roof, supported at two opposite corners. Within this space liturgical functions were laid out with great formality and symmetry around two axes given by the diagonals of the square plan. Though this could hardly be called a centralized plan, its intense formality reveals the direct influence of Wittkower's Palladian studies, and the use of a simplified geometrical grid to dispose the parts suggests also a study of Le Corbusier's 'Traces rĕgulateurs' (Banham 1966, 41).

Banham (1966, 41) argues that "…as far as the development of Smithsons was concerned, the importance of the design is purely negative –it was their last *formal or Palladian* scheme…" (Italics added). At this point Banham's opposition of a-formal with traditional and formal must be emphasized. In his viewpoint, Smithson's entry is "formal" not only for that it has an apparent set of formative ideas underlying the overall form, but also for that, such ideas have a determinable lineage with the tradition; the traditions of Palladio and Le Corbusier. Hence, in Banham's view, both the Spence's winning project and Smithson's entry have the same essential characteristics; they are formal and traditional (Figure 3). Therefore, it seems that while accepting existence of such conceptual content, i.e. a geometrical order in an overall design, Banham mainly rejects the dominant formative role of such content in a design, and historical lineage of some type. As it would seem, the implications of such a position are primarily epistemological, and methodological.




a b

Figure 3 Coventry Cathedral competition entries. a, the winning project by Spence (1954), b, Smithson's entry (Banham 1966, 49).

However, even if we accept a-formalism as an approach, through topology, proposing a way of producing architecture; forms, compositions and concepts, without pre-conceiving them, as it would seem, still it does not provide a solution to the problem initially raised by Summerson. There could still be a hiatus, a leap between the program and the form or solution. This is not only the case for architectural creation; actually, such a problem also exists in the program and architecture's roles in the "revolutions in social sphere," and "re-orientations of our time."

### 3.1.3 Stanford Anderson on Tradition

Primarily addressing Banham's 1962 article, and pursuing his arguments on tradition and science, a year later, Anderson (1965) presents a paper titled "Architecture and tradition that isn't 'trad Dad,'" in a seminar given at the Architectural Association, London, later published in *The History Theory and Criticism of Architecture.* Anderson begins the article with the following statement:

> Traditionalism, in the sense of seeking to maintain the status quo, has been traditionally and rightly combated by most twentieth-century architects. But, having rejected the authority of tradition, modern architects have then sought a new authority. Most commonly architects have claimed to find an authority in science and technology (1965, 71).

"Anti-traditionalism," is "virtually" a "universal characteristic of modern architects." Anderson, too, interprets "traditionalism," as a "mental disease," but argues that its "excesses," lead to a reaction that tended to reject tradition totally, rather than "a revised attitude to tradition." He calls this "end" as a "cultural euthanasia," which was expressed violently by the Futurists, followed by most of the modern architects, and "recently" Banham himself. Actually, what Anderson refers to is a line of thought which Banham's theorizing is a "recent" example.

Anderson addresses and calls into question the following points in Banham's theorizing:

> Even if we were to accept that such a thing as a qualitative change distinguished modern architecture from that which precedes it, does this liberate us from the past? Is the traditional operational lore of architecture categorically superseded? Or is the situation of architecture similar to that of physics, where older hypotheses … remain theoretically suggestive or pragmatically operative? But,

even if we were to acknowledge only the tradition of the Modern Movement itself, what should be our attitude towards tradition. Quite aside from the point that, at best, the writing of history falls somewhat short of achieving an 'immutable and scientifically ascertainable succession of facts,' can historians project a future course? Are tradition and technology hostile opposites which cannot work in concert? Is the concept of a 'scientific surfride' which demands little more from the architect than daring and a sense of balance the most rational or, indeed, the most radical possible adaptation of science by architecture (Anderson 1965, 74)?

As it would seem, the main problem identified in Banham's course is his view of tradition, and related with it, the apparent historicist, and scientific determinist tone in his orientation and his presentation of tradition and technology, or tradition and science as incompatible couples. In his critical evaluation of Banham's view, the main foundation of Anderson is Popper's epistemology. This is also the case in the alternative view that he puts forward.

Merriam-Webster (2000) gives the following definitions of tradition that are particularly relevant for the present purposes:

● an inherited or established way of thinking, feeling, or doing : a cultural feature (as an attitude, belief, custom, institution) preserved or evolved from the past.

● an inherited principle, standard, or practice or body of principles, standards, and practices serving as the established guide of an individual or group: a literary or artistic rule or standard (as of theme, style, symbolism) or a body of such conventions normative for a period or group: a technique or set of habits used in making the artifacts characteristic of a period or culture: the cultural continuity associated with such a tradition in a given region.

● a line of historical continuity or development marked by distinctive characteristics

● cultural continuity embodied in a massive complex of evolving social attitudes, beliefs, conventions, and institutions rooted in the

> experience of the past and exerting an orienting and normative influence on the present.

Since Popper's ideas are the main basis of Anderson's arguments on tradition, returning to these ideas would be fruitful at this point. In his "Towards a Rational Theory of Tradition," Popper starts with an argument on the "traditional hostility, between rationalism and traditionalism." He states that

> Rationalists are inclined to adopt the attitude: 'I am not interested in tradition. I want to judge everything on its own merits; I want to find out its merits and demerits, and I want to do this quite independently of any tradition. I want to judge it with my own brain, and not with the brains of other people who lived a long ago' (Popper 1965, 120-121).

However, Popper argues that, "the matter is not quite simple as this attitude assumes…," for the fact that "…the rationalist who says such things is himself very much bound by a rationalist tradition which traditionally says them." Actually, he distinguishes between "two main attitudes possible towards tradition." In the first case "tradition is accepted *uncritically*, often without even being aware of it," while the second case involves "a critical attitude, which may result either in acceptance or in rejection, or perhaps in a compromise" (1965, 122). Tradition gives us a framework, a basis to start with, and an instrument to operate. One cannot completely free oneself from the bonds of tradition, but rather shift from one to another. However, in Popper's (1965, 122) words, "we can free ourselves from the taboos of a tradition; and we can do that not only by rejecting it, but also by *critically* accepting it." It must be underlined that the critical attitude requires an awareness and understanding of a tradition, and then we can evaluate it, and conclude with acceptance, compromise or a rejection.

As it was also cited by Anderson (1965), Popper (1965, 129) states that one is "badly advised if his teacher advises him, 'go around and observe'…" On the other hand, he's well advised if his teacher advises:

> Try to learn what people are discussing nowadays in science. Find out what difficulties arise, and take an interest in disagreements. These are the questions which you should take up. In other words, you should study the *problem situation* of the day. This means that you pick up, and try to continue, a line of inquiry which has whole background of the earlier development of science behind it; you fall in with the tradition of science. It is a very simple and decisive point, but nevertheless one that is often not sufficiently realized by rationalists –that we cannot start afresh; that we must make use of what people before us have done in science. If we start afresh, then, when we die, we shall be about as far as Adam and Eve were when they died (or, if you prefer, as far as Neanderthal man). In science, we want to make progress, and this means that we must stand on shoulders of predecessors. We must carry on a certain tradition. From the point of view of what we want as scientists – understanding, prediction, analysis, and so on– the world in which we live is extremely complex. I should be tempted to say that it is infinitely complex, if the phrase had any meaning. We do not know where or how to start our analysis of this world. There is no wisdom to tell us. Even the scientific tradition does not tell us. It only tells us where and how other people started and where they got to. It tells us that people have already constructed in his world a kind of theoretical framework –not perhaps a very good one but one which works more or less; it serves us as a kind of network, or as a system of co-ordinates to which we can refer the various complexities of this world. We use it by checking it over, and by criticizing it. In this way we make progress (Popper 1965, 129).

As it would seem, such a model demands a threefold structure: first, something with which to start, namely a tradition to depart from, second, new creations and third, a critical attitude to evaluate, to alter, and change what already exists and what is proposed. Such a theory renders the idea of *tabula rasa* as impossible: In Popper's (1965, 130) words, "…you need something with which to start. If you have nothing to alter and change, you can never get anywhere."

Moreover, new creations are only meaningful in "a setting of traditions and institutions –such as myths, poetry, and values–…" (Popper 1965, 130).

To sum up, the following conclusions highlighted in Popper's (1965, 27-28) "Sources of Knowledge and Ignorance," would be fruitful

> Quantitatively and qualitatively by far the most important source of our knowledge –apart from inborn knowledge- is tradition. Most things we know we have learned by example, by being told, by reading books, by learning how to criticize, how to take and to accept criticism, how to respect truth.
>
> The fact that most of the sources of our knowledge are traditional condemns anti-traditionalism as futile. But this fact must not be held to support a traditionalist attitude: every bit of our traditional knowledge (and even our inborn knowledge) is open to critical examination and may be overthrown. Nevertheless, without tradition, knowledge would be impossible.
>
> Knowledge cannot start from nowhere –from a *tabula rasa*- nor yet from observation. The advance of knowledge consists, mainly, in the modification of earlier knowledge. Although we may sometimes, for example in archeology, advance through a chance observation, the significance of the discovery will usually depend upon its power to modify our earlier theories.

On the basis of this framework, Anderson warns that rejecting "traditionalism" should not amount to rejecting "tradition itself" and seeking to replace it with "science." Even if we believe to be so as it was claimed by Banham earlier, this does not free ourselves from the tradition since not only architecture but also science depends on a prior body of knowledge and a tradition to operate. In architecture, one must seek for an "interpretation of tradition that will recognize our debt to the past without establishing the past as an authority" (Anderson 1965, 71). Anderson's main point is to suggest tradition as "…a necessary common ground upon which we operate," without falling into what we call traditionalism. This could only be achieved by a critical attitude towards tradition.

It is interesting to see that, for example, many of the cited articles from Banham, which are the main targets of Anderson's criticism, are at the same time constitute a framework of discussions that is one of the important originating points for Vidler's arguments, and an essential foundation of his proposal. Actually, as it would seem, Vidler's position can be interpreted as the present day continuation of this tradition, advanced, and critically adapted to the specific conditions of the present day. This is another point showing that certain lineage of thought is still inherited, possibly together with some problems inherent in the related ideas. This shows that there is a high potentiality of the arguments made by Anderson, or more specifically by the opposing paradigm, to be relevant and in this sense worth to reconsider for the present problem situation.

**The Problem of Historicism**

There are two major definitions of the word historicism as they are given by Merriam-Webster (2000). They are as follows:

> ● a theory that all sociocultural phenomena are historically determined, that all truths are relative, that there are no absolute values, categories, or standards, and that the student of the past must enter into the mind and attitudes of past periods, accept their point of view, and avoid all intrusion of his own standards or preconceptions.
>
> ● the practice of writing or treating history in accordance with such a theory: a theory of history holding that the development of human society is a process governed by inexorable laws of change operating independently of human wills or wishes.
>
> ● a strong or exaggerated concern with or respect for the institutions and traditions of the past: the use of or undue reliance upon historical forms or styles in art especially in architectural design.

As it would seem, these are quite distinct, if not opposing definitions. For example, Pevsner's (1961, 230) use of the term refers to the third definition, while in the present discussion the term mainly refers to the first and second.

For Popper (1989, 3), historicism is "…an approach to the social sciences which assumes that this aim is attainable by discovering the 'rhythms' or the 'patterns', the 'laws' or the 'trends' that underlie the evolution of history." As it would seem, Banham's approach is an excellent example of such thinking within the specificities of architecture. As it is identified by Anthony O'Hear (1983, 128), so does Pevsner, despite his apparent tone against "historicism" in the word's third sense.

As it would be remembered, like Banham, the historicists believe that by compiling historical data, and by analyzing and evaluating historical facts, it is possible to determine "the laws of the history," and by projecting these laws to the future course of history, the future can be predicted. Banham's scientific determinism can also be evaluated within this framework. In Anderson's words, it is a "blind technological determinism," which implies that "…technology has a kind of mystic, unconscious will, or that it is at least a closed system which generates its own goals." In this sense, change or development is controlled by technology, setting its own laws, destinations, and goals without any outer intervention.

On the contrary, as it is proposed by Popper, the future course of history is not dependent on the knowledge of the past. On the contrary, "the course of human history is strongly influenced by the growth of human knowledge … we cannot predict, by rational or scientific methods, the future growth of our scientific knowledge … we cannot therefore, predict the future course of human history" (Popper 1989, vi-vii).[26]

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[26] Actually, from a slightly different point of view, I have discussed Popper's alternative model under the title "the Evolutionary Conception of Teleological Achievements and Ends-Guided Processes," in Chapter 2. The arguments made at that section can be considered as a part of the present discussion.

Within the specificities of architecture, Anderson (1965, 69) proposes that, in architect's problem of shaping and re-shaping the physical environment,

> The radical step would be to formulate problems and hypotheses within our own architectural problem situation, and then to criticize and test them as rigorously as our current information and methods permit. As science and technology have been known to profit from science fiction, so architecture could profit from a form of "architectural fiction." But architects must learn not to take such writings and projects either predictive history or as established theory. Like science fiction, it would bear fruit only when it had been critically assimilated into the problem situation.

Before concluding this part, Anderson's advance on Popper's epistemology in his application of it to architecture deserves a special mention. It is related with the application of the notion of conjecture to architecture. In his interpretation of architectural designs, the designs are not taken as conjectures themselves. When mentioning about a certain work, Anderson implicitly refers to its thought contents rather than the work itself. For example, Berlin *Mietkaserne,* and Le Corbusier's Roehampton, are mentioned as the carriers of the architectural ideas, addressing the public housing problem. For example, Roehampton carries Le Corbusier's "city-in-a-park" concept, and so on.

To sum up, Anderson's article can be interpreted as one of the first and rigorous representatives of a certain view and interpretation of Modern Architecture. On the other hand, it presents a rigorous criticism of a mainstream approach in architecture that seems to be continuing some of Modern Architecture's problems deriving from its narrow functionalism, anti-traditionalism and historicism/determinism. Related with this, but perhaps more important, it is the seminal article that introduces Popper's epistemology to architecture for the first time. Actually, it might also be interpreted as a basis that sets the foundations of a line of inquiry, which later turns into a paradigmatic (or a mainstream) position represented in the works of scholars such as Rowe and Colquhoun. Although Anderson's article does not particularly deal with methodology, it can also be interpreted as a predecessor to some studies in design methodology that take Popper's epistemology as their conceptual basis.

### 3.1.4 Alan Colquhoun on Tradition and Design Method

In his article titled "Three Kinds of Historicism," while identifying the roots of historicism or historical determinism in architecture in Hegel, Colquhoun (1983, 89) underlines its "profound influence on the framework of thought characteristic of the artistic avant-garde in the late nineteenth and early twentieth centuries." In Hegelian idealism, the emphasis is on the

> historical teleology… [that] … replaced the will of the historical subject with the suprapersonal will of history itself. The ideal was not seen as informing the individual protagonists of history ,,, it constituted an implacable historical will, of which the historical subject was the unconscious agent (Colquhoun 1983, 89).

In such a thinking,

> Art and architecture could fulfill their historical destinies only by turning their backs on tradition. Only by looking toward the future could they be faithful to the spirit of history and give expression in their works to the spirit of the age. In architecture, this meant the continual creation of new forms under the impulse of social and technological development, and the symbolic representation of society through these forms (Colquhoun 1983, 89).

Colquhoun (1983, 89) interprets this as the "developmental aspect of the avant-garde," which is emphasized by some of the "historians of the Modern Movement, such as [Sigfried] Giedion, Pevsner, and Banham."

However, Colquhoun (1983, 89) argues that, this is "…not the only, and perhaps not the most important ingredient of the twentieth century avant-garde," there is also what "…Philippe Junod in his book *Transparence et opacitě,* has called 'gnosiological idealism.'" The mentioned theory grows out of "the general atmosphere of historicist tradition," and it "…systematically [seeks] to exclude from artistic creation the last traces of *imitation," w*hile rejecting that "…the work of art is a mirror in which one sees something else" (Colquhoun 1983, 89). This is the notion that is called the "opacity"[27] of the work of art, which was later developed further by the Russian Formalists and became an essential component of the avant-garde thinking (Colquhoun 1983, 89). Since "…opacity denies that the work of art is merely a reflection or imitation of some model, whether this model is thought of as a platonic form or as consisting of the 'real' world … it resists both realist idealism and naturalism." However, it is not inconsistent with the idea of tradition, "…by giving priority to the autonomy of artistic disciplines, it allows, even demands, the persistence of tradition as something that is internalized in these disciplines." In this conception, "the artistic tradition is one of the 'objective facts' that is transformed by the creative act" (Colquhoun 1983, 209).

Colquhoun proposes "the study of architecture as an autonomous discipline –a discipline which incorporates into itself a set of aesthetic norms that is the result of historical and cultural accumulation and which takes its meanings from this." This would be a valid approach to the problem of tradition in architecture. However, such aesthetic norms and values cannot be seen as "… constituting a closed system of rules or as representing a fixed and universal natural law." Opacity of a work of art lends support to this approach, since it does not "…presuppose that architecture is a closed system which has no contact with outside life, with the nonaesthetic." In Colquhoun's (1983, 209) words,

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[27] For a more detailed discussion on the notion, see the end of this section.

> …all systems of thought, all ideological constructs, are in need of constant, conscious criticism; and the process of revision can come about only on the assumption that there is a higher and more universal standard against which to measure the existing system. History provides both the ideas that are in need of criticism and material out of which the criticism is forged.

The evolutionary argument in these statements is apparent, and perhaps this is why there are many parallels between the described model and the one implied by evolutionary epistemology. This is so both in terms of knowledge and tradition, and in terms of method. For example, it is apparent that the conception of tradition in these arguments perfectly overlaps the conception of tradition in evolutionary epistemology. Another perfect match is the idea of criticism, in terms of its place, and importance in the interpretation of tradition, and also in the creative process. But, perhaps above all, what Colquhoun does is to foreground the evolutionary pattern inherent in the tradition of architectural and artistic avant-garde. This is important; Colquhoun's reference in doing this is not evolutionary epistemology, but the tradition of art and architecture itself. This not only shows the inherent evolutionary aspect in architectural and artistic avant-garde but also as an outcome, the formulations made until now provide an invaluable approximation of the evolutionary conception of the architectural ideas, and to a degree evolutionary model of architectural design I put forward in the present study. That is to say, the position taken by the present study by proposing the evolutionary theses are supported by two rigorous traditions, one from epistemology, the other from art and architecture.

Colquhoun's works provide more than this, especially in terms of architectural design methodology. This issue is well taken into consideration in an earlier paper, titled "Typology and Design Method," of 1967. In the mentioned paper, one of the targets of Colquhoun's criticism is the Modern Movement in architecture, particularly its functionalist doctrine. For Colquhoun (1969, 72),

> The Modern Movement in architecture was an attempt to modify the representational systems which had been inherited from the preindustrial past and which no longer seemed meaningful within the context of a rapidly changing technology. One of the main doctrines at the root of this transformation was based essentially on a return to nature, deriving from the Romantic movement but ostensibly changed from a desire to imitate the surface of natural forms, or to operate at a craft level, to a belief in the ability of science to reveal the essence of Nature's mode of operation.

Underlying this doctrine lies what Colquhoun calls "biotechnical determinism," and this theory is the basis of the "belief in the supreme importance of scientific methods of analysis and classification derives." He argues that

> The essence of the functional doctrine of Modern Movement was not that beauty or order or meaning was unnecessary, but that it could no longer be found in the deliberate search for final forms. The path by which the artifact affected the observer aesthetically was seen as short-circuiting the process of formalization. Form was merely the result of the logical process by which the operational needs and operational techniques were brought together. Ultimately, these would fuse in a kind of biological extension of life, and function and technology would become totally transparent (Colquhoun 1969, 72).

Such a view could help architecture to cut its ties with past forms and past solutions and create the absolute new, something that merely comes out of functional considerations. The process is teleological, since "aesthetic and architectural form … [is not] something which was achieved … [with] the conscious interference of the designer, [but] …something …which was postulated as his ultimate purpose." Colquhoun identifies the relation of "biotechnical determinism," with the Spencerian evolutionary theory:

> According to [the Spencerian evolutionary theory] the purpose of prolonging life and the species must be attributed to the process as a whole, but at no particular moment in the process is it possible to see this purpose as a conscious one. The process is therefore unconscious and teleological.

These arguments are also important in the sense that they show why for example Colquhoun does not interpret his discourse as evolutionary. Actually, this is a common view of "evolution" in architecture, often taken as granted at least in some circles. It shows the main difference between Darwin's non-teleological and non-determinist model with Spencer's.

Colquhoun argues that, although it seems conflicting, this determinist approach made the "free expression" available for the architects. Once the ties with the meaning systems and the tradition of architecture are cut, all left, in Colquhoun's words, is the "permissive expression, the total freedom of the genius which … resides in us all." Architecture produced through historical determinist processes and free expression supposes an "onomatopoetic relation" between the form (construction) and the content. Colquhoun states that,

> By insisting on the use of *analytical* and *inductive* methods of design, functionalism leaves a vacuum in the form-making process. This it fills with its own reductionist aesthetic –the aesthetic that claims the 'intuition' with *no historical dimension*, can arrive spontaneously at forms which are equivalent of fundamental operations (Italics added).

Colquhoun rightly reminds that in the form creation process, even if all the requirements and operational needs are fulfilled, there is still the need for intervention, and in every stage, there are intentional and intuitional interferences of the designer. Thus, he admits that "… purely teleological doctrine of technico-aesthetic forms is not tenable." In every stage of design,

"… the designer is always faced with making voluntary decisions and that the configurations which he arrives at must be the result of an intention and not merely the result of a deterministic process."

With reference to Thomas Maldonado[28] Colquhoun (1969, 73) suggests that

> The area of pure intuition must be based on a knowledge of the past solutions applied to related problems, and that creation is a process of adapting forms derived either from past needs or from past aesthetic ideologies to the needs of the present. Although [Maldonado] regards this as a provisional solution –"a cancer in the body of solution"– he nonetheless recognizes that this is the actual procedure which designers follow.

This puts the particular emphasis on the tradition as a body of past forms and past solutions. Colquhoun argues that, "…not only we are not free from the forms of the past and from the availability of these forms as typological models but that, if we assume we are free, we have lost control over a very active sector of our imagination and of our power to communicate with others." However, this does not mean "a reversion to an architecture which accepts tradition unthinkingly."

The evolutionary aspect of the suggested model is once more obvious; "past solutions" or "typological models" represent the evolutionary inheritance, "adaptation" represents the change and transformation of the inherited solution or model by creating new variations, and the "needs of the present" represent the selective conditions to test these adapted or transformed variations.

[28] Actually, at the very beginning of Colquhoun's article there is a quote from Maldonado. For Colquhoun, Maldonado suggests that "...in cases where it was not possible to classify every observable activity in an architectural program, it might be necessary to use a typology of architectural forms in order to arrive at a solution." However, Maldonado thinks, these forms are "...like a cancer in the body of the solution and as our techniques of classification become more systematic, it should be possible to eliminate them altogether."

At this point, let us return to the following passage, that has been already cited in the introductory chapter, which is about the nature of the mentioned (evolutionary) change. For Colquhoun (1969, 74),

> One might postulate that the process of change is carried out, not by a process of reduction, but rather by a process of exclusion, and it would seem that the history of the modern movement in all the arts lends support to this idea." In painting and music, for example, in the works of Kandinsky and Schöenberg, traditional formal devices were not completely abandoned, but were transformed and given a new emphasis by the exclusion of ideologically repulsive iconic elements.

Colquhoun argues, "The value of … the process of exclusion is to enable us to see the potentiality of the forms as if for the first time, and with naivety."

Here, as it would seem, on the background of what Colquhoun calls the process of exclusion, lies a selectionist/evolutionary schema or structure. At the same time, what is apparent once more is the reference to the formalist doctrine. For example, for the Russian Formalists, a literary creation comes about by the "reorganization and a 'regrouping of the old elements,'" of the preceding "forms," not created anew or as "an antithesis of" them (Erlich 1981, 259). The change is done in the "obsolete" device same as it was identified by Colquhoun in Kandinsky and Schöenberg's works. In the formalist conception, the inheritance of "elements" and their "selective elimination" are apparent, indicating an underlying evolutionary pattern.

Of course, this is not the only reference to the formalist ideas, but there is also the notion of "dominant" that is important to the present study, which deserves a special mention at this point. In Russian Formalism, *Dominanta* or dominant is conceived as "[a] preeminent component or group of components," which insure "…the unity of the work … as well as its 'perceptibility'…" (Erlich 1981, 199). A work as a system, as it is stated by Tynjanov, "…does not mean coexistence of components on the basis of equality; it presupposes the preeminence of one group of elements and the resulting deformation of other elements" (Erlich 1981, 199). Actually, the idea of dominant is a part of Russian Formalists' larger view of a work (of art) that can be summarized as follows.

In the early years of Russian Formalists, Shklovsky defines "a work of literature," as "the sum-total of all stylistic devices employed in it" (Erlich 1981, 90). Erlich (1981, 90) argues that "the term 'sum-total' seems to imply the notion of literary form as a mere bundle, a loose aggregate of individual devices." As the discourse of the Russian Formalists evolves, this definition was changed. Erlich (1981, 90) states that Shklovsky's "'sum-total of devices' was supplanted by the concept of an esthetic 'system' where each device had a certain function to perform." As such, "earlier static approach to literary craft," gave way to a new approach that proposes a dynamic integration of devices which formalists called a "system." The notion of literary work as a "system" is perhaps best described in Jurij Tynjanov's (2002) essay titled "On Literary Evolution." Tynjanov (2002, 66-67) proposes that

> The analysis of the separate elements of a work, such as the composition, style, rhythm, and syntax in prose, and the rhythm and semantics in poetry, provides sufficient evidence that these elements, within certain limits, can be abstracted as a *working hypothesis,* although they are interrelated and interacting …. The interrelationship of each element with every other in a literary work and with the whole literary system as well may be called the constructional *function* of the given element. On close examination, such a function proves to be a complex concept. An element is one the one hand interrelated with similar elements in other works in other systems, and on the other hand it is interrelated with different elements within the same work.

A "system" in formalist view is "a complex whole, characterized by interrelatedness and dynamic tension between individual components and held together by the underlying unity of the esthetic function" (Erlich 1981, 199) In this sense, "the constructive function of each component in the system … lies in its relatedness to other components and, *eo ipso,* to entire system" (Erlich 1981, 199).

In formalist tradition, a work is viewed as "a closed-off unity," where each element constituting it "receives its meaning...within the structure of the whole..." (Bakhtin and Medvedev 1991, 45). In other words, a work is a closed-off, self-sufficient "architectonic structure"[29] constituted by weaving together of formative or constructive elements, contributing to work's formation in various ways. In Formalism, this structure is the basis for a critical and structured analysis and interpretation of a work where the task of the critique or interpreter is "… to reveal the constructive unity of the work and the purely constructive functions of each of its elements" (Bakhtin and Medvedev 1991, 45).

[29] In the Foreword of his *Problem of Form in Painting and Sculpture,* Hildebrand (1945, 11-12) describes "architectonic structure" as follows: "...as in a drama or symphony, so here our perception enables us to realize a unity of form lacking in objects themselves as they *appear* in Nature. It is the quality essential to this realization which I wish to denote by the term architectonic.... The problems of form arising from this architectonic structure, though they are not given us immediately and self-evidently by Nature, are yet the true problems of art. *Material* acquired through a direct study of Nature is, by the architectonic process*, transformed* into an artistic unity. When we speak of the imitative aspect of art, we are referring to *material* which has not been developed in this manner. Through architectonic development, then, sculpture and painting emerge from the sphere of mere naturalism into the realm of true art" (Italics added). The term is borrowed by Bakhtin and Medvedev (1991, 45) and used within their problem situation.

### 3.1.5 Colin Rowe on Program and Paradigm

> *Facts, then, come to be like figures in hieroglyphic writing .... There they are, holding up their clean profiles to us so ostentatiously; but that very appearance of clarity is there for presenting us with an enigma, of producing in us not clarity but confusion. The hieroglyphic figure says to us, 'You see me clearly? Good –now what you see of me is not my true being. I am here to warn you that I am not my essential reality. My reality, my meaning, lies behind me and is hidden by me, and this means that in order to arrive at the true and inward meaning of this hieroglyph, you must search for something very different from the aspect which it figures offer.*
>
> *—Josě Ortega y Gasset*[30]

Some of the issues of Colquhoun's "Typology and Design Method," are also addressed by Rowe in his essay titled "Program versus Paradigm: Otherwise Casual Notes on the Pragmatic, the Typical, and the Possible." Rowe's article was written in a relatively latter date than Colquhoun's, and consequently in different conditions, i.e., when the "typological concern" in architecture was already on the agenda and becoming popular. Different from Colquhoun, (and also Anderson) Rowe had a better chance for critically viewing, evaluating, and theorizing two paradigmatic positions or models. Actually, the opposition "program versus paradigm" comes from such a theorizing.

The main concern of the article is the examination of "two prevalent and rival proposals as to the correct means of architectural and urbanistic problem solving" (Rowe 1996, 9). For Rowe (1996, 9), these are "two mental orientations" often presented as mutually exclusive. The first one refers to "the widespread presumption that an act of analysis will automatically result in an act of synthesis," while the second is "…no more than the inversion of this point of view –the presumption that a synthetic statement is intrinsically a hypothesis for the discovery of a significant empirical detail." These two orientations, which are interpreted by Rowe as "worship of program (or data

[30] Cited in Rowe (1996).

addiction), and worship of paradigm (or excessive typological concern), with reference to their dominant characteristics, can best be studied and discussed under the terms "program," or "programmatics" and "paradigm."

There are two definitions of the word program, which are relevant for the present purposes. In its general definition, a program is "a plan of procedure … a schedule or system under which action may be taken toward a desired goal, [or] a proposed project or scheme…" (Merriam-Webster Unabridged Dictionary 2000). Such a definition is relevant for architecture, however a more applicable one is that a program is "…a statement of an architectural problem and of the requirements to be met in offering a solution…" (Merriam-Webster Unabridged Dictionary 2000).

In architectural and urbanistic problem solving, the first orientation puts a high value on the concept of program, and it is based on a "…presupposition that a document entitled the program is the legitimate and neutral *fons et origo* of all acts of synthesis …." Rowe's criticisms of these orientations are threefold. First, in terms of programmatics, with reference to Summerson, Rowe argues that, "…an allegedly neutral compilation of data … is a very vulnerable affair: and particularly is this so when the program confesses to include a predictive dimension." Second, equally, in the constitution of a program or a brief, "… a prejudiced discrimination of relevance will always occur," in the "…information which we all inhabit." Therefore, "even with the greatest of good will, some aspects of a problem will always be downgraded and others preferred." That is to say,

> …the program will always (and, mostly, inadvertently) be biased. It will never be the simple statement of the problem so much as the implication of a solution. It will be like almost any question. It will frame a highly restricted repertory of possible replies. And, if a question can only rarely be neutral, then what to say about that complex of largely dissimulated value judgments which seems invariably relatable to any extreme infatuation with programmatics (Rowe 1996, 24) .

Furthermore, there is no way to gather, yet alone know, all the "facts" which could be relevant for the "present" situation. Third, actually the main question is, "…are 'facts' invariably external to human consciousness, and is an accumulation of 'facts', apparently without any human intervention, infallibly equipped to promote its own controlling hypothesis?" Rowe (1996, 25) points out that

> … [such questions] are rarely confronted by the devotees of programmatic and the enthusiasts for data collection whose practice (otherwise known as waiting for printout) might, as a policy, be summarized as follows: We can't act until we have all the facts, and then we won't need to act, since then the facts will automatically arrange themselves.

Apparently, this would also not possible since such "regularities" or "arrangements" should exist prior to any data collection, or observation.

The second orientation, is based on the idea that "an entity generally specified as the typical and the typological and apparently a reserve of our collective memories and Platonic indiscretions…" as "whether we will or not, the insuperable starting point for investigation." This second position, for Rowe "… will clearly place high value on the concept of paradigm."

The definition of the word paradigm is given as "example" or "pattern" (Merriam-Webster Unabridged Dictionary 2000). Rowe's reference is Thomas Kuhn's definition for the word paradigm in *The Structure of Scientific Revolutions.* For Kuhn (1970, viii), "paradigms" are "…universally recognized scientific achievements that for a time provide model problems and solutions to a community of practitioners."[31] About the rising status of the typological concern in architecture, Rowe asks,

[31] Actually, Kuhn (1977) later revises his description of the paradigm in his "Second Thoughts on Paradigms." In this revision, "paradigm" is conceptualized as "global, embracing all the shared commitments of a scientific group..." which Kuhn suggests to be better replaced with

> How to react to that spectacle of semiotic argument, circular courtyards, neo-Grec peristyles, high staccato, Fellini billowing curtains, semi-Tuscan *altane,* the pseudo-Boullee, the neo-Schinkel, the revived Von Klanze, and all the other current, and 'metaphysical', graphic paraphernalia?

Rowe declares that he has sympathy with the typological concerns (of the neo-Rationalists), as opposed to "the academic doctrines which presume that a factual accumulation will lead to a scientific conclusion …," but still, "…left unpersuaded by neo-Rationalism's formal repertory and particularly unpersuaded by its attendant polemic." What Rowe questions is,

> just why do so many of [neo-rationalists], while rejecting the morphology of Le Corbusier, feel obliged, after a good fifty years have gone by, to recapitulate extravagant pitch of his polemic? Why, when forms are repudiated, does a certain psychology persist?
>
> …[the point is] when heuristic convenience becomes interpreted as universal panacea, when useful metaphor becomes translated as naïve prescription, when paradigm (without apology) is simply substituted for program, then surely the fundamental error of Modern Architecture is yet again rehearsed (this time in reverse)…. (Rowe 1996, 32)

While the program worship involves procedures that are "too flat and empirical," in the present case they are "too exalted, too idealist, and, too *a priori.*" Rowe argues, "In the first case, the future is to be no more than a prolongation of the present (surely intolerable) and, in the second case, both present and future are to be no more than a continuation of the past (surely no better)." In his words,

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the phrase "disciplinary matrix," and paradigms, parts of paradigms, or paradigmatic are conceptualized as constituents of this "disciplinary matrix," as "objects of group commitment" (Kuhn 1977). Actually, one can propose that, in this sense paradigms in the first sense can be interpreted as a tradition, and in the second, all the constituents which a tradition might carry.

> So, as we speculate on the problems of program versus type, on the problem of an academy become recently extinct and the problems of another academy not yet in full order, might it not, possibly be argued that we find ourselves confronted with no more than the superficial alternatives of a false empiricism and a false idealism? And, if an empiricism which refuses to concern itself with the *fabric of ideas*, can only be illusory, and if an idealism which rejects involvement with *empirical detail* will only be inadequate, then must it not further be argued that it is exactly within this theater of the mind that today we find ourselves placed (Italics added) (Rowe 1996, 28)?

It seems that, the thing that appeals to Rowe in the "typological concern" of New-Rationalists is primarily related with its demand for a tradition. However, the problem seems to be related with the nature of that relation, which seems to be primarily based on formal and stylistic references to classical architecture, and incompatible with such references, its polemical or utopian content inherited from Modern Architecture. Typology establishes or implies a specific type of relation with the tradition, so does the paradigm. It is apparent from his polemic, Rowe's position seems to be departing from both of these and emphasizing an alternative position, which implies and demands a different relation with the tradition and utopia.

### 3.1.6 Colin Rowe and Fred Koetter on Tradition and Utopia

In *Collage City,* tradition and utopia are presented as "only … reservoirs of ethical content available for our use." For Rowe and Koetter (1978, 122),

> [These couples are], whether separately or together, positive or negative, have been the ultimate servicing agents of all the various cities of 'science' and 'people', of 'nature' and 'history' already noticed; and, since there is no doubt that, practically, they have acted as a very coherent litmus of action and reaction (perhaps the most coherent of any) there are cited as final, though far from absolute, references.

Although in this formulation, the main concern is the design of cities, or urbanistic problem solving, it is also relevant for architecture and architectural problem solving. With reference to Popper's conception of tradition, tradition is interpreted as follows:

> …Tradition is indispensable –communication rests on tradition; tradition is related to a felt need for a structured social environment; tradition is the critical vehicle for the betterment of society; the 'atmosphere' of any given society is connected with tradition: the tradition is somewhat akin to myth, or –to say it in other words– specific traditions are somehow incipient theories which have the value, however imperfectly, of helping to explain society (Rowe and Koetter 1978, 122).

However, these arguments are only meaningful if they are "…placed alongside the conception of science from they derive: the largely anti-empirical conception of science not so much the accumulation of facts but as the criticism, in terms of non-performance, of hypotheses" (Rowe and Koetter 1978, 122). As it would seem, like Anderson (1965), Rowe and Koetter's point of reference in *Collage City*, is Popper's conception of tradition. Therefore, actually, arguments of Popper on tradition, which have been already introduced previously, are perfectly relevant for the present case. However, their advance on the issue is slightly different and in this context, tradition is taken into consideration with respect to the idea of utopia.

Utopianism, in Popper's conception refers to the belief that an action "…must be preceded by a determination of ultimate ends…," "…a more or less detailed description or blueprint of our ideal state," followed by "a plan or blueprint of the historical path that leads towards this goal."[32] Rowe and Koetter (1978) emphasize Popper's distinction between "a rational approach to tradition," and "…the rationalist attempt to transform society by the agency of abstract and

[32] As it would seem, this description is much related with the discussions made under the topic "historicism," and "indeterminism" previously. Many arguments made under these topics are also relevant for the present situation.

utopian formulation." As it would seem, this description has much in common with the concepts of "historicism," and "determinism" that have been discussed earlier. A utopian world and the path that leads to it, is "totally designed" or blueprinted, and thus everything that happens and would happen is predetermined. Such a world, to use Popper's (1972a, 217) words, is a "deterministic nightmare." As it is also argued by Rowe and Koetter (1978, 87),

> Utopia has never offered options. The citizens of Thomas More's Utopia 'could not fail to be happy because they could not choose but be good' and the idea of dwelling in 'goodness', without capacity for moral choice, has been prone to attend most fantasies, whether metaphorical or literal, of the idea of the ideal society.

However, there are two issues, which Rowe and Koetter's position differs from Popper's. The first is that they underline the fact that it is impossible to expel the utopian content from architecture. This is not only impossible but also if it is done so, architecture's reason for existence ceases. Therefore, rather rejecting it, the notion should be reconceptualized. In doing this, Rowe and Koetter (1978, 124) show a possible direction by asking the following question: "*How is that, if enlightened traditionalism may be distinguished from blind traditionalist faith, the concept of utopia cannot be comparably articulated?*" Their main proposal is a piecemeal approach to architectural and urbanistic problems, where small utopias are possible. It is a proposal that essentially involves critical appraisal and transformation of the existing, rather than total design through blueprints. Second proposal of Rowe and Koetter is their distinction of two versions of the utopian idea: "…utopia as an, implicit object of contemplation and utopia as an explicit instrument of social change," and high value given to the former. These final conceptions can be interpreted as Rowe and Koetter's advance on Popper's ideas on tradition and utopia. They are extremely important because they provide the condition to incorporate the valuable content in Banham's and Summerson's positions to the evolutionary model.

### 3.2 Evaluation of the Section One

Once the criticized content is reconsidered or filtered out, the ideas that come out of these discussions provide a valuable conceptual framework for the present study. As it would seem, even if some content is criticized and eliminated, the material very well fits the selectionist and evolutionary schema. The major implications of the discussions made in this chapter are twofold:

The first is about epistemology, about tradition, about architectural forms or ideas and about the utopian dimension of architecture, and about the critical attitude towards all. The emphasis is given on the importance and inevitability of tradition in architectural design. From the evolutionary point of view, a relation with tradition apparently implies some type of inheritance, although there may be different variations of such a relation. It is also stated that despite the strong problems it creates, utopia, at least a certain interpretation of it must be an important part of architecture. From the evolutionary point of view, utopia in general, and studies such as Summerson's and Banham's with a heavy emphasis on program and utopia in particular could be interpreted as representing the change and the forward movement from what already exists, in a sense a search into the unknown. Finally, a very important component is the criticism often presented as the complementary component of tradition. From the evolutionary point of view, criticism stands for selection, an entity not only presenting a critical filter for the tradition, but equally for the utopia. These ideas primarily provide a precursor to the evolutionary conception of architectural ideas developed in this thesis.

The second major implication of the examined studies is about the architectural design (process). Here the emphasis is on the nature of architectural problem solving, or design, which on the one hand is tied to past ideas, on the other, involves transformation or adaptation of these to meet the specificities of the "present" conditions. These discussions can be interpreted as an originating point for the second model proposed by the present study: the evolutionary model of architectural design. However, they should be considered as a part of another line of inquiry from "design studies," which is introduced in the next section.

### 3.3 Section Two: Conjecture/Analysis Model of Architectural Design

Popper's influence on architecture is not limited with the studies examined in the previous sections. Actually, the studies summarized and discussed until this point, although they involve discussions addressing design, represent a line of inquiry that might be evaluated as primarily belonging to "architectural theory." There is another major line, which might be evaluated as belonging particularly to the studies in "design research."

As it has already been mentioned in the introductory chapter, Archer (1999, 567), emphasizes the importance of Popper's studies for the studies in "Design Method" and "Design Research." His influence upon design method and design research is actually latter than the introduction of his ideas to art by Gombrich (1960), and to architecture by Anderson (1965), but represents a longer line.

#### 3.3.1 Bill Hillier, John Musgrove and Pat O'Sullivan on Conjecture/Analysis Model of Design

As it is stated by Bamford (2002, 251), although Broadbent prematurely announced the emergence of "a new generation of design methods" based on the "Popperian view of designing," it was 1972, when Hillier, Musgrove and O'Sullivan published their seminal essay titled "Knowledge and Design" that Popper's ideas "moved center stage" in the studies in design method. Their rigorous analysis and application of Popper's epistemology to design methodology was followed by the succeeding articles including Jane Darke's (1979) "The Primary Generator and the Design Process" and Stefani Ledewitz's (1985) "Models of Design Studio Teaching." As it has already been stated, these studies constitute a line of inquiry, or more specifically a tradition that come down to the present day, and recently represented by Bamford’s review titled “From Analysis/Synthesis to Conjecture/Analysis: a Review of Karl Popper’s Influence” (Bamford 2002), and a follow-up article titled “Design, Science and Conceptual Analysis” (2003).

In his review, Bamford (2002, 245) restates the two “principal” or “paradigmatic” models of design in “methodological circles in architecture” as “analysis/synthesis” and “conjecture/analysis.” The roots of these two models lie “in philosophy of science, and in different conceptions of scientific method.” For the description of the model of “analysis/synthesis,” Bamford (2002, 246) cites the following passage from Wolfe:

> … the process would be as follows: First, all facts would be observed and recorded, without selection or a priori guess as to their relative importance. Secondly, the observed and recorded facts would be analyzed, compared and classified, without hypothesis or postulates, other than those necessarily involved in the logic of thought. Third, from the analysis of facts, generalizations would be inductively drawn as to the relations … between them.

The analysis/synthesis model of design is based on the common traditional view of science that can be evaluated as “naïve inductivism.” If we refer to Popper's (1965, 154) description, inductivism is the “view that science starts from observation and proceeds, by induction, to generalizations, and ultimately to theories.” In the conventional thought, “science is distinguished from pseudo-science by its empirical method which is essentially inductive, proceeding from observation or experiment” (Popper 1965, 33).

Analysis/synthesis model of design, which is based on this view, is challenged by the seminal paper titled “Knowledge and Design,” written by Hillier, Musgrove and O'Sullivan in 1972. This is not the first challenge, but one of the most rigorous ones together with Colquhoun's earlier “Typology and Design Method” of 1967. As it is argued by Hillier, Musgrove and O’Sullivan (1972, 73), underlying the science's influence on design, is "the notion that science can produce factual knowledge, which is superior to and independent of theory; and the notion of a logic of induction, by which theories may be derived logically from an analysis of facts." These notions lead to following assumptions:

> First, that that the role of scientific work is to provide factual information that can be assimilated into design; second that rationalized design process, able to assimilate such information, would characteristically and necessarily proceed by decomposing a problem into its elements, adding an information content to each element drawn as far as possible from scientific work, and 'synthesizing' (i.e. inducting) a solution by means of a set of logical or procedural rules (Italics added) (Hillier, Musgrove and O'Sullivan 1972, 73).

The alternate model is known as conjecture/analysis or concept/test, which was powerfully formulated, by Hillier, Musgrove, and O'Sullivan in 1972. Since the root of conjecture/analysis model of design is Popper's conception of science and scientific method that was already introduced in Chapter 2, to remind and to bring the framework to the present discussion, some aspects of Popper's thoughts are worth to restate at this point.

Popper (1965, 53) proposes that the inductive method "based on many observations" is not sufficient for arriving at hypotheses and conjectures. As it was stated earlier, such a procedure proceeds by "imposing regularities upon the world," by trying to discover "similarities in it, and to interpret it in terms of laws invented by us." First, we "jump to conclusions," then test these conclusions, to see if they were wrong. If observations show that they are wrong, then we may discard what was proposed (1965, 53). In this sense, the procedure or process of science essentially involves trial and error, or more specifically conjectures and refutations.

In such a view of science and scientific method, "…a logic of induction and the principle of verification, previously the twin pillars of positivist science, were both unattainable and unnecessary, and … science could be contained within a hypothetico-deductive scheme" (Hillier, Musgrove and O'Sullivan 1972, 72). The point is that "factual (perceptual) knowledge" cannot exist outside a theoretical (cognitive) framework," and "problem-solving, as we understand it today, is not the aggregation of objectively-derived facts, but a dialectic between pre-conceived solutions and observed facts" (Ledewitz 1985, 4). Conjecture/analysis model differs from the analysis/synthesis model as follows:

> First, its core stragem is conjecture-analysis rather than analysis-synthesis. Secondly, the purpose of analysis is primarily to test conjectures rather than to optimize by logical or magical procedures. The notion of optimizing which architects believe they carry out can be easily contained within a conjecture-test psychology of design. Thirdly, the solution in principle is allowed to exist at a much earlier stage than in the analysis-synthesis model. Fourth, the model shows the path of convergence on a unique solution without introducing notions like the optimization of information which, while attractive theoretically, are largely unlifelike and unworkable. Fifth, the model suggests *within its basis concepts* the possible origins of solutions in principle, a matter on which the design methodologists are notoriously silent or mysterious. Sixth, the model corresponds to the observed sequences of products of design, namely a set of descriptive documents of increasing refinement and specificity. Seventh, it recognizes implicitly that both information and conjectured solutions are inherently incomplete, but a stop has to be called somewhere. This is precisely equivalent to the situation in science. Eighth, and perhaps most important, the model emphasizes the importance of designer's pre-structuring of the problem, rather than denigrating it. It recognizes that architects' approach –and should approach– design holistically and not piecemeal (Hillier, Musgrove and O'Sullivan 1972, 79-80).

In Hillier, Musgrove and O'Sullivan's (1972, 75) words, in design, "the maker's capability in pre-structuring the problem is the very basis of his skill …."

> Design is *essentially* a matter of pre-structuring problems, either by a knowledge of solution types, or by a knowledge of the instrumental set in relation to solution types, and that this is why the process of design is resistant to the inductive-empiricist rationality so common in the field (Hillier, Musgrove and O'Sullivan 1972, 75).

The first thing to say about conjecture/analysis is that, it must not be taken as a method, but rather as a model of architectural design, which refers to a process or a procedure. In a close observation, the evolutionary structure behind this process or procedure can be identified.

Hillier, Musgrove and O'Sullivan propose the following idea as their basic conceptualization of design.

> For example, it seems unproblematic to say that when a design problem is stated, there are, theoretically at least, a number of solutions open, probably a very large number. Yet only one of these possible solutions will be the final one that is built. We may reasonably say that some process of *variety reduction* has taken place. The variety of possible solutions has been reduced to one unique solution by some means. The succession of documents produced during design reflect this progressive reduction of variety. More and more specific drawings for example exclude more and more detailed design possibilities (Hillier, Musgrove and O'Sullivan 1972, 77-78).

Apparently, this is a perfect explication of the selectionist schema behind the conjecture/analysis model. We may elaborate and advance the proposals as follows. Since not all the conditions that are relevant to a design can be known, either at the begging of the design process, or at any stage of it, and since there are almost an infinite number of ideas that can contribute to the design, we may suggest that at the beginning of a design process, theoretically, there are infinite variations possible. Equally, the procedure of design primarily involves not only variety reduction but equally, variety creation. Therefore, the succession of documents produced during design also reflects externalization of a set of variations to be evaluated to decide which one meets the conditions. Design is about creation or construction of something, rather than finding a solution out of already existing (or possible) set of solutions. Furthermore, a design is not a solution itself, but a thing, which might only provide potentials and conditions.

For Ledewitz (1985, 5) design is a “developmental process” that operates in terms of producing “conjectural” solutions and then “testing” these tentative trials. She states that

> By conjecturing or imaging, a designer conceives of a 'solution in principle,’ early in the design process, which is progressively developed and refined (or discarded). The representation of the conjecture by drawing or making models is a means of elaborating it and communicating it back to the designer or to others for evaluation or “testing” (Ledewitz 1985, 5).
>
> The activities of conjecturing and testing, intuition and rationality, creative leaping and rigorous analysis, thrive on each other; oscillating or cycling between them is what enables the designer to learn from his or her work and progressively improve design” (Ledewitz 1985, 5).

In Hillier, Musgrove and O’Sullivan’s (1972, 79) conception,

> When a conjectural approximation of a solution stands up to the test of the increasingly specific problem data (bearing in mind that it is always possible to collect more data and to produce more conjectures) a halt is called to both conjecturing and data-gathering, and a solution in principle is agreed to exist. Further specification

> takes place (i.e. further variety reduction) by completing a full design, and this is followed by a further refinement when the final production drawings are made.

We can also reconsider and advance these proposals. It is true that design process also involves refinement. But rather than being merely stages towards more detailed (or refined) version of a design, the succession of documents also point to (part or whole) variations created during the design process, as a means of embodiment of various ideas, externalized and recorded so that they could be evaluated. That is to say, the process of conjecture/analysis should not only represent a (single) developmental line of a design from a less detailed towards a more detailed description of a design. Alternatively, might it be an all-encompassing procedure operational not only physical development of a design, but actually in many other possible layers? Conjecture, in this conception actually has three dimensions: First, it refers to the physical being of the design (or the work), and acts of making related to its physical being. Second, it refers to ideational or conceptual content of a design. Third, it refers to mental activities that are operational in the act of "conjecturing." Analysis, on the other hand refers to testing of the "conjecture." In architecture, this is the evaluation of the proposed design (conjectural solution if we prefer) with reference to a set of conditions. Apparently, it is not merely about testing the pre-conceived solutions with the observed (empirical) facts, but rather with a set of conditions, not all are empirical.

Such questions are not unexpected, since conjecture/analysis is derived from evolutionary epistemology, and it is not primarily about, say, design of an artifact or about the design itself. A scientific theory can be formulated by the means of a written language. Here, the text is a means of externalization and exosomatic representation of the content of the theory, and it is a means of carrying and transferring such content. The point is that, an architectural design cannot be seen as such.[33]

There are many criticisms directed to "conjecture/analysis" model, such as "a building is not itself a problem, something which can be solved" (Bamford 2002, 252), or "a building is not a conjecture," that can be tested or "refuted." Lionel March (1976, 266), too, makes a distinction between a "scientific hypothesis" and a "design hypothesis" and between the "processes," and "products" of logic, science, and design as follows:

> The philosophy of Karl Popper has had some influence on modern architectural design theory. In the main its impact has been pernicious, but this is as much the result of misunderstandings as it is of Popper's own shortcomings. Just as Popper draws a distinction between logic and empirical science, so too must a distinction be made between these and design. To base design theory on inappropriate paradigms of logic and science is to make a bad mistake. Logic has interests in abstract forms. Science investigates extant forms. Design initiates novel forms. A scientific hypothesis is not the same thing as a design hypothesis.

Arguments as such emphasize the dangers of too literal application of such paradigms to architecture and architectural design, or weaknesses of analogies between incompatible disciplines or areas. However, if these statements are closely examined, it would be clear that various layers of a design are either confused or taken as one and the same thing that lead the model's critics and even model's proponents to equalize or misconceive a building and a hypothesis, and designing a building and constructing a hypothesis. For example, a building, as a physical thing surely cannot be a hypothesis since hypotheses belong to the world of ideas, namely world three. On the other hand, a building or a design carries such "hypothetical" content, which can be

[33] For example, a theory written on a piece of paper does not mean anything to an animal. It is only meaningful for those who can read and understand it. But, a shelter as a world 3 object carries the idea of sheltering and the idea of a shelter, but also, as a world 1 object, it provides an objective opportunity in the physical world that could also be appraised by an animal.

considered in these terms. To remind, such confusion does not apply to Popper's conception of science, scientific knowledge, and scientific method, owing to his three-world ontology, since first he locates science and scientific knowledge with reference to this structure, within world three. Such a clarification is also required for architecture. Design operates on various layers, weaved together, each layer with its own specificities, which must be considered in its own terms.

### 3.3.2 Jane Darke on the Primary Generator

In her article titled “The Primary Generator and the Design Process,” Darke (1979) takes and advances the conjecture/analysis model by introducing the notion of “primary generator.” For Darke (1979, 38), “the idea of primary generator is a useful way of conceptualizing a particular stage in the design process, that stage that precedes a conjecture.” Introduction of the notion means a transformation on the conjecture/analysis model, which turns it into generator/conjecture/analysis.

The “primary generator,” is the “concept or objective that generates a solution … It can in fact be a group of related concepts rather than a single idea” (Darke 1979, 38). Such objectives or concepts “…form a starting point for the architect, *a way in* to the problem, he does *not* start by listing all the constraints.” The difference of the “primary generator” from “the first conceptualized image, the ‘conjecture’ in the terms of Hillier *et al,”* is that “the term ‘primary generator’ does not refer to that image but to the ideas that generated it” (Darke 1979, 38).

This is an important advance on the model. As it would seem, “primary generator,” operates primarily on the level of ideas. In introducing such a notion, Darke suggests that, in the creation of an architectural design, there is an entity (an idea) that precedes and informs the initial conjecture (or conjecturing). In this conception, the mentioned entity in a sense precedes such an act. Actually, what is suggested by Darke can be expanded to the whole design process. That is to say, such ideas which precede “conjecture” or “conjecturing” are operational throughout the design process, not only at the initial stage. “Primary generator” can be interpreted as one of such ideas, among many.

Therefore, with the introduction of the primary generator, the original schema of conjecture/analysis should not be transformed into generator-conjecture-analysis as it was suggested, where generator represents a distinct procedural step or a stage which resides at the beginning of the process. The process should remain as conjecture/analysis where a set of “generators” are always operational throughout the whole process, in a sense representing a layer.

### 3.4 Evaluation of the Section Two

The introduction of conjecture/analysis model of design is not only a means of constituting the conceptual framework of the present study, but also a means of introducing the design model that is the basis of the evolutionary model of architectural design. In this sense, this section can also be placed right before Chapter 5 where the model is developed. In parallel, the conclusion of the present section can also be taken as an introduction to the Chapter 5.

The arguments made throughout the introduction of the conjecture/analysis model of design show that the model has potentials to be reconsidered and expanded. This could be done by examining the model’s roots in evolutionary epistemology from a wider point of view, and by emphasizing and foregrounding the evolutionary pattern inherent in the model. The first demands an understanding of the conjecture/analysis model by focusing to its context within which it was conceptualized. The second demands going into the roots of the model in the theory of evolution or selectionist theory, particularly the theory’s interpretation and advance in evolutionary epistemology. Actually, these tasks were largely accomplished in Chapter 2.

This chapter completes the constitution of the conceptual framework of the present study. Taking this framework as a basis, in the next two chapters, I go on to develop and formulate the evolutionary models.

# CHAPTER 4

# CONCEPTUAL INHERITANCE IN ARCHITECTURE AND THE EVOLUTIONARY CONCEPTION OF ARCHITECTURAL IDEAS

*The first method of evolution is, in brief, that of introducing some novelty, anatomical or physiological or behavioral, and having it tested by natural selection. The second method of evolution introduces something new in place of natural selection, namely conscious critical rejection, and that, I think, is the really fundamental difference between natural evolution and cultural evolution. Some people have said that the difference is that natural evolution is Darwinian in character, but that cultural evolution is Lamarckian and proceeds by induction. This I think is a mistake. Cultural evolution is also Darwinian; the difference is only that, in place of natural selection, we ourselves begin in part to take responsibility by way of the critical elimination of our efforts.*

*—Karl R. Popper, The Self and Its Brain*

In Chapter 2, I briefly introduced the theory of evolution, and pursued the application and expansion of the idea in evolutionary epistemology. As a complementary component, I also presented Popper's three-world ontology. In doing these I set the epistemological and ontological position of the present study, and construct the conceptual framework of it. As the complementary framework, in Chapter 3, I introduced two groups of studies from the theory of architecture, from the late 50s and early 60s, which aim critical reconsideration and revision of the ideas of Modern Architecture. From the viewpoint of my epistemological and ontological position, I reviewed the merits, and the problems of these studies. I suggested that, introduced studies constitute two paradigmatic positions, often presented as oppositions, but actually, the content of these studies provide a valuable and complementary material if critically reevaluated, and their valuable content can take place under a governance of a wider view of architecture and architectural design.

From a different point of view, in Chapter 3, within a particular context, I also reviewed and reconsidered the studies that utilize Popper's epistemology in architecture. This means, in the related chapter, by critically reviewing these studies, I also set and state the context of the present study, and the tradition within which the study is embedded, and the line of inquiry which I intend to pursue and contribute to, by undertaking such a study. In doing all these, I utilized the theory of evolution, or the selection theory, particularly its conception in evolutionary epistemology, as my primary schema or preconception underlying my models. With this respect, I reexamined the mentioned studies from architectural theory, from an evolutionary point of view, and foregrounded the "evolutionary" within them. In doing this, I established the foundations of an "evolutionary model of architectural design" and an "evolutionary conception of architectural ideas." At this point, I will continue my study by conceptualizing the evolutionary models.

In Chapter 3, the discussions solidify around the issue of tradition. Apart from Banham and Summerson's apparent opposition, Rowe, Anderson and Colquhoun, while emphasizing its importance, conceptualize and elaborate the idea of tradition within the specificities of architecture. In doing this, Rowe and Anderson's direct reference to Popper's studies is noticeable; actually, they utilize both Popper's conception of tradition and his epistemology for addressing various issues in architecture. Architectural tradition comes out to be an important part of their models. Colquhoun's approach, on the other hand, varies slightly from these in terms of its main reference points and in terms of its more explicit handling of some architectural issues in evolutionary terms. That is to say, Colquhoun provides a framework that perfectly overlaps with Popper's conception of tradition, and Anderson's and Rowe's advance of the notion in architecture, but his framework has its main roots in artistic and architectural *avant-garde* and in Modern Architecture. He, proposes that creative act cannot exists in an epistemological vacuum but it is always embedded in a set of objective, but still temporary and changeable "facts," namely a tradition, which was constituted by historical and cultural accumulation of ideas. This is, in Colquhoun's conception, the "raw material" of architecture, to be interpreted, used, and transformed in a creative act. Colquhoun's conception of tradition and his placement of it within architecture can be interpreted as the architectural counterpart of Toulmin's notion of "conceptual inheritance." Colquhoun does not explicitly mention the inherent evolutionary aspects of his model. On the contrary, in his criticism of the "biotechnical determinism" of Modern Architecture, he identifies and emphasizes the common points of the doctrine with Herbert Spencer's evolutionary theory. Actually, neither Rowe nor Anderson foregrounds such a structure, despite the fact that an evolutionary or selectionist schema is implicit in their approaches. Actually, as it was already stated, the notion of "evolution," refers to various conceptions, not all of which are applicable to architectural phenomena and some of which deviate much from the essence of the original conception, such as the Spencerian evolutionary theory, which showed determinist and teleological overtones.[34] Perhaps this is the reason why approaches or models of Colquhoun, Anderson, and Rowe are never interpreted as "evolutionary" by themselves.

It would be interesting to remember, in evolutionary epistemology, the evolutionary schema is particularly emphasized throughout the key discussions. This is primarily related with the genuine and deep understanding of the theory of evolution and its rigorous adaptation and advance for the specificities of epistemology and cultural evolution. Such an understanding and a follow-up application would also be possible for architecture. This is the matter of the present and the succeeding chapters.

In the present chapter, I develop an evolutionary model that is called the "evolutionary conception of architectural ideas." The model mainly refers to

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[34] For example, see Colquhoun's discussion on the issue (Colquhoun 1969, 45).

the existence, and life of architectural ideas or concepts, and conceptual inheritance regarding these ideas. This view is based on the hypothesis that architectural ideas have a life of their own and this life has an evolutionary nature. The main reference of this view is the evolutionary epistemology and three-world ontology. Actually, the suggested conception is a means of application of the three-world ontology and evolutionary epistemology to the specificities of architecture.

In the present chapter, first I introduce and critically discuss a recent study that puts forward an evolutionary design model by applying the idea of evolution and some key notions from genetics to the specificities of architecture. The study is important since it presents a certain interpretation of the theory of evolution and introduces a certain way of utilizing it in explaining architectural phenomena. While critically reconsidering this study, I propose an alternative view of the theory of evolution in its application to the specificities of architecture.

## 4.1 Evolution as Transference of Elements or Aspects Between Architectural Designs

In literature on architectural precedents, implicitly or explicitly, it is often accepted that precedents, or certain components of the precedents are used in the creation of new designs, by adaptation, recombination or otherwise. The components are often taken as indistinguishable from the specific cases that they were "originally," taken. For example, Moraes Zarzar's (2003) book[35] titled *Use and Adaptation of Precedents in Architectural Design* is one of the most recent examples, which present and rely on such an approach. In her book Zarzar (2003, 6-7, 151) proposes that, "features" or "precedent-components" or more specifically, "architectural genes," are actually transferred from one design to another.

[35] This book is based on Zarzar's PhD. Dissertation titled *Use and Adaptation of Precedents in Architectural Design: Toward an Evolutionary Design Model,* completed in Delft University of Technology under the supervising of Prof. Alexander Tzonis in 2003.

The main concern of the book is the use and adaptation, or in its author's conception, the “reuse,” of design precedents in the design process. Its main objective is to establish a model and a (computational) theory that would function as an initial step for developing a computational tool “… to facilitate the use of design precedents to assist architects in the creation of innovative designs” (Zarzar 2003, 1). The model is intended to be applied to architecture

> [for] understanding the phenomenon of change in the design process to the extent to which they are based on the re-use of design precedents … to know what was reused, how it was re-used, as well as which features (precedent-component) were modified and recombined through time and how” (Zarzar 2003, 8).

In the book, precedents are taken as features and sometimes principles transferred to new designs either in clusters or independently, rather as whole projects or buildings.

One of the major discussions, which come out of Zarzar’s thesis, is the relation between the process of re-use of design precedents and the Darwinian evolution. The main problem addressed in this discussion is the possibility of “representing re-use and adaptation in design with the help of the Darwinian evolutionary model” (Zarzar 2003, 112). It is based on the hypothesis that logically, a process or phenomenon is evolutionary if it meets the basic principles of the theory of evolution: variation, selection, and inheritance. About this, Zarzar makes the following assumptions:

> If we assume that in design, precedents are patterns; that inheritance is the transference of characteristics from one design to another to solve actual problems; that many designs are only variations of a theme; that sketches produced during one design process are compared so that the fittest, the design which shows the highest performance, will survive, then we can say that in this perspective, the process of re-use of design precedents can be called evolutionary (Zarzar 2003, 117).

There are three distinct propositions made at the beginning of this paragraph, not all of which are directly related with the conclusion, each emphasizing a distinct alternative for application of the theory of evolution to architectural design. Zarzar (2003, 8, 12) argues that her thesis draws analogies with the "biological Darwinian Theory of evolution and genetics" to the degree that they can help to structure architectural phenomena.

The first thing to say is that, in fact, the theory of evolution and genetics are related but distinct matters. As it was emphasized in the Chapter 2, the theory of evolution refers to a special type of change. On the other hand, genetics refers to biology, and involves heredity of living organisms through the units of heredity: the genes. While the first one can be applicable to architectural phenomena, the second would need forced analogies or non-applicable entities such as the "genes" themselves. That is to say, when one seeks an evolutionary pattern or schema in a phenomenon, one does not need also to seek for genes. It fact Zarzar (2003, 12) anticipates the possible problems in utilizing such analogies:

> The analogy of design with the biological evolutionary model faces two major risks. Firstly, there is a risk of misrepresenting biology by using pseudo-concepts which are either very reductionist or false. Secondly there is a risk of blindly applying biological theories to architecture, forgetting the distinct characteristics of both fields and thus not satisfying the conditions of a tool to serve architects in practice.

A better account of such a problem is made by Dennett. Dennett (1995, 345) does not deny that "… there is cultural evolution, in the Darwin-neutral sense that cultures change over time, accumulating and losing features while also maintaining features from earlier ages." However, he also raises the question "… whether such evolution is weakly or strongly analogous to, or parallel to, genetic evolution, the process that Darwinian Theory explains so well …." He foregrounds the problem that could reside in such a forced analogy by making the following arguments:

> At one extreme we may imagine, it could turn out that cultural evolution recapitulates *all* the features of genetic evolution: not only there are gene analogues (*mémé*s), but there are strict analogues of phenotypes, genotypes, sexual reproduction, sexual selection, DNA, RNA, codons, allopatric speciation, demes, genomic imprinting, and so forth – the whole edifice of biological theory perfectly mirrored in the medium of culture (Dennett 1995, 345).

It is almost impossible to disagree with this, but, in a closer investigation, as it would seem, Dennett, too, falls into the fallacy that theory of evolution equals to genetic evolution, or, they are the same thing. That is to say, neither of the listed notions; the phenotypes, genotypes, sexual reproduction, sexual selection, DNA, RNA, codons, allopatric speciation, demes, genomic imprinting, actually are elements of the idea of evolution, or the selection theory. To remind, the selection theory has its own specificities, which does not require or presuppose the elements mentioned by Dennett. However, in the case of non-applicability of the genetics and notions borrowed from genetics Dennett is right. What is also interesting, which supports the present position, is that his definition of cultural evolution, which he could find no word to replace the term "evolution," almost perfectly matches the conception proposed by the present study.

Zarzar, at the point of developing an evolutionary model, defines her problem as the lack of explanatory power of the Darwinian evolution, "the underlying mechanism of inheritance," therefore not providing an adequate material for this purpose. To resolve this problem, Zarzar pursues the path that seems to be logical at the point. She introduces some key notions from genetics as an advance on the Darwinian evolution, utilized as an analogical source for her study. Before pursuing this line, she investigates the notion of *mémé,* in

Dawkins' (1989, 192) original conception, replicating units of cultural evolution, analogous to genes in biological evolution. Since this is an already established notion that seems to be the answer to Zarzar's problem, it has be either ruled out to be replaced with a better conception, or perhaps reinterpreted in a different light. Zarzar prefers to rule out the notion. After a short summary, Zarzar confesses that "reductions are part of an analogy," but "Dawkins' reduction would misrepresent the process of re-use in design." For Zarzar (2003, 89) the concept of *mémé* is not suitable for her model for the following accounts:

> Firstly, the *mémé* concept has been extended and reinterpreted by many researchers; to avoid misconceptualization of the real processes in design, we have decided to keep away from Dawkins' analogy between culture and biological evolution. Secondly, we claim that the *mémé* used to date can mean anything: a symphony and a part of it, evolutionary theory or the mechanisms within it. In this sense it is not serviceable: it is not clear what is being transmitted from generation to generation ….

At the end of the discussion, in place of Dawkins' idea of *mémé,* Zarzar prematurely proposes the idea of an "architectural gene" that she calls the d-gene. It is a replacement, because as *mémé,* stands for the "unit of heredity" for cultural evolution, and its biological counterpart, the gene stands for a "unit of heredity" for biological evolution, "architectural gene" or the d-gene intends to stand for the "unit of heredity" for architectural evolution. There is one important difference that I would like to emphasize: perhaps because of Zarzar's preconception that evolutionary link occurs between two or more artifacts, one "generation" to another, one "species" to another, and one design to another, *mémé* has to be ruled out. This is because the idea of *mémé* implies that the evolution and transference of a *mémé* might exist outside the artifacts. It basically refers to a type of "conceptual inheritance," not transference of aspects between artifacts.

It should be noted that one of the primary references of Zarzar's thesis is Gregor Mendel's thoughts on inheritance. Zarzar argues, "to describe the mechanisms of re-use, one has to explore the process behind the design generation." She claims that this requires "a description of all information concerning the building … observed on the final design or artifact, and … accumulated during the design process including the mental processes." Obviously, since this is not possible, she proposes "… an analogy with the biological mechanisms of inheritance as a tool to find a representation for re-use in design" (Zarzar 2003, 118). As a first stage, she applies Mendel's notions of genotype[36] and phenotype[37] to architecture as follows:

> … phenotype is the representation of a building, i.e. a group of characteristics visible in the product … while the concept of genotype … refers to decisions applied at process level, in particular, decisions concerning the re-use of design precedents …. By analyzing a design process, one can see all the 'crosses' which were effectuated, whether they were accepted or not. The characteristic that appears in the product is the dominant factor, while those not selected at that time are considered 'recessive factors' …. The genotype of a design may only be observed if one can explore the design process and identify the used design precedents … (Zarzar 2003, 121-122).

As a second stage, she goes on to explore "what kind of processes or mechanisms can be (analogically) used to represent transmission and expression of design precedents … How do some characteristics 'pass' from one design to another," and finally how these characteristics are "expressed," in genetics and embryology. As an outcome, she introduces two concepts to architecture, taken from these fields: regulatory d-genes that guide growth,

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[36] In *Merriam-Webster* (2000), following definitions of Genotype is given: "the type species of a genus," "the genetic constitution of an individual or group," "the totality of genes possessed by an individual or group," "a class or group of individuals sharing a specified genetic makeup."

[37] In *Merriam-Webster* (2000), following definitions of Phenotype is given: "the detectable expression of the interaction of genotype and environment," "the visible characters of an organism," "a group of organisms sharing a particular phenotype."

differentiation, and morphogenesis, and structural d-genes that fulfill the ‘orders’ or the descriptions given by the regulatory genes.

Tzonis' (1992) “Form-Operation-Performance” frame, which Zarzar prefers to call POM (Performance-operation-morphology), finds its place in this framework as a descriptive or representative tool for the genes and how do they come together. *Unité d'Habitation* is taken as a case for illustrating the proposed model, to show how the “qualitative model is applied to represent the process of re-use of design precedents in architecture” (Zarzar 2003, 163-164). The task is twofold: searching previous designs of Le Corbusier, in Zarzar's terms “species,” for determining features and the presumable evolutionary links from one to another, and searching features, or with the term used in the thesis, the “genes” in these designs and for verifying their evolution and linkages. The selected “species” are *Maison Dom-ino*, Citrohan Houses, *Immeubles-Villas*, and the determined features or the “genes” are bottleracks or wine bins, roof gardens, and the *piloti*.

Without pursuing further, as a whole, the model proposed in the thesis can be interpreted as “genetic” rather than “evolutionary.” The emphasis on a “genetic” model of architectural design leads to the hypothesis that “inheritance” is the transference of characteristics from one design to another analogous to characteristics inherited from one organism to another through genes.

Such a hypothesis is at least cannot be generalized to all designs, and such a “genetic” relation between architectural designs is not traceable. Nevertheless, the main problem is not that we cannot trace or determine such “genetic” links between artifacts and determine the “origins” of the architectural genes or aspects as analogous to genes. The main problem is that in design such genetic links simply do not exist as they do in biological evolution; even in the cases that seem to have such relations. For example, Le Corbusier's designs provide generally “easy” or “obvious” samples, which are helpful to illustrate such relations between specific designs. So they are utilized as illustrative cases in

Zarzar, where for example, one of Le Corbusier's five points, the “roof garden” is conceived as originated from the vernacular houses of İstanbul, transferred first to the Citrohan Houses, then to *Immeubles Villas* and finally to the *Unitě d'Habitation*. The chronology of the use of the idea and its evolution and existence in these cases is accurate. However, the “genetic” relation between the objects is merely an illusion. The given examples are actually four cases that carry the variations of the idea of “roof garden.” There is an evolutionary inheritance; however, it exists not between the designs, but in the level of ideas and in the level of tradition. That is to say, if there is a conceptual inheritance, it exists within the world of ideas and it refers to inheritance of ideas.

**Evaluation**

● The first problem in such a model seems to be coming from a misconception that presents evolution and genetics as two indistinguishable entities, and the thought that genetics provides a conceptual framework that is applicable to architecture.

● Associated with the first, second problem is related with the view of designs analogous to “species” where aspects of these designs are like “genes” which are transferred from one design to another.[38] Two further problems come out of this view.

● If the actual model is the genetics and the evolution, then it is problematic that a set of genes are transferred between same species and each species should follow an ancestor that precedes it. Apparently, both phenomena are hardly analogous to designs and the creation of architectural designs. That is to say, such evolutionary relation between designs cannot be generalized. Buildings are not analogous to species; there is no genetic transfer between

[38] However, it must be noted that Zarzar's conception of architectural genes is structured rigorously, especially after the introduction of the “form operation performance” frame originally conceptualized by Tzonis (1992). It does not illustrate or help to illustrate the evolution between the designs though, but more of how architectural knowledge finds its place in the conception of a design and the structure of this relation. In this sense interestingly, model is still valuable in many aspects without the mentioned fallacy. However, it needs a reconsideration and reinterpretation. This issue will be discussed in the succeeding chapters.

designs, and finally not every new design has an (genetic) ancestor. Actually, the nature of conceptual inheritance in architecture could be explained in purely selectionist terms, without resorting to genetics.

● In evolution, variation and selection applies to species, not genes. Therefore, if architectural designs are analogous to species, in such a model, the architectural artifact should be the subject of variation and selection. However, such an analogy would not be plausible, since a new architectural design only in some occasions start from an already existing design and proceed simply to transform it. Therefore, a new creation in architecture cannot be interpreted as a variation of an existing design. This is a clear mismatch with the selectionist paradigm.

**4.2 Conceptual Inheritance in Architecture**

To remind, as it was already mentioned in the Chapter 2, actually, "the pattern of 'variation and selective perpetuation,'" in its application to other fields, should be treated "… as one special case of a more general pattern of historical change," and one should look for "corresponding patterns with different parameters" (Toulmin 1972, , 320).

Following this key proposition made by Toulmin, in architecture, the selectionist pattern could be identified in the architectural tradition, mainly related with the matter of "conceptual inheritance." As it was stated in the introductory chapter, at any point in time, architectural tradition (like any tradition) represents an inherited body of ideas and conceptual structures, an "intellectual content" that is the basis of the "present practice" and the basis of further creations and modifications. This is what Toulmin calls the "conceptual inheritance."

"Intellectual novelties" are bound up with such a "conceptual inheritance" in a twofold manner.

● As it was already stated, new conceptual creations are established upon an already existing "intellectual content" specific to a domain. No creation can exist within a conceptual vacuum. In this sense, architectural tradition provides the intellectual basis for the creation of new ideas. That is to say, every new creation is bound up with a "conceptual inheritance."

● Every new creation is also evaluated with reference to the existing "intellectual content" of a discipline, and only if it wins a place and embedded within that tradition, it could be retained and inherited. In turn, every new creation, which is accepted or embedded within a tradition, works as a "unit of effective modification," which ensures the "stable" evolutionary transformation of it.

Yet from another point of view, design of an architectural work is always bound up with a certain "conceptual inheritance," not only for that architectural tradition provides the "material" to be reappropriated and reused for the new designs, but also for that the "material" it provides is one of the basis for the evaluation of what was created.

### 4.3 Architectural Thought Contents

> *At one time, while giving a criticism to a student, a direction evolved. It came through the discussion as I was drawing. But it seemed to me it was a condition of discovery which went beyond ... was quite independent of whether I drew it or whatever. It was the principle involved. It was a direction, it wasn't anybody's property. I came back later on and asked the student what had transpired. Had it been of any use? He said, "I couldn't use it because it wasn't mine." I said, "Whose was it?" And he said, "yours." I said, "it wasn't mine either. It was an idea, which has the capability of fluttering around free; so you can use it if you want."*
>
> *—Fred Koetter, taped interview with Stuart Cohen, The Texas Rangers*

"Intellectual content" of a field is constituted by the thought contents, or "objective contents of thought" that are available to that field. In this section, I introduce and examine three studies that present different views of architectural thought contents or ideas. After introducing and critically evaluating these studies, I will try to develop and propose a wider view of architectural ideas, with an evolutionary or selectionist emphasis, which could contain all the thought contents that architecture might concern.

**The Architectural Idea**

> An idea, so to speak, is the cornerstone around which to build the design. The idea of an architectural design is that spirit which is felt throughout the design, the spiritual part of the building …. It is the thought of the designer's mind that guides him every decision and ultimately results in the continuity of the whole design …. An idea, architecturally, is the scheme or motif behind a design. It is, if handled right, apparent in the creation itself and furnishes the reason for the design looking as it does. A good idea is readily discernible in a building and doesn't have to ask why this or that was done in the construction of it because the reason is obvious in the design (Caragonne 1995, 262).

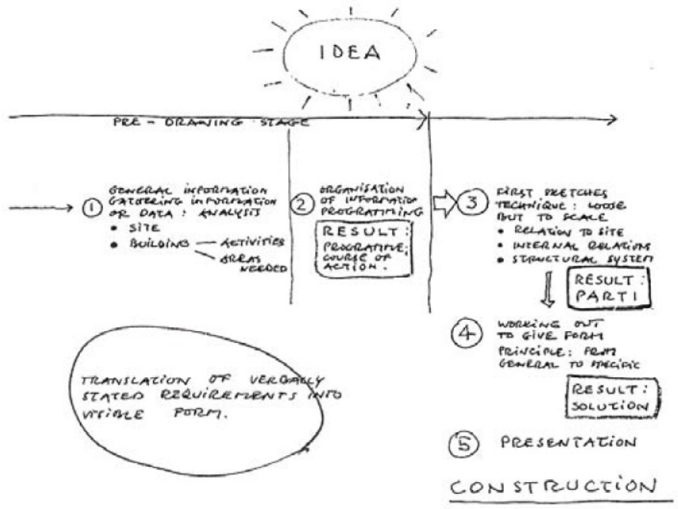


Figure 4 A diagram of the architectural idea within a design process (from Bernard Hoesli’s notebook) (Caragonne 1995, 263)

These are the responses of the students of the University of Texas, School of Architecture, in a written examination, in 1957. Architectural idea (Figure 4), as it is stated by Caragonne (1995, 262), "…was a salient and important feature of the new program," and "…the mysterious universal, timeless essence of the architectural idea" was "…one of the most fascinating aspects of the new teaching as it evolved …."

In these definitions, an architectural idea is conceptualized as the "dominant" element that initiates and/or governs the design process, or more specifically, creation of an architectural design. However, there is not a single understanding of it, for example, in design, an idea might be an organizational or formal element, which works as a schema, or it might be a set of principles, which guide the making, or provide the reasons. Caragonne (1995, 264) argues, "different ideas might emerge emphasizing different facets of the problem – functional, spatial, structural, or any two or all of these in combination, depending upon the predilection and the sophistication of individual students." However, the emphasis is given on "idea" as an overarching element, which "would clearly illustrate and express an *architectural* response to the requirements of program, site and structure" (Caragonne 1995, 264). The nature of the architectural idea is expressed as follows:

> Semantically, the architectural idea was nearly always expressed metaphorically, but in a visual rather than a literary sense. The precise selection of that metaphor was important. For example, "a floating box wrapped around a sculptural core" or "the erosion of an implied cube" or "the superimposition of a structural grid over a system of freestanding volumes" could all serve to describe Le Corbusier's Villa Savoye at Poissy. However, the latter metaphor might more accurately approximate that complex interweaving of space and structure than the former two. The student's choice of parti was also influenced by the precise formulation of the idea. The ability to hone one's definition of the architectural idea, to distill it down to its precise spatial, structural essence often proved to be a reliable indicator of the ability to develop that idea to the greatest extent architecturally (Caragonne 1995, 264).

Here, in these conceptions, the strong emphasis on the formative aspect of the architectural idea is apparent. That is to say, no matter whether the idea emphasizes the structural, spatial, programmatic facet of the design, it always refers to a description, which in a sense sets relation between this facet and the form.

Another emphasis is on the location and the privilege of the idea in a design process. The idea "emerges" at the very early stages of the design process, and from that point on, as a dominant; it governs, and rules the whole process. Actually, this is widely accepted notion of the architectural idea or concept. However, still, it is, on the one hand, quite a narrow conception of the architectural idea, in terms of both scope, and variety, on the other, by definition, such a conception could only point to a "specific" type of architectural idea.

**The Form-Operation-Performance Frame**

The problem situation of Tzonis (1992) in "Huts, ships and bottleracks: design by analogy for architects and/or machines," is capturing and representing "architectural knowledge," in the pre-parametric level, as they reside in the precedents, and consequently the use of this knowledge in the conceptualization of new designs.

In the study, a structure, or more specifically, to use Marvin Minsky's (1974) terminology, a frame[39] is proposed. Tzonis (1992) argues that

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[39] Following summary can be made about the frames: In his influential essay "A Framework for Representing Knowledge," Minsky (1974) starts by describing a theory of artificial intelligence and thinking. The essence of the theory is given as follows: "When one encounters a new situation (or makes a substantial change in one's view of the present problem) one selects from memory a structure called a 'frame,'" which is "a remembered framework to be adapted to fit reality by changing details as necessary." The general idea of frame (and its modified version frame-system) has its epistemological roots in the "paradigms" of Kuhn. For Minsky, a "frame" is a data structure for representing a typical (or already known) situation such as a solution to a particular problem or an object. Typically, several kinds of information can be attached to a frame. Minsky argues that a frame is typically "a network of nodes and relations," where the "'top levels' of a frame are fixed, and represent things that are always true about the supposed situation." There are many slots or terminals at the lower levels those must

> Frames are a powerful data-structure to capture standard cases, and exploit law-like facts of architectural knowledge. They can embody architectural rules and principles qualitatively employing nominal values. They can carry out symbolic reasoning without excluding the possibility of using non-verbal, "sub- symbolic," numerical computations. Visually the idea of a frame can be displayed through a graph whose nodes and links, stand for objects and relations between them. These nodes and links make up a kernel of design thinking which gets hold of constants, facts. Nodes and links spread out of this kernel to account for particular fact- instances through slots, terminals which can receive specific values and keep track of differences and changes.

Based on this structure he proposes a frame for representing "architectural knowledge," in the pre-parametric or conceptual level, which he calls the Form-Operation-Performance frame. He describes the basic structure of this frame under the governance of three main and a supplementary elements. The first element is the form or morphology, "the most obvious place to start putting together such a system," which is about "how a design product is made … its characteristic attributes, its spatial composition and its material structure," which denotes the "configurational attributes as well as the physical constitution of design products." Second element is the operation; from a perspective of physiology, "the form of building controls, holds or channels, people, objects, equipment associated with activities." From the point of teleology, the third element is the performance of the buildings, anticipated or actual. Finally, all the above is considered in terms of a fourth element; "in reference to the context within which the artifact is to be realized" (Tzonis 1992). The frame works as a whole; the form, operation, performance and context are always interrelated. In Tzonis's (Tzonis 1992) words,

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be filled by specific instances or data. Each slot or terminal can specify conditions its assignments meet where these assignments are usually sub-frames. The slots can be assigned "to be a person, an object of sufficient value, or a pointer to a sub-frame of a certain type." These terminals are already filled with default values, which can be interpreted as assumptions or expectations subject to displacement with new items that fit better to the confronted situation or problem.

> [This interrelationship] can be expressed in constraints that state which performance of a building may result from which operation and, in turn, which operation may result from which form, a rule chain whose links are neither deterministic nor closed. The performance of an artifact may depend on external conditions, conditions that apply to its operation, as the operation itself may depend on external conditions attached to the artifact's form.

Operationally, morphogenesis "…starts with prescriptions of performance and terminates with prescriptions of form." By searching for "the form that artifacts have to take to bring about one or more performances that have to come about," it tries to answer questions such as: "if a building has to be highly safe (performance-norm), what pattern of circulation of people has to occur (operation), and if this circulation pattern has to take place what the configuration corridor has to be have (form)" (Tzonis 1992). On the other hand, "context enters the design reasoning by attaching conditions within which the principles or rules about relations between form-operation-performance apply." For example, it applies as follows: "If a corridor has a specific shape X then people can safely evacuate a building unless the lighting conditions are of type Y" (1992).

Form-operation-performance frame is one of the frames among many that might be utilized to represent an architectural design. However, the mentioned phenomena might be far more complex than the proposed system or structure allows for. The problem mainly derives from the concept of frame itself, essentially a little bit mechanistic as a model for representing architectural designs. That is to say, what is important is the structure of the relation, what Tzonis (1992) calls the "syntactic relation" of the extracted form to the total form of the precedent, which "helps designing a new whole through recomposing precedents." In its present state, the elements of a frame structure are like parts of a machine, to be assembled and reassembled together by the governance of a set of rules. The relation between the elements is prone to be one-way and mechanistic. On the other hand, it is also questionable if form-operation-performance frame has the potential to cover all the ideas, which potentially or actually have a formative contribution to the creation of a design.

**The Issue-Concept-Form Formalism**

In "Precedents in Design: a Computational Model for the Organization of Precedent Knowledge," Rivka Oxman (1994, 141) begins with emphasizing the importance of "prior knowledge" as "a significant source of knowledge in the creative process of design." She goes on to argue that

> In employing knowledge from prior design ideas relevant to the current problem may be accessed from past designs. Since a design precedent is a recognized past design the term provides a convenient reference for this characteristic of the unique knowledge embedded in a known design. The process of the selection of relevant ideas from prior designs in current design situations has been termed *precedent-based design.* In the course of exploration of design ideas within precedents, designers appear to be able to browse freely and associatively between multiple precedents in order to make relevant connections. Furthermore, browsing enables the discovery of new, often unanticipated, concepts in precedents (R. Oxman 1994, 141).[40]

The basic distinction of the model from conventional ways of "formalizing the organizational structure of precedent knowledge," is that Oxman's model aims to reflect the "cognitive model of design reasoning," rather than indexing precedents in terms of archival categories such as "name, historical period, style, or location" (R. Oxman 1994, 142). In her conception, a design precedent is "a recognized, specific design in which the unique conceptual points and ideas are denoted as distinct knowledge chunks." For her,

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[40] Here Oxman's reference is Roger H. Clark and Michael Pause's (1985) *Precedents in Architecture*. About precedent, in the introduction they state that "...our concern is for a continuous tradition that makes the past part of the present. We do not wish to aid the repetition or revival of style whether in whole or part. Rather, by a conscious sense of precedent that identifies patterns and themes, we hope to pursue archetypal ideas that might aid in the generation of architectural form" (Clark and Pause 1985, vii). Their main concern is architectural form.

> the exposition of knowledge by the proposed system is dependent upon the structure of chunks of information and their representation. Precedent knowledge is … considered as the explication of the relevant insights of particular designs and the appropriate linkages of information between multiple design precedents. It is this organizational structure which contributes to the accessing of knowledge relevant to the problem at hand (R. Oxman 1994, 142).

The model suggests that the proposed structure is required for “decomposing” knowledge from a “holistic case” into “separate chunks of design knowledge.” She states, “one means to decompose case knowledge into separate and independent representational chunks is the concept of the *story* which is currently employed in the [Case Based Reasoning] community” (R. Oxman 1994, 143). The idea of “design story” is described and elaborated as follows:

> A design story is here defined as an annotation of the conceptual design content which characterizes the uniqueness of a specific design precedent. Stories organize facts to make point. A significant story provides explicit linkages between *design issues of the problem,* a particular *solution concept,* and a related *form description* of an element of the design solution. These linkages are, in fact, the knowledge content of the precedent representation (R. Oxman 1994, 143).

A knowledge schema for design stories requires a representational schema that consists of three components, issues, concepts, and forms. A design story is a means of connecting and linking these components, to make a meaningful chunk of knowledge out of them.

The components are described and elaborated as follows. A “design issue” is “a point related to the design task which is deliberated by the designer” (R. Oxman 1994, 143). A point “may be formulated by the programmatic statement, the intrinsic problems of the domain, or by the designer himself.” A “design concept” “is the formulation of a design idea in relation to an issue. It is a form of ideation related to the design task" (R. Oxman 1994, 143). A design concept is different from a specific design solution, since it only provides the principle but do not imply the realization. The final component is the "design form," which is "the specific design artifact which materializes the solution principle." Oxman and Heylighen (2001) call this structure "Issue-Concept-Form formalism," where "issues stand for high-level statements or starting points (orientation for instance), concepts refer to domain-specific ways of achieving certain issues (centrality is as possible concept to achieve orientation), [and] … forms represent the physical realizations of these concepts."

The case selected to illustrate the model is James Stirling's *Staatsgalerie* New Building and Chamber Theater in Stuttgart (Figure 5). The "design story" of the building is given as follows:

> The problems posed by the programme included the relationship between the site and city. The site sloped down to a motorway that cut the old cultural area of the city in two (issue of *urban continuity*). The new gallery had to complement the demands for … an urban *path-through* the scheme. Stirling found that … the *circular drum*, a public space at the heart of the building organization, could also act as a pivot resolving the varied circulation patterns (R. Oxman 1994, 144).

This is the design story, which is actually constituted by a set of architectural ideas operational in the design of the *Staatsgalerie.* Here, in Oxman's (1994, 144) words,

> the design issue is 'urban continuity'. The design concept which was employed to address the design issue is the principle "path-through". In this case the concept, 'path through' describes the ability to pass through the building without entering it. The ramp within the drum, or central circular courtyard, is the form element which materializes the solution principle of 'path through'.

Oxman (1994, 144) argues that, “this illustrates the relationship in a typical design story of a design issue, the concept of a solution principle responding to the issue, and the form element which materializes the principle in the design.”

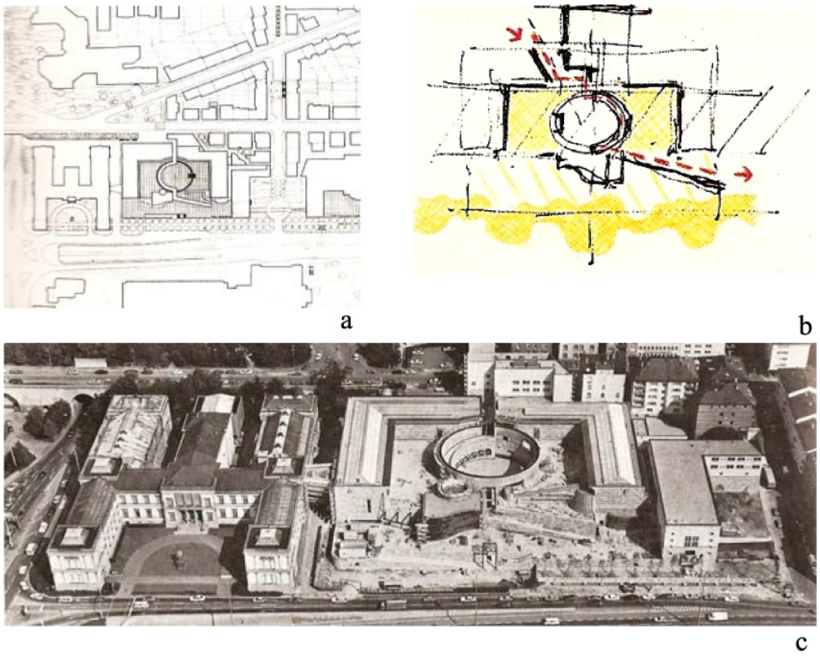


Figure 5 *Staatsgalerie* New Building and Chamber Theater, Stuttgart, Stirling. a, site plan, b, concept diagram, c, photograph of old and new State Gallery (Arnell and Bickford 1987).

**Towards an Expanded Conception of Architectural Ideas**

> Simply listening to conversations in design practices and talking to many members of a well established practice has revealed just how dependent the designers are on their collective experience. When working in the practice of a very well known and highly respected British architect I was astonished to hear three different people use the same somewhat esoteric word within the space of one day. The word in fact was ‘Belvedere’. Of course, a perfectly normal and acceptable architectural term, but not one you hear very frequently. Three times in one day from three different mouths suggests something special is happening here (Lawson 2001)!

The story is Bryan Lawson's, and the following arguments are particularly relevant and valuable for the present purposes. For him, this situation suggests, "that this word represented a complex set of ideas that were common ground within the practice [of architecture]" (2004, 446). His reference is Richard McCormack, who describes the "process leading his design for the Chapel at Fitzwilliam College Cambridge" as follows: "…at some stage the thing (the worship space) became sort of round but I can't remember how …. Early on we were playing with round shapes in square containers, you know the sort of thing …" (Lawson 2004, 446). In putting up a sentence like this, Richard expects one to "understand from this reference a whole series of architectural ideas…." Lawson (2004, 446) argues,

> Listening to conversation in such practices reveals just how extraordinarily efficient communication becomes since enormously complex and sophisticated set of ideas can be referred to using simple diagrams, catchphrases (for example, 'round shapes in square containers') or even single words, (for example, 'belvedere'). Such a phenomenon is hardly new to us. It is precisely that of concept formation or the development of schemata. For experienced architects, the concept or schema of 'round shapes in square containers' includes not just the simple idea of that geometry but the whole game of contrasting the carved and straight lines, and all the examples and variations have been developed by other architects. For MacCormac's practice members, the schema of 'belvedere' was not restricted to the commonly shared idea of a viewing tower. For them, it was not a matter of a building typology at all but rather a whole series of devices for organizing space vertically in order to afford dramatic views that helped building users to build mental maps of their surroundings. They collectively delight in these ideas and have studied them and exploited them in previous designs.

He further suggests that

> … a process of sharing ideas and value systems through the collective selection and evaluation of experience serves that

> purpose and contributes to the formation of a team language. However, in design the process seems to me to be even more central. These collected ideas serve as extraordinarily concise and terse symbols for complex combination of ideas. The complexity and sophistication of design experience can thus be communicated by a single word or phrase enabling remarkably intense conversation that can move rapidly through the creative phases of design decision-making. The ability to move so quickly through complex ideas is probably one of the attributes of successful design teams (Lawson 2001).

If viewed from a different angle, beyond the already apparent arguments made in these passages, we may propose that neither “belvedere” is a thing, or merely an idea, or a concept, nor “round shapes in square containers” is only a description of certain geometry. These are actually “architectural ideas.” This is so not only that they are accepted as the common conceptual ground within a “disciplinary matrix,” but also with reference to the very nature of the architectural design (process). So, let me return to the previous discussions and ask the following set of questions:

What makes “path-through” an architectural idea, and “urban continuity,” and “the ramp within the drum or central circular courtyard,” not? Why does “the ramp within the drum or central circular courtyard,” in Oxman’s conception refer to “a form” as distinguished from “a concept,” but “round shapes in square containers,” in Lawson’s conception refers to an architectural concept or an idea? Or, can we say that “a floating box wrapped around a sculptural core” or “the erosion of an implied cube” or “the superimposition of a structural grid over a system of freestanding volumes” are merely forms or form descriptions of Le Corbusier's Villa Savoye, but not the architectural ideas behind these designs?

I suggest that, within the specificities of architecture, and architectural design, “urban continuity,” “path-through,” “the ramp within the drum, or central circular courtyard,” “round shapes in square containers,” “belvedere,” “a floating box wrapped around a sculptural core,” “the erosion of an implied cube," or "the superimposition of a structural grid over a system of freestanding volumes" are all architectural ideas. Not limited with these, a structural idea, a certain interpretation of housing, and a certain programmatic, functional, spatial, or formal organization can all be interpreted as architectural ideas. In other words, they are all architectural thought contents, but with different characteristics. In this sense, all actual and possible thought contents, which architectural designs and architectural design process might pertain, can be viewed as architectural ideas.

The expanded conception of architectural ideas permits us to view the structures offered previously in a new light. For example, within the "Issue-Concept-Form Formalism" both "issue" and "concept" can be interpreted as two distinct types of architectural ideas with different characteristics, having a specific relation between them. To the degree the characteristics of the ideas themselves, to that degree the nature of the relation between them is important. There might be a tendency to view the relation by reductionist, mechanistic or deterministic structures. But the relation can be also be viewed in the light of the selectionist schema that might provide a better, a non-reductionist, non-mechanistic and non-determinist account of it. Such a view would work as a basis for "the evolutionary conception of the architectural ideas," and "the evolutionary model of architectural design" that will be put forward in the succeeding chapter.

Simply, let us take the case of *Staatsgalerie.* At the outset, there should be a museum located within the boundaries of the lot. At the same time, there is the idea of "urban continuity" operational in the design process (and in design thinking). Apparently, such an idea neither describes a form or solution, nor intrinsically implies a configuration towards this end. There should be another idea, which would deal with this "issue." Let us suppose that, the designer proposes a block with a "U" scheme, as the primary design concept that would control the overall form of the building. As it is, such an idea would not survive because of the conditions demanded by the idea/condition of the "urban continuity." Apparently, the proposed solid block will prevent the "urban continuity." As in the actual case, the designer introduces another idea superimposed on the first: a "path through." This idea implies that, what was initially proposed (U shaped block) could remain but only if transformed so that it could allow a "path through" it. As it would seem, a proposal carrying such an idea could fulfill the condition of "urban continuity." Still, like the "U" shaped block, "path through" has no intrinsic formal implication or explicit formal description, and there should be an idea towards this end. The designer proposes the idea of "the ramp within the drum or central circular courtyard" superimposed on the initial "U" scheme. This idea has a form description that would transform the initial schema. With its introduction, the proposal would pass the selective condition of "urban continuity" and "path through."

Of course, this is a hypothetical reconstruction of the design process and the design reasoning of the *Staatsgalerie.* Such a hypothetical reconstruction can be constituted in many other ways. However, here, the point is to illustrate that the relation between these ideas could be examined in selectionist terms.

Such an evolutionary pattern remains even if the process is reversed. Say, the idea of "the ramp within the drum or central circular courtyard," is proposed at the outset without reference to the issue of "urban continuity." However, by its nature, if "urban continuity" were the issue, the idea would permit such a condition to exist.

At this point, it must be noted that knowledge of "earlier solutions" might provide "shortcuts" in design reasoning in such conditions.[41] That is to say, owing to its associations in previous experiences, an idea might be remembered or related with a certain issue or a condition. For example, if the architect knows a set of ideas that have the potential to fulfill the issue of "urban continuity," then, in design reasoning these ideas might be utilized with relation to each other. Futhermore, for example, once the ideas of "the ramp

[41] Here, my primary references are Popper's and Campbell's arguments on problem solving which was introduced and discussed in the Chapter 2.

within the drum or central circular courtyard," and "the urban continuity," are identified and understood in *Staatsgalerie,* with relation to each other, they might be remembered (and reused) with such interaction in mind and of course with reference to the case of *Staatsgalerie*. However, this neither means that the relation between the two ideas lost its selectionist character (and solidified,) nor implies that the ideas are bound up with each other and could not be used independently. The evolutionary relation remains intact. Actually, this relation is the basis that they are remembered, recalled, and utilized together. Furthermore, same combination of ideas might not work in different situations since there might be other conditions that might filter out them or demand a new variation or interpretation.

The point is that the relation between the ideas of "urban continuity" and "the ramp within the drum or central circular courtyard" in this specific case can be explained and represented in selectionist terms. Actually, such a selectionist relation can be generalized; that is to say, architectural ideas and the relation between them can be viewed in evolutionary or selectionist terms, and this view might provide a plausible, a non-reductionist, non-mechanistic and non-determinist account of the phenomena.

### 4.4 The Evolutionary Conception of Architectural Ideas

As a part of the "conceptual inheritance," the evolutionary or selectionist pattern can also be identified in the existence, life, and evolution of architectural ideas.

It is likely to identify instances of an idea in many designs, having different interpretations and varied according to differing conditions. These instances could be interpreted as "variations" of an idea that represent its lineage. Every architectural idea is subject to selective elimination within the specificities of a design in which it was invested, the specific conditions related with the design itself. The use of an idea in a design means that it lasted that specific conditions and retained. Since it is now carried by a design, it is a subject of conceptual inheritance. Actually, yet from another point of view, the way an idea is interpreted and invested in a design is related with the life and existence of that specific idea. In turn, the idea's existence and life is dependent upon such interpretations and variations.

These set of propositions presents the "evolutionary conception of architectural ideas." I will clarify and elaborate the model further on two studies of Colquhoun and Tzonis.

The evolutionary model is supported in "Displacement of Concepts in Le Corbusier" where Colquhoun (1981a) addresses Le Corbusier's reinterpretation of tradition in his "five points." The study is particularly important in the sense that it illustrates how conceptual innovations might take place in a particular conceptual inheritance, and how and in what sense ideas might find different interpretations in different designs. Of similar importance is Tzonis's (1992) already introduced essay "Huts, Ships and Bottleracks: Design by Analogy for Architects and/or Machines," which lends a great support to Colquhoun's position, consequently to the present study.

Colquhoun (1981a, 51) distinguishes Le Corbusier's architecture from the "majority" of the modern architects', "in the extent to which it makes reference to the architectural tradition or to the examples of existing buildings." Modern Architects, including Le Corbusier, sought for new "authorities" such as science, program, or technology to replace tradition, in Colquhoun's (1981a, 51) words, at least, their emphasis on a "need to reject tradition" was apparent in their "theoretical statements." However, in his work, "Le Corbusier refers constantly to the architectural tradition either by invoking its principles and a*dapting them to new solutions* or by overtly *contradicting them* ..." (italics added) (Colquhoun 1981a, 51). Le Corbusier took "the rule system of the academic tradition (in contrast to matters of content rather than form, or on physiognomic, expressionist aesthetics)," as his starting point. Colquhoun argues that in Le Corbusier's "five points," each of the stated principles "takes its departure from an existing practice," and "reverses" it (Figure 6). The argument goes as follows:

> The use of *pilotis,* for example, is a reversal of the classical podium; it accepts the classical separation of the piano nobile from the ground but interprets this separation in terms of voids rather than mass. The *fenétre en longueur* is a contradiction of the classical window aedicule. The roof terrace contradicts the pitched roof and replaces the attic story with an open-air room. The free facade replaces the regular arrangement of window openings with a freely composed surface. The free plan contradicts the principle by which distribution was constrained by the need for vertically continuous structural walls and replaces it with a free arrangement of nonstructural partitions determined by functional convenience (Colquhoun 1981a, 51).

In fact, there may be other traditions, vernacular, high, or otherwise, and sources, which might even be outside architecture. As it was stated by Colquhoun, technology, or more specifically "elements of technology" is one of these sources:

> Technology provided the means of rescuing architecture from the false rhetoric into which it was thought to have degenerated in the nineteenth century and of reestablishing that identity between technique and representation which existed in the periods still dominated by a craft tradition -an identity by virtue of which the essence of a building consisted of the objectification of building process (Colquhoun 1981a, 63).

However, for Le Corbusier, "… more than any other architect, technology had a metaphorical role, in which complete machines became paradigms for the new architecture" (1981a, 63). Ocean liner is one of these paradigms, not only "designed according to" scientific and objective principles, but also for example it provides, "for the limited period of its use, all the requisites of communal life," and an organization of human society according to "rational principles" (1981a, 63). In the *Unité d'Habitation,* Colquhoun (1981a, 63) argues, it is not only the rational principles of an ocean liner but also the poetry of its forms is involved:

> The building is poised on its *pilotis* like a ship afloat; its inhabitants have the same relation to the surrounding countryside as the passengers of a liner have to the sea. It reproduces the liner's communal promenade decks and its private cabins; its plant is arranged on the roof like the liner's funnels and superstructure.

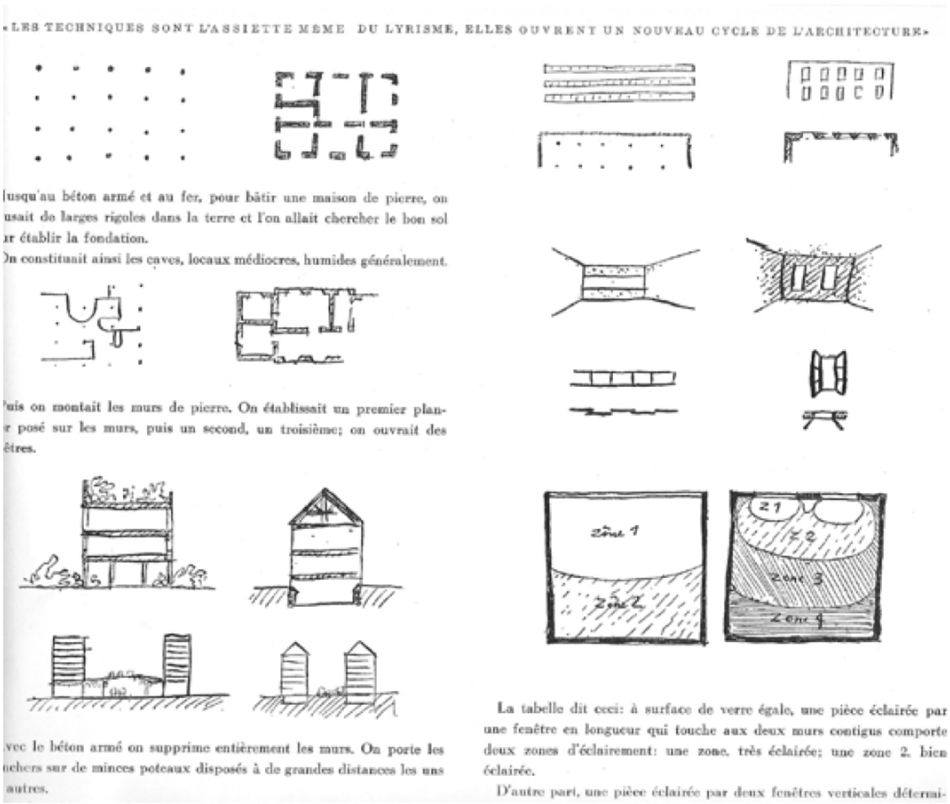


Figure 6 Reversal and transformation of ideas, Le Corbusier (Boesiger and Stonorov 1999a, 129)

These relations do not essentially involve a "picturesque evocation…. Every visual analogy is tied to a *functional* correspondence. The liner is not a romantic image of the modern age; it is an example of its very *principles* at work and is thus a *valid model* for architecture" (Italics added) (Colquhoun 1981a, 63).

That is to say, for example, one of the dominant design concepts of an ocean liner can be expressed as "a floating horizontal block, containing stacked living cells." This partially matches the architectural idea behind the *Unité d'Habitation*: "a horizontal block elevated over *pilotis,* containing stacked living cells" (Figure 7). This is the evolutionary lineage, which can be identified with the comparison of the two instances of the idea in two designs. The "horizontal block containing living cells," finds its place in the design of a housing block, with its programmatic potentialities and formal implications. The idea of "floating" is replaced with "raised" (since a building cannot "float"). The formal description, the boat-shape, which permits floating on the water, is eliminated since there is nothing to float on, and the new conditions demanded by the idea of "elevated block," do not permit (or demand) the boat-shape to exist. The "*piloti*" took the place of the boat-shape as the corresponding formal solution, which meets these conditions.

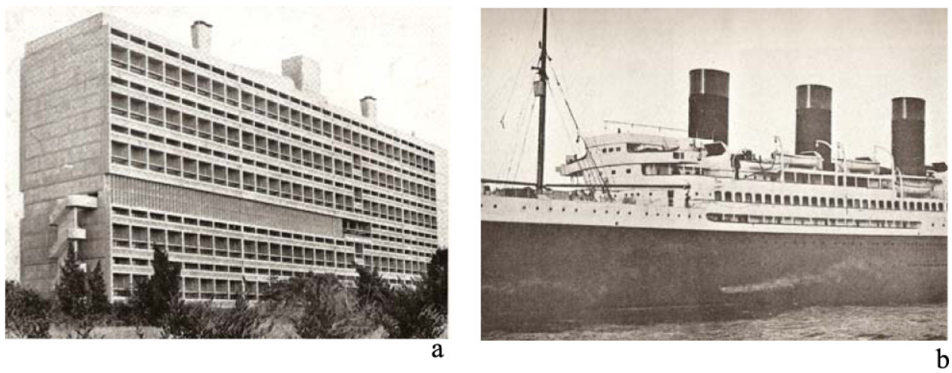

Figure 7 a, The Unité d'Habitation, Le Corbusier, b, The Liner "France" (Corbusier 1970).

What happens, if we reconstruct it hypothetically, is that, two variations of an idea that find their places in two distinct designs. These variations are actually interpretations of an idea with relation to the conditions that come with the specificities of the mentioned designs, such as its program, requirements, function, physical conditions, and so on.

Tzonis' (1992) "Huts, Ships and Bottleracks: Design by Analogy for Architects and/or Machines," where he also develops his arguments on the case of *Unité d'Habitation* can be evaluated as a follow-up to this position that clarifies the point furthermore.[42] For Tzonis (1992), Le Corbusier conceives "…the building's spatial concept, grasping from the outset, seemingly effortlessly and spontaneously, its fundamental aspects, inventing a truly complex multi-functional unprecedented form …." He argues that this invention involves "a multitude of precedents: the savage hut, the liner, the wine bottle rack, [and] the Greek Temple," recalled from memory, examined, dissected, and recombined while "putting old tools to new uses and old ones in new compositions" (Tzonis 1992). Le Corbusier's reasoning in the design of the *Unité d'Habitation* is given as follows:

> Assuming the performance description of the project Le Corbusier searches for precedents. He asks: 'Do I know any products which': … do not disturb the natural continuity of the terrain, [which] …have independent bearing framework and subdivision structures, [which] …have public spaces with commanding horizontal vistas (Tzonis 1992)?

From the selectionist point of view, the reasoning of Le Corbusier can also be hypothetically reconstructed as follows: Assuming the conditions of the project, Le Corbusier searches for ideas. He asks, if he has "any ideas" which

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[42] In the essay, Tzonis' main problem situation is the shortcomings of the "analytical paradigm," behind computational applications in architecture. Tzonis argues that computer made its entrance into architecture by two seminal works: Serge Chermayeff's and Christopher Alexander's (1963) *Community and Privacy*, and Christopher Alexander's (1967) *Notes on the Synthesis of Form*. These works "had a lasting paradigmatic impact on architecture: their views shaped the framework within which people thought about what and how computers could contribute in design…," which he calls the "analytical paradigm." From a wider point of view, the "analytical paradigm" is based on the positivistic conception of scientific method, and it shares its shortcomings with its non-computational applications.

could fulfill the following conditions: “keeping or not disturbing the natural continuity of the terrain,” “having independent bearing framework and subdivision structures,” and “having public spaces with commanding horizontal vistas.” This formulation would be perfectly plausible. As it would seem, the last three are the programmatic requirements of the *Unité* that are architecture ideas themselves. Here they are a means of selection; they provide the selective conditions of the design situation of the *Unité,* a type of sub-world with specific conditions that will determine the ideas and their variations to survive or not.

Tzonis goes on his formulation as follows: as an answer to these questions, from memory, or from a library of objects, or a thesaurus of precedents, Le Corbusier “selects” the following precedents on the stated bases:

> The “peasant hut”… the hut does not disrupt terrain continuity...the “winebottle rack” … the bottle-rack has bearing framework which is relatively independent from the shell of the bottles … [and] the “ocean liner”, … the ocean liner has deck with commanding vistas (Tzonis 1992).

As a next stage, Le Corbusier identifies the related “form aspect in the precedent artifacts” and “isolates and extracts” that “specific part of their spatial form” from the precedent to be utilized in the new creation.

In this case, too, there can be an alternative hypothetical reconstruction: As an answer to the specific conditions, Le Corbusier selects the following ideas. The *piloti* has a potential to fulfill the condition of “keeping the natural continuity of the terrain undisturbed” (while, for example a “podium” has not). The “frame structure,” has a potential to fulfill the condition “having independent bearing framework and subdivision structures.” Finally, “the deck,” has a potential to fulfill the condition “having public spaces with commanding horizontal vistas.” Actually, these are ideas (or thought contents), which are also carried by the “peasant hut,” “winebottle rack,” and the “ocean liner.” As it would seem, first, in this formulation, ideas are utilized free from where they are recorded (or carried). Second, they are taken as objective entities possessing certain potentialities and implications that might fulfill the specific conditions of the various designs, and not tied to a specific condition or a case by default. That is to say, if this was not the case then an idea carried by a "winebottle rack," or an "ocean liner" would not be possibly also exist (be utilized) in an architectural design.

For example, the instances of the idea of "*piloti*," can be identified in fishermen's huts in Asia, or peasant's huts. Fishermen's huts are located at the sea, raised above the sea level by supports such as columns, pillars or stilts. These elements provide a solution to the problem of humidity and they let the sea flow under the raised structure. The instance of the idea exists in the *Unité*, also with its structural implications. However, conditions (whether programmatic, functional, and physical) differ in the two cases. In the first case, they are determined by the sea and humidity, in the second, by, the idea of continuity of the terrain, and the ideas of "flowing nature" and "flowing air" under the building. However, related with the nature and potentialities of the idea, it can answer (or survive in) both set of conditions. Actually, these two uses are related with the programmatic and functional potentials that exist in the design concept, and its two instances or applications can be viewed as two different interpretations of the idea. We can extend this argument to the other instances of the concept in building types such as s*erenders* (Figure 8, c-d), Anatolian granary buildings, and their Spanish correspondents *hórreos* (Figure 8, a) and *paneras* (Figure 8, e). In these buildings, programmatic requirement (or function) is to protect the stored goods from humidity, insects, and animals. As it would seem, in all cases, the idea provides objective programmatic potentialities beyond its existence on a specific design.

What we see from these examples are the instances of the idea of *piloti,* varying, or taking different interpretations depending upon the conditions of the specific case. For example, possibly due to the availability of material, *pilotis* of *serenders,* and *horreos/paneras* are constructed by stone and timber alternately. Furthermore, despite the extreme similarities between *serenders,* and *horreos/paneras,* it cannot be claimed that one of them had “evolved” from the other, or the ideas they possess had transferred “genetically” (or in some other means) from one to another. Actually, they (and the ideas they carry) are the outcome of a similar set of conditions, whether these conditions are structural, functional, formal, and contextual. Yet from another point of view, we may also say that two instances of a same idea might come into existence or invested in designs differentially, independent from each other, owing to similar conditions.

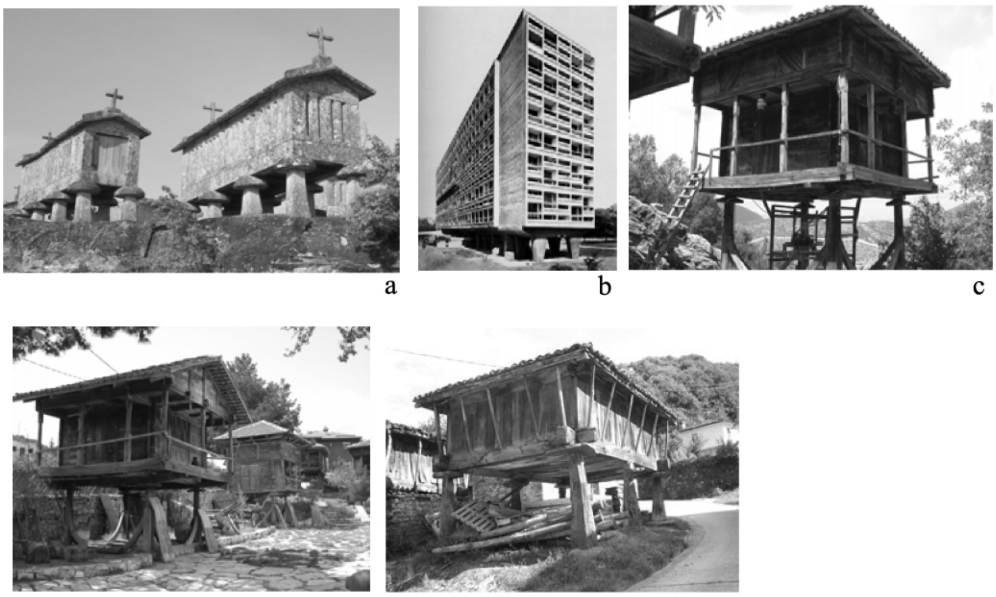


Figure 8 a, *horreos*, b, *Unité d’Habitation*, c-d, *serenders,* e, *panera* or *horreo* (Images of serenders are taken by Prof.Dr. Vacit İmamoğlu) (Horreo and panera images, Home page: http://www.iberianature.com/material/horreos.htm last accessed May, 2008)

In the same manner, for example, the Kızılay Building in Ankara by Nesrin and Affan Yatman, dated 1980, and the Office Building in Lugano by Mario Botta, dated 1981-1985 carry a set of common ideas. The main scheme can be expressed as a rectangular solid carved or recessed at one corner, while leaving a tower at that corner. For both designs, there are also the ideas of "acknowledging and emphasizing the important corner of the lot," "keeping the overall solid affect of the building," and "providing an exterior space or volume within the boundaries of the main body of the building." Here, too, we cannot mention a "genetic" transference of aspects between these designs. The designs are most probably conceived and designed independently, without an active "reference" or relation with the other.

a b

Figure 9 a, Kızılay Building, Affan & Nesrin Yatman (Home page: http://www.arkitera.com/news.php?action=displayNewsItem&ID=19023 last accessed July, 2008), Office Building Lugano, Botta

The evolutionary or selectionist structure behind the hypothetical reconstructions made for the design reasoning of the examples is apparent. Actually, both the structure and the hypothetical reconstructions have implications for the "evolutionary model of architectural design," proposed in the succeeding chapter.

### 4.5 On the Nature of Architectural Designs with Reference to the Evolutionary Conception of Architectural Ideas

As an element of world 3 itself, an architectural design might also be interpreted as a container of many architectural ideas. In other words, an architectural design carries other world 3 objects within it. [43]

As it was stated earlier, –some type of– exosomatic representation is a requisite for an idea to be(come) a world 3 object, an object of criticism, and consequently an objective content of thought. This is one of the essentials of Popper's three-world ontology. However, it is a requirement the characteristics of which are domain-specific. That is to say, a scientific theory can be formulated by the means of a written language as a text, while an artistic idea might perhaps only find its expression in a work such as a sculpture or painting. In the first case, the mentioned theory is formulated in a text, in the second, the work can be seen as the means of externalization or formulation of an idea.

On the other hand, the ideas or concepts belonging to the domain of architecture can be formulated or externalized in various means, for example in written language as in Le Corbusier's "five points of architecture," or in architectural designs themselves as in the paradigmatic cases of the "five points;" *Unité D'Habitation*, *Villa Savoye* and *Villa Garches*. We can learn "five points" by reading the *Towards a New Architecture,* but also "reading" *Unité D'Habitation*, *Villa Savoye* and *Villa Garches.*

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[43] For example, *Unité d'Habitation* is a design that targets the problem of bringing together many living units in a single block. The building itself provides a programmatic potential through its formal and organizational idea and it carries (or proposes) a certain idea of mass housing (as its programme), and perhaps a certain type of living (also as its programme) towards this end. This is one of the major problems or programmatic requirements addressed by the design as a whole. On the other hand, for example the idea of *piloti* addresses the problem of "raising a building above the ground," which is actually a programmatic requirement that concerns (or addresses) particularly a structural issue and a contextual issue. Combined with the idea of using reinforced concrete structurally in a certain way, it refers to the structural issue, combined with the idea of providing an uninterrupted nature, it refers to the contextual issue.

However, in the mentioned designs, different from the “five points,” the *piloti* is design-operational, that is to say, it is recognized together with a specific instance, and a set of selective conditions specific to that instance and can in turn be used operationally in new designs.[44] Perhaps more important, a design's content is subject to many readings and interpretations. Any attempt of analysis and understanding brings its preconceptions, in Popper's terms “horizon of expectations,” to conceive what was carried by the design itself to yield not only new interpretations of the set of ideas invested in the design's creation but also might lead to invention and discovery of new ones. In this sense a design itself can be viewed as a creative device, and reading it as a creative act.

An architectural design contains various ideas weaved together in a complex structure. With this respect, designs permit a holistic study of its thought contents with relation to the structure or set of relations that bring them together. For example studying the idea of a *piloti* by identifying, analyzing and understanding it from the *Unité d'Habitation,* from fishermen’s huts in Asia, or from *serenders*, might differ in many aspects. Each design might present a variation and a different interpretation of the idea.

As it was already stated, each design is like a sub-world within world three, which presents its own specific conditions and it is constituted by a set of ideas. In this sense, every design presents a context that is effective on the ideas and consequently the analysis of the design itself and ideas it carries. The specific conditions presented by a work selectively controls the ideas invested in a work. In turn, an architectural idea, which is carried by a specific design, can be interpreted as an instance of an idea that is adapted to the specific conditions possessed by that design. Designs further present how ideas are adapted to the specific conditions of the designs and the way they are embodied with relation to other ideas and the specificities of the design is important. The evolutionary or selectionist relation is particularly important in understanding such content in a design.

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[44] From a slightly different point of views, this aspect is also emphasized and discussed by Akın (2002) and Lawson (2004).

From another point of view, designs are at the same time can be viewed as the carriers of the ideas, or more specifically, can be interpreted as the vehicles of conceptual inheritance. In turn, existence and life of an idea is dependent upon its instances on such means of embodiments. Actually, what is essential is to know that “vehicles of conceptual inheritance” do not necessarily point to the built designs, but also drawings, sketches, models, texts, and whatever that can be utilized for externalizing architectural thought and whatever has the potential to carry it.

Therefore, from a design, an idea can be distilled, learned, and made one's own schemata[45], to be later reinterpreted and reused for the creation or design of new designs. In this sense, an architectural design is interpreted as an open work from which many architectural ideas can be read and distilled from, including the ideas that are not originally or intentionally invested in its creation. In this conception, every design is viewed as itself a unique creation that cannot be explained in terms of inheritance of aspects either from a predecessor or in terms of evolutionary transformation or adaptation from a precedent. They are taken as carriers of architectural ideas, or vehicles of conceptual inheritance, not the primary subject of the evolutionary process.

[45] Schemata is one of the important and basic ideas of cognitive theory which refers to “an internal representation of the world,” which consists of “an organization of concepts and actions,” that are used for perception, observation, thinking, judgment, learning, understanding, interpretation, problem solving and creation, and can be revised and expanded by new information. Referring to cognitive theory, learning can be interpreted as building an intellectual organization of such concepts and actions that is called schemata (Grider 1993, 2).

# CHAPTER 5

# THE EVOLUTIONARY MODEL OF ARCHITECTURAL DESIGN

In the previous chapter, I proposed a model that mainly refers to the existence, life, and evolution of architectural ideas within world 3 and within a tradition. It was suggested that an evolutionary or selectionist pattern could be identified in such a life. The model was derived from the idea of applying the conceptual framework coming from evolutionary epistemology to the domain of architecture. I also put forward a set of complementary theses related with architectural designs and architectural ideas with reference to the proposed model. Now, in the present chapter, I pursue the investigation by carrying the notions and the discussions made until now to a new area: architectural design process.

In this chapter, I put forward an evolutionary model of architectural design. The model mainly refers to reconsideration of the process of architectural design in the light of the evolutionary or selectionist schema and its associated notions. In doing this I follow a line of inquiry from design research. The proposed model can be interpreted as an advance on and expansion of a certain model of design known as "conjecture/analysis," which was initially conceptualized by Hillier, Musgrove, and O'Sullivan (1972), and later advanced in the studies of Darke (1979) and Ledewitz (1985). The model was introduced in the Chapter 3. The evolutionary model of architectural design mainly involves elaboration of the "conjecture/analysis," by foregrounding and emphasizing the evolutionary or selectionist pattern or schema inherent in the model, and reconsideration of the model by introducing the structure of three-world ontology.

### 5.1 The Evolutionary Model of Architectural Design

#### 5.1.1 Three-World Ontology and the Design Process

> World one embodiments of world 3 objects, such as handwritten books, or printed books, or articles in journals, are extremely important; but they are important not as world 1 objects but as world 3 objects. Examples of other such world 1 embodiments of world 3 objects are: a geographical map, a plan of a building, or of an engine, or of a motor car, or of an aeroplane. (Popper 1980).

Following these arguments, we may say that, during a design process, the design in development belongs to (or resides in) both world 3 and world 1. The drawings, sketches, models, and other such tangible means of expression produced during the design process belong to world 1 since they are physical objects, but they also belong to world 3 since they are the products of the human mind; they carry thought content "coded" on their "material substrates." These can be interpreted as world 1 embodiments of world 3 objects. From a certain point of view, drawings, sketches, models are means of externalization or exosomatic representation of ideas operational in the design process so that these ideas could be tested and evaluated. As it is stated by Popper (1980),

> Such maps or plans are based upon theories; they are, precisely like books, embodiments of world 3 objects. The causal efficacy is very obvious: such maps and plans, of a new harbor, or a new airport, have indeed been instrumental in changing world 1.

World 1, in turn presents a set of conditions for the evaluation of the proposed designs. Architecture (and architectural design) is always bound up with the conditions of the physical or material world, and even if design typically operates in terms of representations, these conditions affect the process. Apparently, a design, both as an object of the world 1, and as an object of the world three, is the product of the world 2. It is the outcome of largely subjective and unknowable mental processes of the human mind operational during the design process: the designer's own schema is operational in every stage of the process.

### 5.1.2 Architectural Design as a Process of Formation/Making and Evaluation/Selection

The architectural design process could be viewed as following the pattern of variation and selective retention, or more generally, of trial and error. Such a pattern was apparent in Campbell's and Popper's arguments on problem solving, and behind Popper's conception of scientific discoveries which follow the process of conjecture/analysis, and it could be applied to the architectural design (process). As it was identified in the Chapter 3, such a pattern also exists in the conjecture/analysis model of design, primarily owing to its roots in evolutionary epistemology.

The conception of design process proposed in this section is essentially based on the selection paradigm, particularly its interpretation in evolutionary epistemology, and on the conjecture/analysis model of architectural design. Established on this basis, in the present study, the design process is conceived as a process of "formation/making and evaluation/selection." The process is conceived as such so that it would better represent the architectural design process, while foregrounding the selectionist schema, and well fitting to the specificities of architecture and architectural design.

In this conception, "formation or making" refers to the embodiment of a design. Such an act involves physical making (i.e. drawing, modeling, sketching, etc.), but also it is informed by the architectural ideas that are operational in such a making.[46] Apparently, such a structure is essential since making or forming cannot be altogether free from thought contents operational

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[46] It must be noted that as far as making or formation is concerned, such a model do not rule out form-making acts such as expressionist making, random trials, or algorithmic form creation.

in the design process, and ideas cannot lead to a design without the making and the externalization/embodiment. In Hillier, Musgrove and O'Sullivan's (1972, 74) words, "… in areas like design … physical activity, is preceded by cognitive and reflective activities."

Although formation or making proposes (or actualizes) physical changes in world 1, world 1 in turn, has no direct (and automatic) contribution to or formative control over such formation process. Apparently, here the reference point is the selectionist or evolutionary model. Otherwise it would be a Lamarckian approach.

In each new stage, there are a number of ideas or elements that are perpetuated and some others selected or filtered out by the conditions specific to a design. In each stage, there might be newly introduced ideas.

The "evaluation or selection" refers to the selective elimination stage. The design and all that it contains are evaluated with reference to the selective conditions provided by the physical world and equally by the world three, which "selectively" controls the formation of a design. Here the important point is that the physical world is not the only source of such conditions. The ideas are also operational in the evaluation. As it was stated by Darke (1979, 38), "design is seen as a process of 'variety reduction' with the very large of potential solutions reduced by the external constraints and by the designer's own cognitive structures…." Through these structures, both formation and selection, and consequently the design process itself are bound up with a certain "conceptual inheritance."

Actually, as it is implied in the arguments, and with reference to the "evolutionary conception of architectural ideas," the selectionist schema not only represents the procedure behind the design process as a whole, but also many relations within it.

### 5.1.3 Formative and Selective Ideas

As it was suggested by the evolutionary model, architectural ideas are operational throughout the design process. With reference to the process of formation/making and evaluation/selection (or conjecture/analysis), there can be two distinct categories of architectural ideas contributing to the process. These are the “formative ideas” and the “selective ideas.” This distinction is particularly important in the elaboration of the evolutionary model of architectural design.

#### Formative Ideas

The ideas with formative or constructive aspects, or the ideas that have a potential to contribute to the creation of a design by “forming” or “transforming,” can be described as the formative ideas. For example, Gombrich's (1960) “schemata,” Mitchell, S.Liggett and Tan’s (1988) *“parti,”* Texas School's (Caragonne 1995) “architectural ideas” can be interpreted as formative ideas. A formative idea might be a schema behind an architectural design, or an abstract or generic formal description of the design, but also a set of principles or an order governing the design’s formation. Algorithms and formulas might also be interpreted as formative ideas. A formative idea might not merely be an “approximation” to the solution but it might also provide “a way into the problem,” and further, a way through and out of it. For example, “the ramp within the drum, or central circular courtyard,” “round shapes in square containers,” “a floating box wrapped around a sculptural core,” “the erosion of an implied cube,” or “the superimposition of a structural grid over a system of freestanding volumes” are all formative ideas.

In most of the cases, ideas with formative nature are referred to in terms of the formal description inherent in them. For example, “rectangular solid” and “orthogonal grid” has formal implications contained in their description. However, this is not an absolute condition, and a formative idea might not intrinsically carry a formal implication or a formal description. As it was already stated, for example, formulas and algorithms actually can be interpreted as formative ideas. Apparently, they could have a formative contribution over a design, but such contribution is not achieved through an explicit formal description.

Formative ideas can further be divided into two sub-categories, as “dominant” or “major” formative ideas, and “subordinate” or “minor” formative ideas. Major or dominant formative ideas can be identified with their high formative or organizational capacity, or more specifically, their dominant formative role in the creation of a design. In other words, they have a major control – organizational or formative– over the design, and over other ideas and the elements. Here, the term dominant is the architectural counterpart of the concept of dominant as it was conceived by Russian Formalists as a part of their conception of work of art as a dynamic system.[47]

Subordinate or minor formative ideas can be identified with their formative affect on the design, but they are often subordinated by a major or a dominant idea. That is to say, an idea can be interpreted as a minor formative idea if it informs the formation/making of a design but under the subordination and control of a major idea. Such ideas might have a (trans)formative affect on the overall form, and also might have their own formative contribution, in both cases, under the governance of the major ideas.

It is not to say that there is a hierarchical or a tree-like structure between the formative ideas, where at the top of the branch, the major formative idea stands. It is more of a set of complex relations between the ideas, where the dominance and subordination depends on the conditions, and the relation between the ideas is always two-way and plastic.

[47] This notion was introduced in Chapter 3.

## The Selective Conditions and the Selective Ideas

Selective conditions are a set of conditions that impose limits and constraints on a design. More specifically, they are a means of selection and evaluation of the design in development. Selective conditions are mainly constituted by the ideas with selective characteristics, and by the physical conditions. Ideas with selective characteristics or more specifically, "selective ideas" are the ideas that have a potential to have selective control over the design.

Selective conditions do not have a direct or active "formative" contribution on the formation and making of a design. That is to say, they are primarily for selection or evaluation, not formation. However, selective conditions still control the formation or making by evaluation or selection, that is to say, by filtering out the ideas, elements, forms, configurations (or even designs) that do not fit to the conditions while letting the suitable ones survive. For example, "urban continuity" and "path-through," which I have mentioned in the previous chapter, are such ideas.

At this point, it must be remembered that, principally, no idea, by default is purely formative or selective. It is more about a "potentiality" with respect to certain conditions. Furthermore, an idea might have both characteristics, that is to say, it might contribute to the design both selectively and formatively. For example, the idea of "having a rectangular solid external form" is obviously a major formative idea that can –rather directly– inform the formation of a design. But at the same time, such an idea might have a selective control over the design by, say, filtering out the ideas or formative interventions which would destroy the overall integrity of the solid (and its overall "solid" effect).

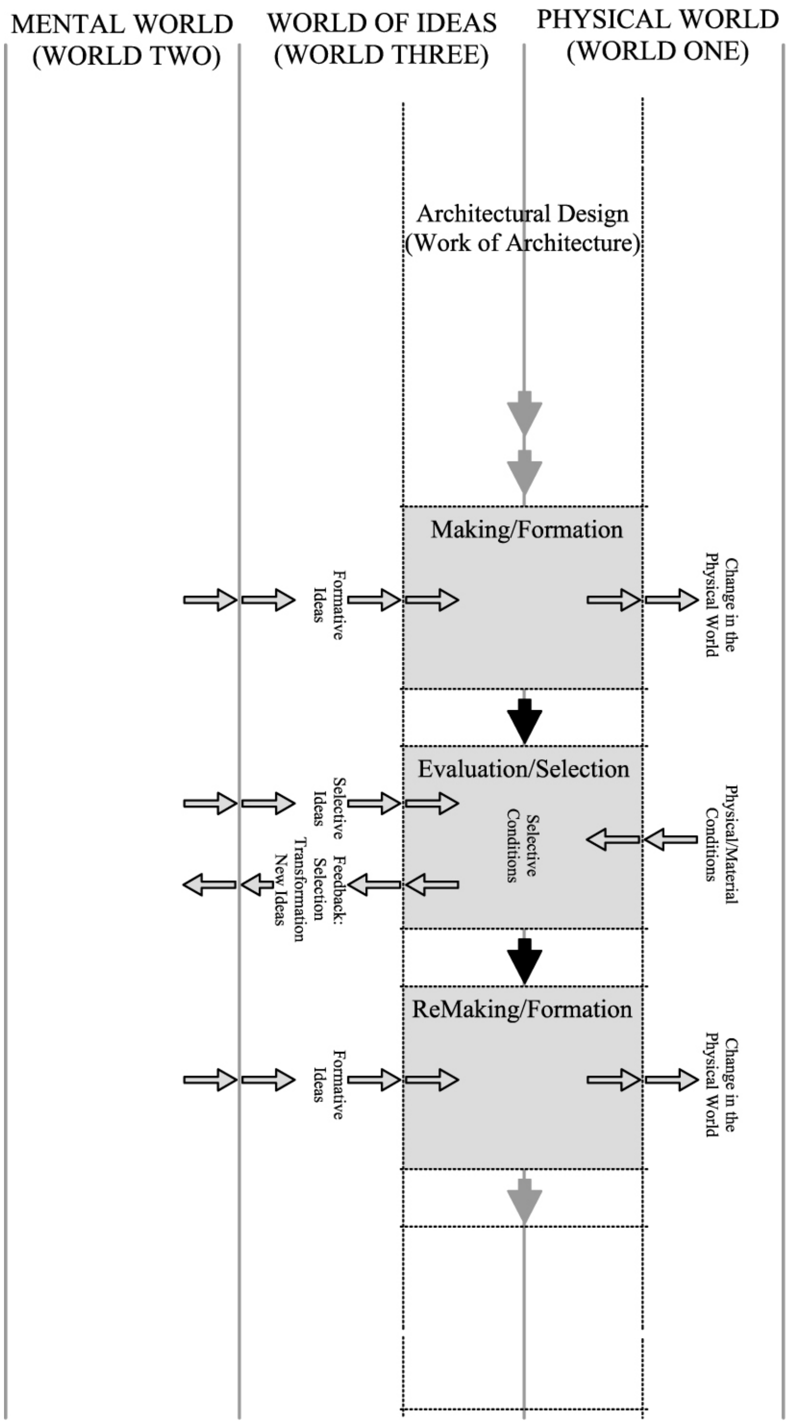



Figure 10 The evolutionary model of architectural design process

## 5.2 On the Nature of Architectural Ideas (or Thought Contents) with Reference to the Evolutionary Model

According to the expanded conception of the architectural ideas, all thought contents, which architecture and architectural design might concern, are conceived as architectural ideas. This is quite a wide scope, which also includes the utopian content of a design and the architectural program. The question is how such conception could be absorbed into the evolutionary design model. That is to say, how various types of thought contents could exist within such a structure? Answer to this question is important since it would reveal the place of such thought contents or ideas within the creative design process and their contribution to the creation of an architectural design.

Actually, it would also be relevant to locate this section at the end of the previous chapter, just after the final arguments. This is so since the following discussions are a means of extension of the discussion towards examining the nature of the architectural thought contents or ideas, and as a means of clarifying the proposed "evolutionary conception of the architectural ideas," and elaborating it.

### About the Intent (or concept)

Intent is the "primary conception of a thing:" one must have had an idea or concept of a thing prior to any attempt for designing and building one (Eisenman 2006, 39). In Eisenman's (2006, 39) words, "owing to … experiential and historical associations, it is difficult … to isolate the concept [or intent] 'temple' from the function 'temple' or whatever *specific form* we associate 'temple'" (Italics added).

From the viewpoint of the present study, actually, intent is a thought content, which represents a set of thought contents subsumed under it. For example, the idea of a "mosque" might come together with a specific type of praying, a specific type of spatial layout enabling this act, a specific type of formal organization, a specific type of overall form, and so on. In this sense, for example, since it might come together with a certain form description (or even a specific form), intent might have a direct contribution over the formation of a design. Even if there is not such a description, it could control the formation of a design by selective elimination.

**About the Structure, Construction and Technology**

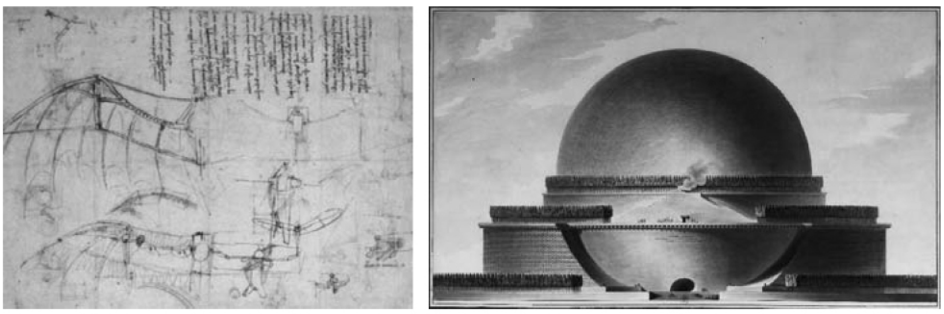
Architectural ideas related with structure and construction (including material and technique) are generally taken as a means of physical embodiment of a design, not for its primary conception. However, this does not mean that such ideas do not belong to the creative design process.

In general, technology may provide a basis for the creation of new architectural ideas, and it may reveal possibilities for the embodiment of these ideas. However, technology not only provides possibilities, but, perhaps more important, similar to a program, a set of conditions. For example, if load-bearing masonry were the only available system for our use, it would only permit shorter spans. This would apparently affect the nature of the formation process of design. Let us say that also timber is available for our use for the lintels of the openings, which would allow longer spans, but still bounded with the load-bearing capacity of the timber. Let us go further and say, we know the idea of structural arch (and, of course how to construct one). This would further enhance the set of variations of spans. However, this time the idea comes with a certain form requirement, which in turn would affect the morphology of the design. Here, the point is that technology, or more specifically construction, structure, and material, provide the conditions and limit the implementation of ideas and applicability of ideas themselves.

However, still, such filtering mechanism might not fully constrain the design process. For example, Leonardo da Vinci had been able to conceptualize the idea of a flying machine, and provided many design concepts of such a machine and parts of it, represented in sketches (Figure 11, a). This was done prior to an available technology and materials, which would make the realization of such a machine possible. However, this conception on the one hand provided problems and problem situations that helped the discovery and development of such a technology and this technology in turn provided a potential for the construction and embodiment of a flying machine and selectively determined its materials, its size, its specific form, and so on. As Eberhard Rechtin (1991, 7) argues,

> for millennia, man had attempted to fly (Mythology gives Daedalus the first credits, though Daedalus and Icarus more likely used kites than wings to escape the labyrinth). Primitive gliders had evolved by the late 1800s...But the true solution to the manned-flight problem would need an integrated combination of efficient engines, airfoil design, new structural materials, and, most important to the final success, a sure means of control. The Wright brothers combined all these, tested the ideas in their own primitive but instrumented wind tunnel, architected a system solution, and performed a careful series of flight tests…

Actually, such examples also exist in architecture. For example, a well-known one is Newton’s Cenotaph by Étienne-Louis Boullée (Figure 11, b).



a b

Figure 11 a, sketches of a flying machine, Leonardo da Vinci, b, Newton’s Cenotaph, Étienne-Louis Boullée (Home page: http://www.uic.edu/depts/ahaa/classes/ah111/imagebank.html last accessed May, 2008)

Of course, as far as the selectionist schema is preserved, a reverse relation is also true. That is to say, for example, if there is a need for a large-span structure, say, for a sports hall, this programmatic requirement filters out a set of possible structural systems, which are not capable of providing the required span.

It must be remembered that within the context of architecture, ideas related with structure and construction must be evaluated as architectural ideas.

**About the Program**

Typically, the program is the set of "requirements to be met in offering [an architectural] solution" (Merriam-Webster Unabridged Dictionary 2000). However, every new design and the ideas that it carries or possesses come into existence in a context within which they will be embedded, whether this context is social, economical, architectural, physical, urban, or otherwise. These contexts already provide a set of ideas to begin with and carry programmes in themselves since they also possess selective criteria to be applied to the new designs. This is related to what Vidler proposes under the name "new environmentalism," where "the radical interrogation of the ethical and environmental conditions of specific sites," is taken as "programs in themselves" (Vidler 2003, 60). Therefore, the program might be used in its expanded conception, as the statement of an architectural problem or set of problems, contextual conditions as programs themselves, and the function; utilitarian, symbolic or otherwise.

However, while accepting such an expanded conception, in the present study, programs are not taken as forces, but rather conditions. The difference is, in the first case the program is conceptualized as a forming or shaping "force" of the design and formation, in the second, it is taken as a selective condition, controlling the formation by evaluation and selection. That is to say, a program's formative contribution to an architectural design is through the selection or evaluation process, by controlling the variations and ideas by selective elimination, which guides the course of “search,” and consequently determining the “solution.”

**About the Utopian Content**

On the other hand, a design also might carry a programmatic content that operates in the reverse direction; from the design to its tradition, the environment, or context, physical, social, or otherwise. For example, when we discuss about progressive social programs, about better human life, better environment, and a good city, or, when we conceive architecture as the instrument of philanthropy, liberalism, the “larger hope” and the “greater good,” we are actually operating in terms of these types of ideas. Such a conception of architectural program might be associated with architecture’s utopian content, and it is subject to the question “how such non-physical things as purposes, deliberations, plans, decisions, theories, intentions and values, can play a part in bringing about physical changes in the physical world?” In the evolutionary conception of architectural ideas, it refers to the creative, exploratory, innovative, but at the same time inquiring, critical and evolutionary forward movement, which is about “what could be” and “what is possible,” about the transformation of “what exists.”

The selectionist paradigm is also operational in this case. This means that, architecture conceived as, say, the instrument of “better human life,” could not actually guarantee or determine the transformation of the world towards this end. In selectionist terms, a work can be evaluated as either enabling or letting and proposing such a life to flourish or exist, or not permitting it. In the first case, it could only provide an objective opportunity to be evaluated, not as a “total design” or a determinist blueprint that controls all.

## 5.3 On the Nature of Architectural Designs with Reference to the Evolutionary Model of Architectural Design

Apparently, what comes out of the evolutionary model of architectural design and the discussions that follow it would be a different conception of an architectural design. That is to say, a design cannot be viewed as a mechanical assemblage of elements or components, “as several [Case Based Reasoning] systems tend to do” (Oxman and Heylighen 2001).

Here once more the reference is Formalists’ view of a work of art as a dynamic system, a closed-off, self-sufficient “architectonic structure,” consisting of weaving together of formative elements, and the notion of dominant that were introduced in Chapter 3. However, the evolutionary model of architectural design and the conception of design implicit in this model go well beyond the Formalist view of a work.

In the evolutionary model, an architectural work (or design) is viewed as neither a direct reflection of the empirical facts or the program, nor architect’s self-expression, but as a unique object, artificially “made” as a solution to a specific architectural problem or a set of problems, “formed” as a result of deliberate application of a set of formative or constructive ideas, and a set of selective conditions. It is a “cloudy” and “dynamic system” or structure consisting of interweaving layers of thought content with evolutionary relations between each other. In this sense, a design is conceived as a variation, solidified at some point of an evolutionary process that is informed and affected by many formative and selective ideas, as well as formative and transformative operations.

# CHAPTER 6

# ILLUSTRATION OF THE EVOLUTIONARY MODELS

The main aim of the present chapter is to illustrate the two evolutionary models: the "evolutionary conception of architectural ideas," and the "evolutionary model of architectural design." Such an investigation does not aim to seek a proof but rather it is a means of illustrating the models, for showing some of the potentialities the models possess and also for examining and discussing their applicability to architectural phenomena.

Furthermore, this chapter presents and illustrates how the evolutionary models could be used as a basis for the study of (past) architectural designs.

This chapter consists of two parts, each corresponding to the illustration and discussion of the respective model. In the first part, sketches and drawings of a house of Botta, produced during the design process are examined in the light of the "evolutionary model of architectural design." The selected case is the single-family house in Breganzona, one of Botta's relatively late designs, designed and built between 1983 and 1988.

Actually, Botta's *œuvre* provides an excellent material for the present study, and I believe that as a whole, they have the potential to expose the full potentialities of the proposed models and help in developing a fruitful and content-rich discussion. This is the major rationale behind selecting a design of Botta. On the other hand, the rationale behind the selection of that specific design is twofold: first, the material provided by the mentioned design is relevant and enough to support the aforementioned aims. Second, since the house is one of Botta's relatively later designs, there is a chance to pursue the lineage of ideas it contains not only in architectural tradition, but also in Botta's own *œuvre*.

In the second part, the evolutionary lineage of some of the selected ideas is pursued in Botta's own *œuvre,* and when possible, in architectural tradition. To do this, a set of architectural ideas from the single-family house in Breganzona are selected and investigated in the light of the "evolutionary conception of architectural ideas."

It must be noted that, "the evolutionary conception of architectural ideas," and the "evolutionary model of architectural design," are actually two complementary models, which cannot be studied in isolation. Therefore, the sections in the present study are considered as a whole and must be read and evaluated in this sense.

## 6.1 Section One: Analysis of Mario Botta's Single-Family House in Breganzona

### 6.1.1 Methodology

As far as one can follow from the materials provided, design of the single-family house in Breganzona begins in September 1983 and ends with the finalized design in October 1986. There are sketches and drawings produced during the design process. This "material" is taken as a means of externalization of the ideas operational during the process. In the following sections, I will reconsider this material that the architectural ideas are recorded in evolutionary terms, or more specifically following the structure and conceptual framework provided by my evolutionary models. Actually, it must be noted that what is examined is not the actual process itself, but rather the material produced during this process. This is essential for my main argument and for the methodology. Related with this, the process, which is the subject of the examination, actually relates to a set of hypothetical reconstructions that do not correspond to the actual process.

### 6.1.2 Analysis of the Design

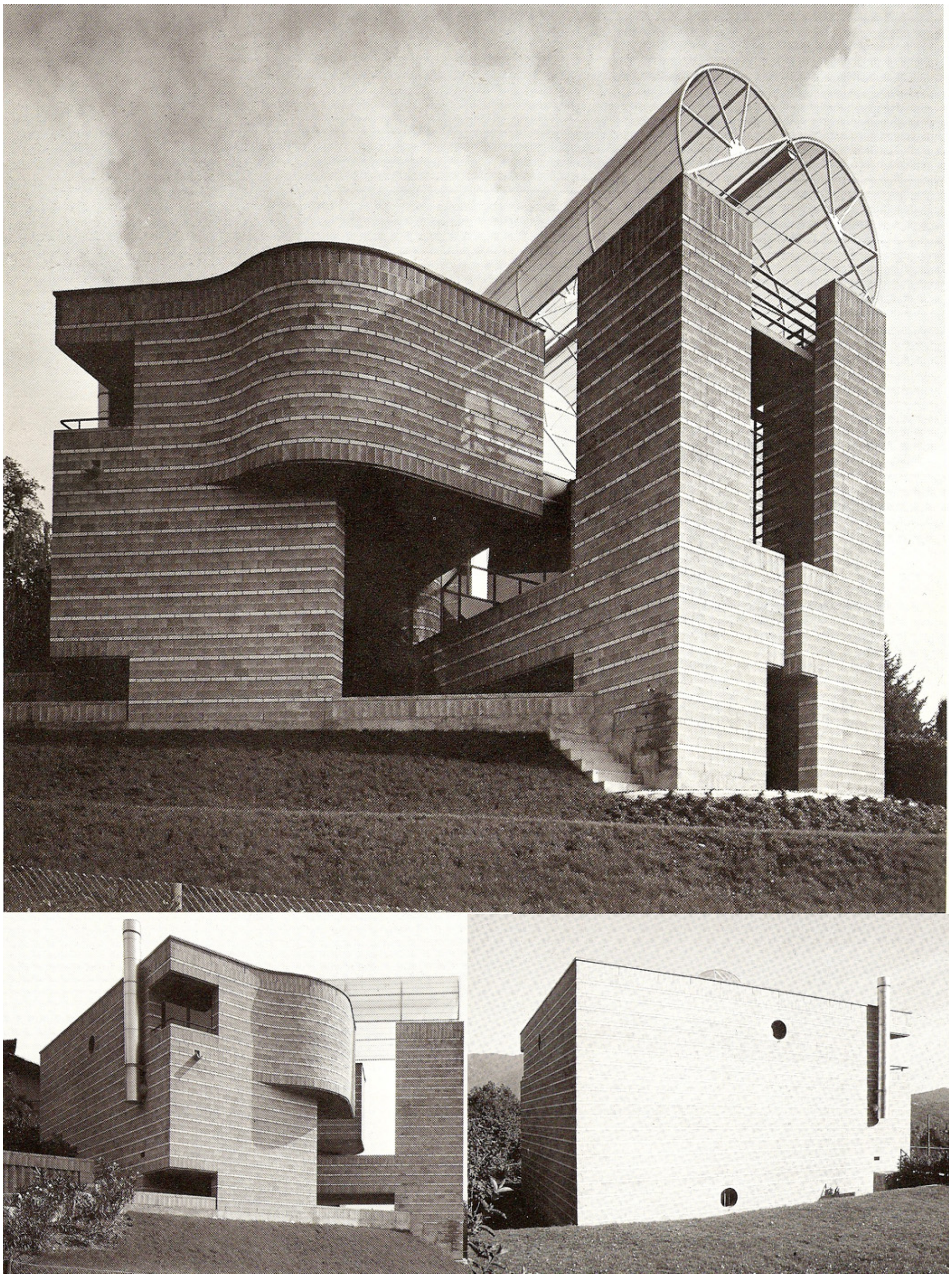


Figure 12 Single-family house in Breganzona (Botta 1989, 64-65)

**September 1983**

The initial formative idea is a rectangular solid, almost a perfect cube, and in plan, a perfect square (Figure 13). These two complementary ideas are the primary formative elements with which the design investigation begin. At this stage of design, both the square and the rectangular solid also work as selective ideas that control the outer boundaries of the design, and its overall form.

However, these ideas seem to have no major affect on the inner organization, either formatively or selectively. There are major ideas that are responsible for the inner organization of the design. More apparent one is an orthogonal grid dividing the initial square into 9 parts (Figure 14, e). This organization gives four perfect squares, with equal sizes, located at each corner of the square, and a cross-axial space in-between these squares. Actually, the same plans can also be read as consisting of four equal size squares at each corner of the square plan, leaving a cross-axial space in-between (Figure 14, g). This can be interpreted as the second dominant or major organizational idea. Resultant centrality and the perfect symmetry of the plan are noticeable. Each square provides a space for accommodating a function or a programmatic element.

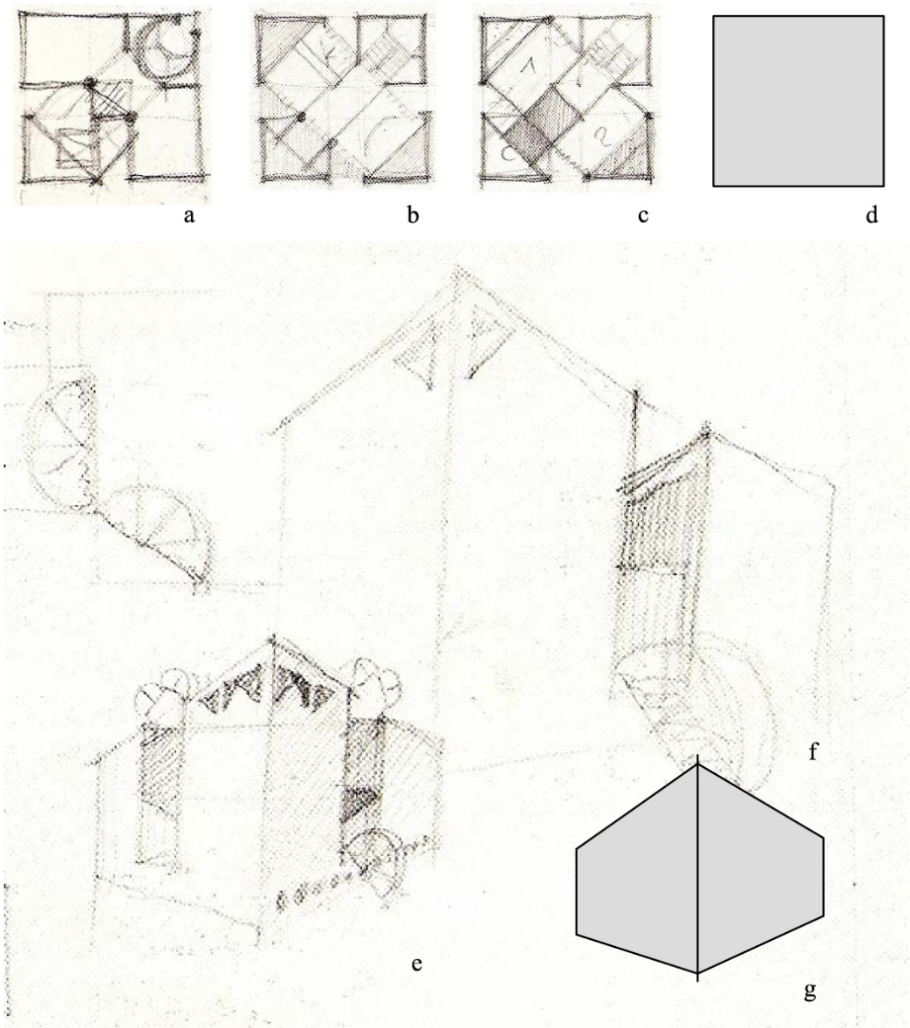



Figure 13 House in Breganzona. Analytical sketches of the dominant or major formative ideas (d and g are drawn by the author) (Botta 1989, 12).

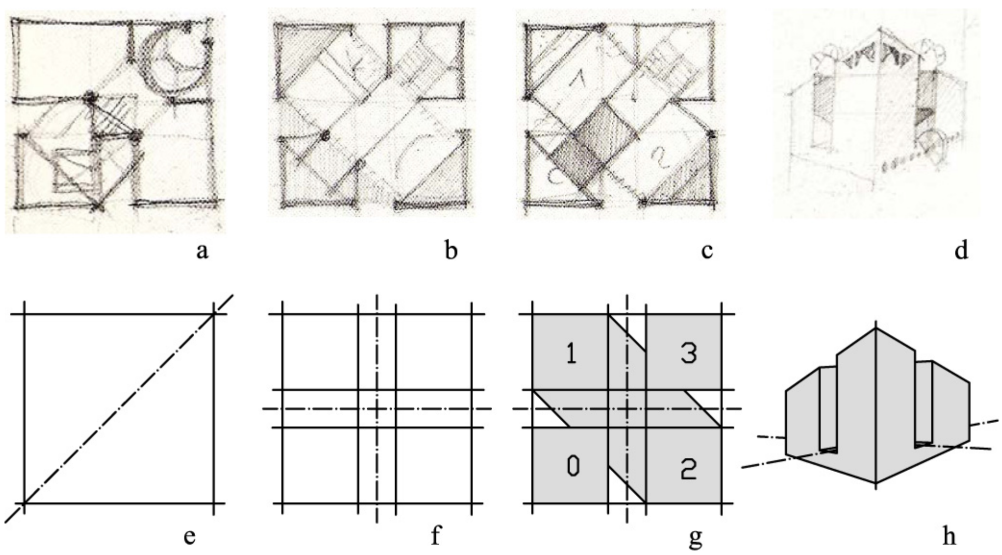



Figure 14 House in Breganzona. Analytical sketches of the formative ideas responsible for the inner order and organization, and the transformative affect of these ideas on the overall design (e to g are drawn by the author) (Botta 1989, 12).

This configuration has a (trans)formative affect on the initial solid. With the introduction of these elements, the initial solid seems to be broken into four rectangular solids, with the vertical slits or openings carving it at all four sides (Figure 14, d-h). There are two important ideas that must be emphasized at this point. First is “keeping the overall integrity and effect of the initial mass.” This is a selective idea that governs all the interventions affecting the overall design, and filters out the incompatible ones. For example, the apertures on all four sides remain as “slits” that do not destroy the overall mass effect of the design. Related with this, or more specifically, supporting this idea, such apertures seem to be carved out of the initial mass, rather than exposing themselves as ordinary openings, i.e. windows, doors, on a plane or surface.. This “carving effect” is particularly emphasized and laid bare, and it is the second selective idea, which emerges at this point.

The two half-circular trusses at the roof emphasize and expose the inner cross-axial space in the third dimension. Neither axis is given primary importance at present. There is, also, a diagonal axis in the plans but only barely identifiable

(Figure 14, a, b, c, e). This seems to be an idea that has no dominant or apparent formative affect –yet– but it is rather a recessed-idea, retaining itself as a trace at the background.

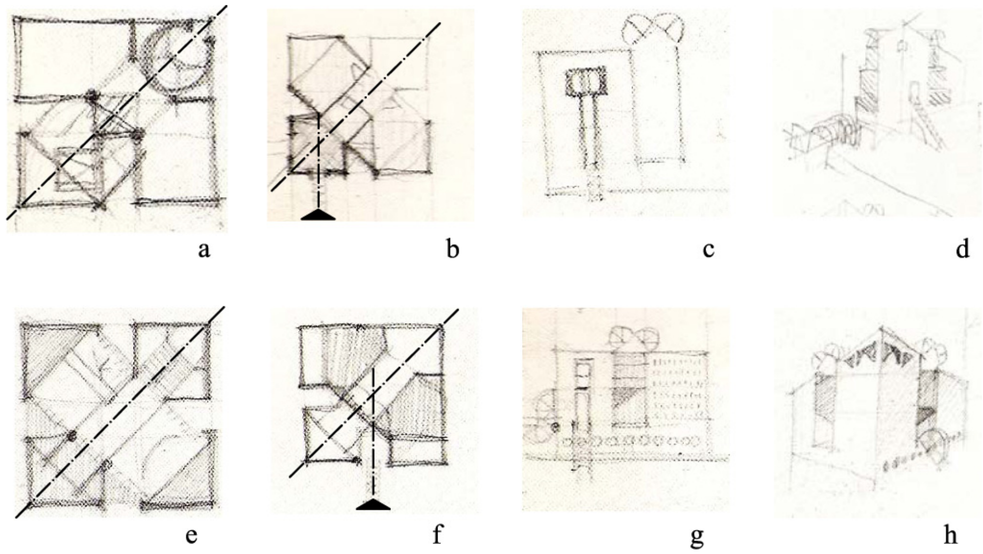



Figure 15 House in Breganzona. a-b, Stairs variations, b-d, f-h, Entrance variations (a,b,e,f added up by the author) (Botta 1989, 12).

There are few minor elements introduced at this stage of the design process. One of them is the stairs introduced for the need of vertical circulation, located within one of the four equal squares (Figure 15, a, e). There seems to be two competing variations, one circular, and the other rectangular. This is the first formative intervention that disturbs the orthogonal symmetry and the centrality of the original schema both spatially and programmatically. First, the intervention emphasizes the diagonal axis and makes it the new symmetry axis. Second, the centrality is to a degree displaced by the introduction of a circulatory element, channeling the movement towards that direction. Third, since one of the four identical squares is reserved for a different programmatic element (i.e. stairs), the spatial orthogonal symmetry is also disturbed. But, all these transformations apply to the inner organization, and they have no transformative affect on the overall form. They are rather subsumed by it.

Another identifiable element is the entrance to the house. At present, there are two ideas, or if we prefer, variations, both suggesting a perpendicular access to the building from one side (Figure 15, b-f). One of the variations proposes an entrance at the middle of one of the facades, right into the cross-shaped inner space (Figure 15, f). The other variation introduces an entrance through the rectangular space that is located in the opposite corner of the stairs (Figure 15, b). In this variation, programmatically, two diagonal spaces are reserved for circulation, one for entrance and distribution space, the other for stairs or for vertical circulation. If we set aside the location of the gate, spatially, this configuration further supports the diagonal axis and diagonal symmetry of the overall organization. However, the location of the gate, dislocated from the diagonal axis, considerably degrades this support. Furthermore, this element demands a transformation on the initial structure, i.e. introduction of another opening at that part of the solid. Under the governance of the major formative idea, another slit is introduced (Figure 15, c-g). However, despite this governance, as it would seem, such an opening does not match the opening of the slit since it competes with such a powerful and primary element and it affects the overall balance of the façade. Perhaps this could be solved by keeping it as a minor element, just an opening (Figure 15, d). However, at this point, the slits or carved openings work as selective ideas that do not permit existence of an entrance without the governance of the cross-axial space. That is to say, in its present state, the selective conditions seem to be filtering out this variation.

The other variation utilizes the aperture of an already existing slit and one of the orthogonal axes, therefore does not affect the overall form. That is to say, it utilizes programmatic potentialities of the already existing formal configuration (or form if we prefer) rather than proposing one by itself. Furthermore, this element is supported by most of the major formative ideas, such as the rectangular solid and the grid structure. Spatially, the element proposes direct access to the center, which in turn supports the central organization, and introduction of it enables equal access to the spaces. However, since it emphasizes and foregrounds one of the two axes of the cross axial space, it intrinsically suppresses the other as a secondary element. In its present state, this variation seems to be passing through the selective conditions.

As a part of the entrances, stairs are proposed for accessing the ground floor level, indicating that the ground floor is raised from the ground above a pedestal (Figure 15, d, h). As one would remember, actually, the pedestal is introduced at the very beginning, as a part of the initial formative ideas.

Perhaps for supporting the symmetry, in one variety, a garage access is introduced at the other side of the façade at the basement level (Figure 15, d). Actually, this is another program element introduced together with the main entrance since both elements programmatically involve an access to the house. At its present stage, the garage is contained within the mass of the building at the basement level.

There is a variety of apertures, which are rough trials at this point. These seem to be primarily controlled by the dominant formative idea, but they are also somehow related with the spatial and programmatic elements, i.e. an entrance, a bedroom.

In terms of programmatic organization, four equal squares are almost like containers, each might take a different program element, i.e. bedrooms at the upper level, staircase, kitchen and entrance space at the ground level, etc. From a different point of view, at this stage, these are the programmatic elements constituting the selective conditions, for evaluating the potentialities of the variable configurations.

**September-October 1983**

While leaving the major formative ideas of rectangular solid and the perfect square intact, in this stage, main spatial and organizational ideas are replaced with a new one; the nine square grid. This is not a transformation of the previous ideas but rather an introduction of a new idea to substitute the old.

The diagonal axis and the cross-axial spaces totally disappear, leaving their place to a different organization (Figure 16, f and g).

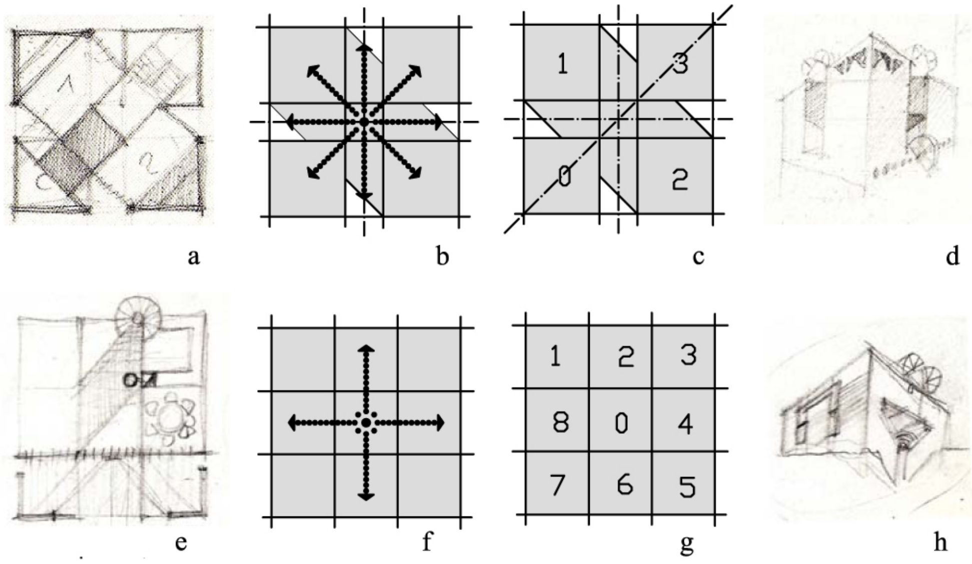



Figure 16 Analytical drawings of the dominant formative ideas, that are in control of the inner organization. Upper row is from September 1983, lower row is from September-October 1983 (b-c, f-g are drawn by the author) (Botta 1989, 13).

In its present use, there is also a structural aspect of the nine square grid, introducing four columns located at four corners of the center square, on the path of the “virtual” diagonal axes. This condition filters out the diagonal axis descendant from the previous stage. For the same condition, the stairs cannot remain where it was previously located, since the columns restrict the access to it from the center square. Consequently, it is relocated at one edge of the square boundary of the plan, one-half extending from the main body (Figure 16, e). It is interesting to see that this element violates the selective condition implied by the initial major formative idea: the perfect rectangular solid effect. In terms of the spatial organization and access between spaces, the former scheme seems to be providing a more flexible organization and a richer programmatic potential while the latter spatial and structural configuration seems to be more restricted (Figure 16, f-h).

At this stage, the idea of external frontality is introduced. This is a new idea that puts the primacy on one of the façades and consequently, reduces the importance of the others. The idea of frontality works as a selective idea and filters out the identical slits on all sides of the facades. It comes together with the diagonal axis, projected onto the façade, now perceivable particularly from outside of the building, contrary to the previous proposal that has axes in plan organization, but not so much affecting the overall three-dimensional form. The axis and the frontality are further supported by the half-circular trusses at the roof, once lying along the cross-axial scheme, this time only lying in one direction, along the axis perpendicular to the front façade. However, introduction of this idea seems to be not so much affecting the plan scheme at the moment, the inner organization is yet rather undecided and ambiguous, only governed by the nine square grid.

Actually, the frontal aperture, which we see in a variation, is the opening of a triangular balcony or a terrace, proposed at the upper floor (Figure 16, e). It is subsumed within the boundaries of the overall solid, with its opening to the front façade, supporting this overall effect, and at the same time newly introduced frontality of the design. This is the first time such a major semi-open space is introduced to the design.

As it would seem at the present, there are many variations of the front façade proposing various façade configurations by particularly focusing on the apertures (Figure 17, e-h). There are also perspectives that are the means of checking the overall outside effect of the design. One can observe from these recordings that all apertures continue to conform to the solid effect of the building.

There seems that there is not a mature or solidified programmatic configuration yet, but the one that is operational at the present stage seems to be following a conventional scheme; the public spaces are located at the ground floor, while the private ones, such as bedrooms and the bathroom are located at the upper. Each program element, i.e. kitchen, dining, bedroom, bathroom, occupies a square of the grid, at one occasion two bedrooms share three squares.

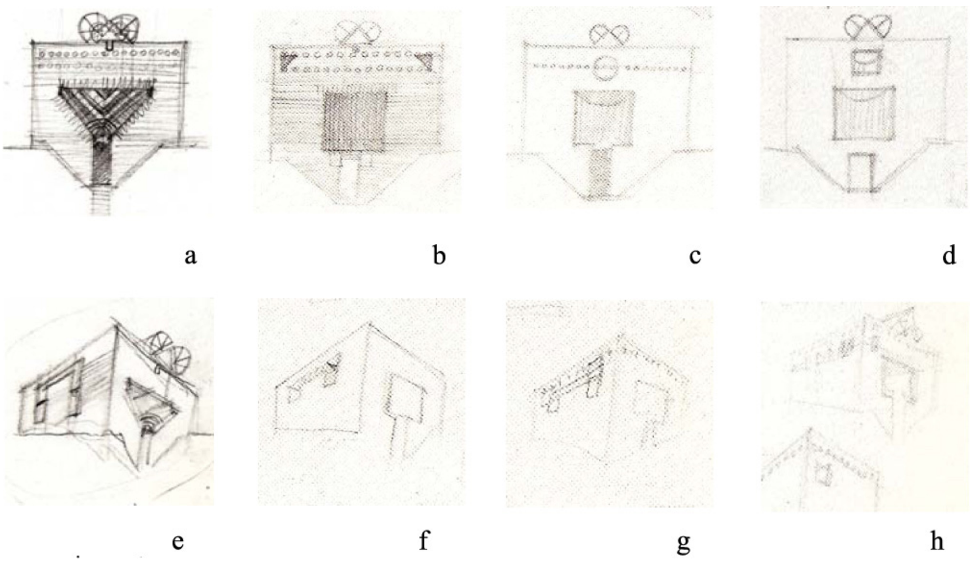



Figure 17 Variations: Transformation of the "front" façade and overall form by entrance variations (Botta 1989, 13).

**November 1983**

In this stage of design, the orthogonal grid is transformed. The new grid structure seems to be primarily derived from the nine square grid; two gridlines shifted towards one corner of the square, providing a differentiation between cells (Figure 18, e). An "L" shaped sequence of cells is reserved for closed spaces of the house. This "L" shaped organization surrounds an "L" shaped semi-open space, an inner court, and a terrace (Figure 18, f). This is a new idea, introduced at this point of design. The terrace and the court are subsumed by the main body of the rectangular solid. These new elements provide selective conditions that possibly filtered out the "perfect" nine square grid. In the present condition, the nine square grid organization would not leave enough space for the main house block, and too much space would be reserved for the space at the corner and the semi-open space to achieve the desired effect. So two axes of the grid are shifted to give more space, while transforming the original nine square grid (Figure 18, e).

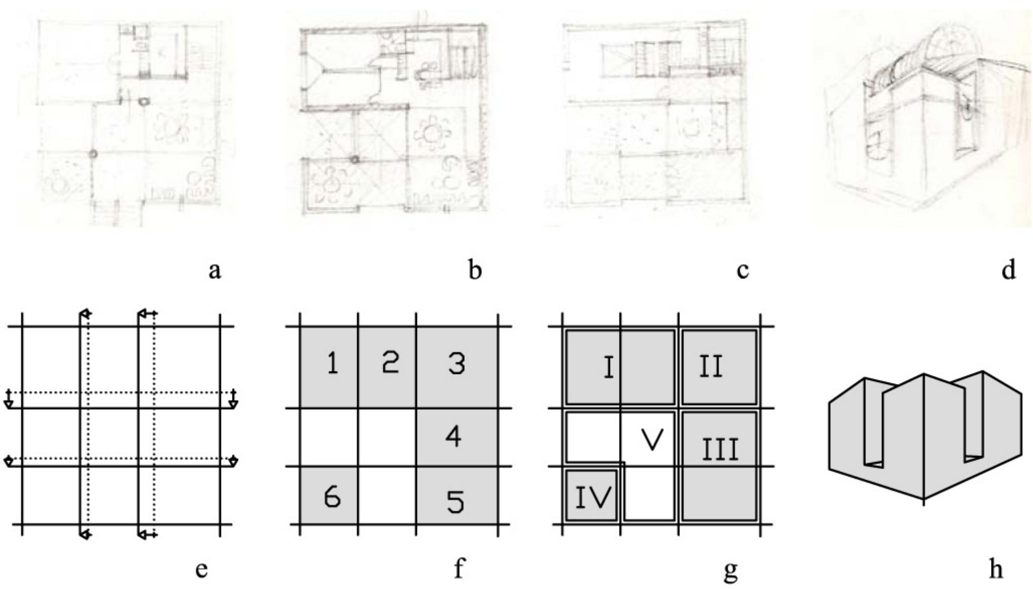



Figure 18 Analytical drawings of the schema of inner organization and the overall form (e-h are drawn by the author) (Botta 1989, 14).

With the introduction of the “L” shaped semi-open space, the idea of frontality is suspended, and the vertical slits are reintroduced to the design (Figure 18, h). From a certain perspective, the overall appearance is quite similar to the one produced in the initial stage of the design process (Figure 14, h). However, owing to the “L” shaped semi-open space compared to the cross-axial space in the previous variation, here, there are only two slits on the two façades instead of four located on the four façades. Actually, this transformation can be attributed to the demand for two entrances to the building, one reserved for cars, the other for the pedestrians. Once two slits on two facades are selected for this purpose, this condition strains two of four identical slits on all sides of the buildings, since they are unused. Another condition might be contextual, provided by the specificities of the site, since on the one hand, these apertures open to the two adjacent streets, on the other, they are oriented towards the view. Owing to this new organization, the single cell at the corner is isolated from the overall solid, and gains somewhat the character of a tower. The trusses at the roof, which are previously lying either along the cross-axial scheme, or along the axis of the front façade, are now covering the semi-open space and the roof of this tower-like block.

The conventional programmatic organization is replaced with a new one. Instead of distributing programmatic elements to different floors following a hierarchical order of public to private, such as living room, kitchen at the ground, bedrooms and bathrooms at the upper floors, in this variation, the basic idea is to distribute programmatic elements in different sections of the "L" shaped block, while grouping the ones with common characteristics together. In such an organization, one leg of the "L" is reserved for bedrooms in all floors (Figure 18, g-I), the other is reserved for living spaces (Figure 18, g-III), and the corner is used for service spaces such as kitchen(s), bathrooms, and stairs (Figure 18, g-II). Overall, in terms of the distribution of the programmatic elements, almost all floors work as a small "house" in themselves, accommodating basic programmatic elements within themselves. At first sight, introducing such a variation might be related with the requirements of the form, with the nature of the "L," but such form would equally permit the conventional programmatic organization. Therefore, the variation must be evaluated better as a part of the investigation; a search occurring primarily on the basis of programmatic search itself. Because of the detailed plan layout, the formally implied cross-axis is somehow degraded. For example, once a primary element, the stairs are pushed to the corner, hidden behind spaces such as kitchen and bathroom, and thus violating the cross-axial scheme. This seems to be not due to the conditions related with the overall programmatic organization, or overall formal scheme, permitting only such a variation. Other plan layouts, which do not violate, say, the implied diagonal axis, would still be possible with these conditions.

There are also many investigations concerning the overall form of the design. Mostly in these investigations, the main scheme is kept intact, but variations of the corner tower and the roof cover are produced. In one variation, the corner tower is rotated 45 degrees, violating the two dominants, the rectangular solid and the square plan. As we will see, introduction of this idea marks an important formative and evolutionary change in the design.

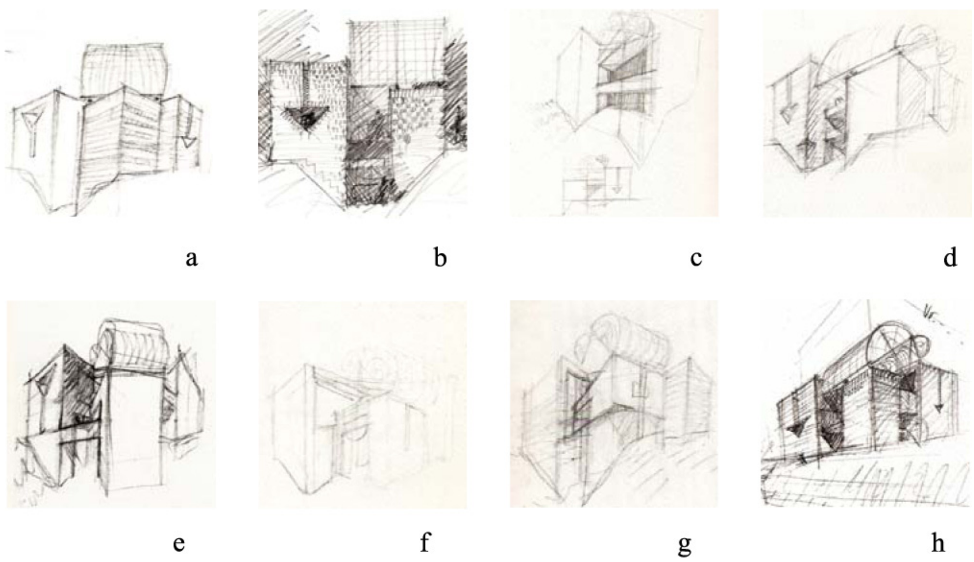



Figure 19 Variations on the overall form of the design (Botta 1989, 15, 16, 17)).

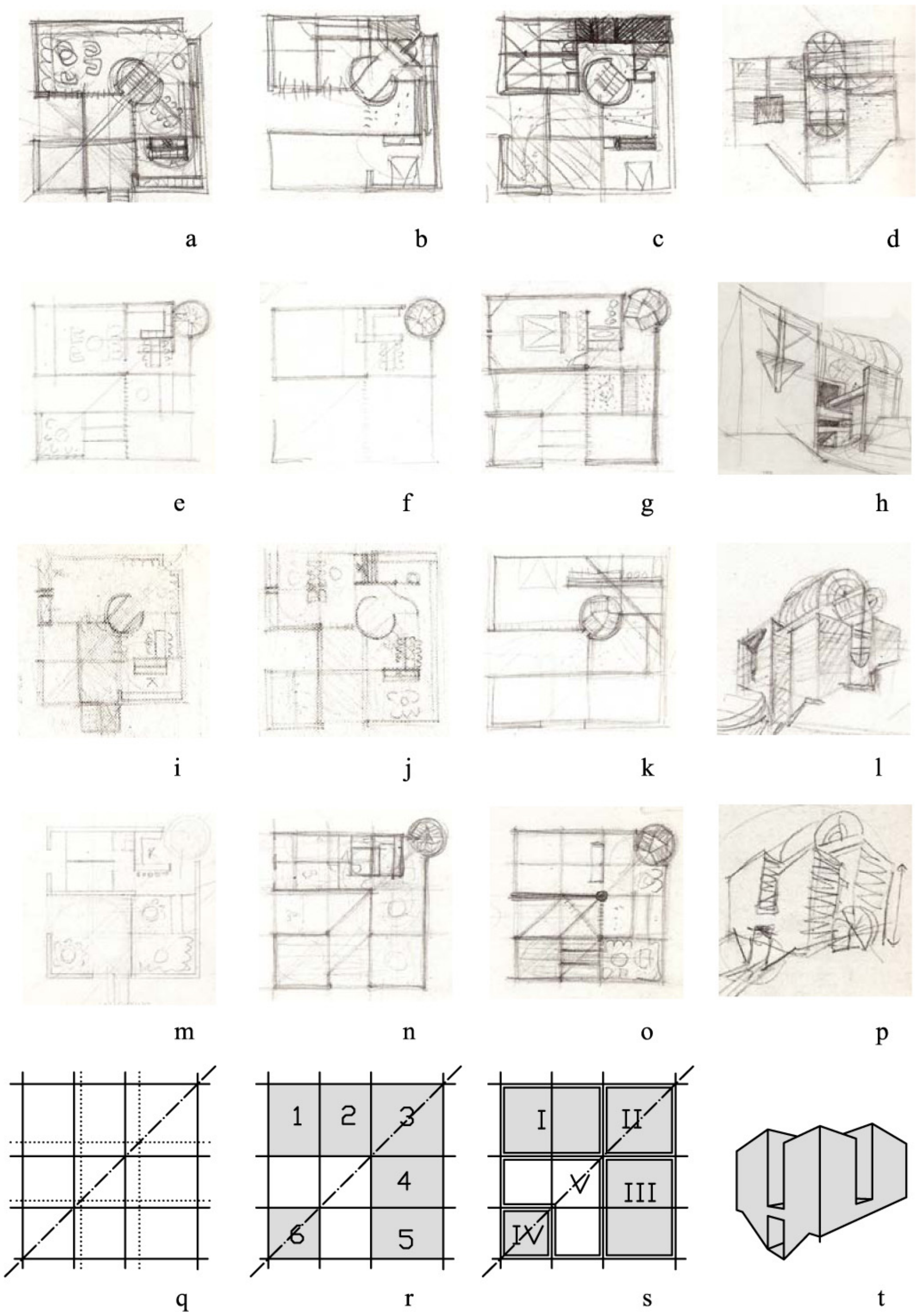



Figure 20 December, drawings of the first variation. (q-t are drawn by the author) (Botta 1989, 18-23).

**December 1983**

This stage of design involves a number of variations that are mainly based on the same set of dominant formative ideas. The orthogonal grid is retained without transformation (Figure 20, q). The major spatial organization, the “L” shaped sequence of cells, the “L” shaped semi-open space, and the corner tower are preserved (Figure 20, r, s). While keeping these, at this stage the trials focus rather on programmatic organization, and consequently on plan layout.

It seems that between the former stage and the present one, the implied cross axis is foregrounded as a selective element. It filters out the previous plan layout, particularly the configuration concerning the service spaces located at the corner. At the same time, the cross-axis becomes a complementary dominant formative idea with other dominant formative ideas at this stage. For example, the stairs, once displaced from the cross-axis and hidden at the far corner of the “L,” are now relocated on the diagonal-axis. In variations, this element is placed either at the inner corner (Figure 20, a-c, i-k), or at the outer one (Figure 20, e-g, m-o). In both cases stairs gain a central position, and becomes a key element in the plan organization.

A return to a conventional programmatic organization is also observable. That is to say, in the these variations, ground floor occupies more public program elements such as living, dining, food preparation while upper floors are reserved for bedrooms and their auxiliary spaces. This condition rules out the departmentalization of the legs of the “L.”

In these variations, two-entrance scheme is also retained, one entrance for cars, the other for the pedestrian access.

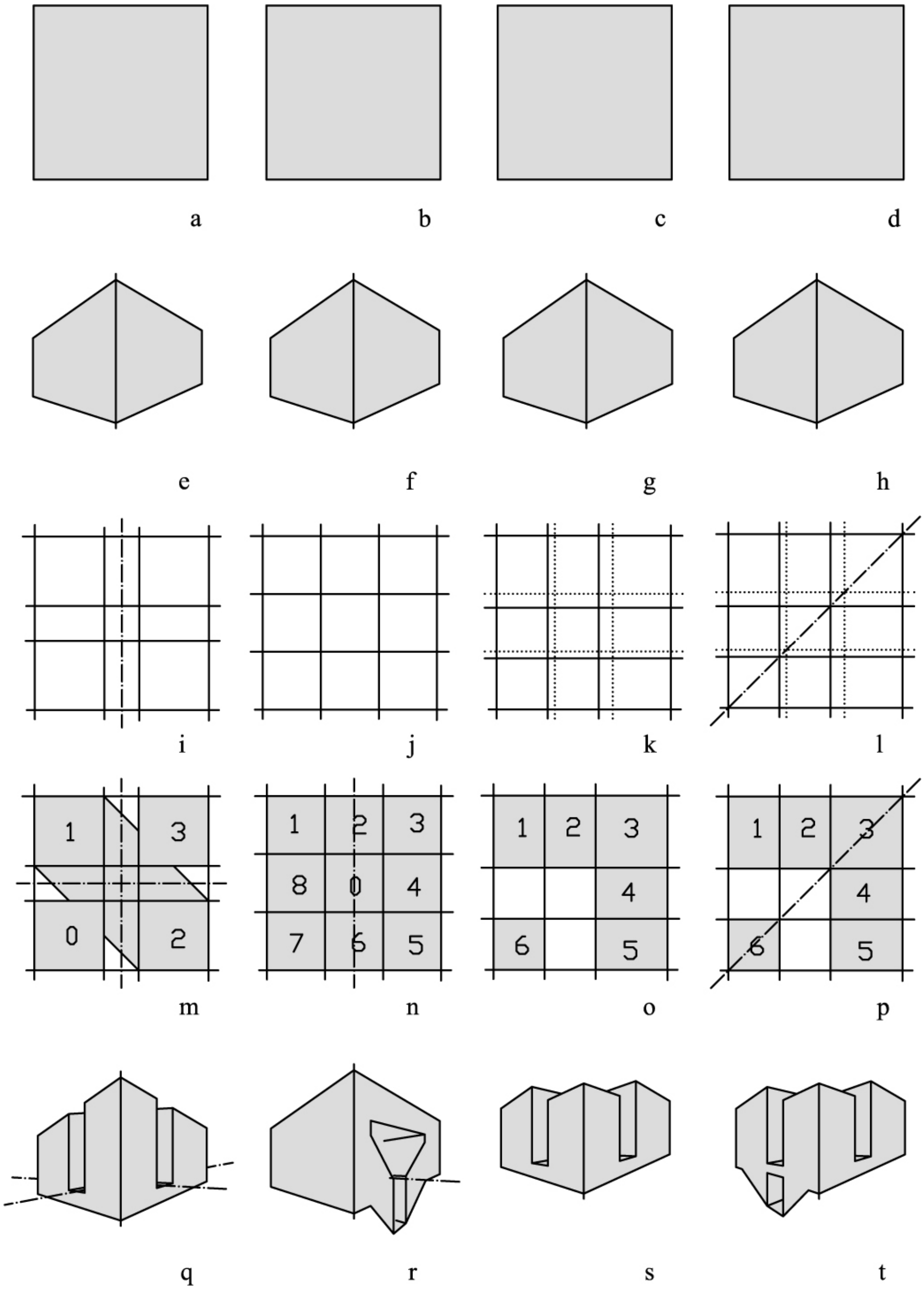



Figure 21 Evolutionary change in dominant formative/selective ideas: from September to December (drawn by the author).

**January 1984**

In this stage of design, the orthogonal grid, the “L” shaped block, the corner tower and the semi-open space (the inner court) between these two, are retained from the previous stage.

One of the major ideational changes in this stage is the diagonal-axis gaining importance and emphasis both as a formative and selective idea. Now, the cross-axis is the formative and organizing element. All the important elements of the plan organization, such as the main entrance, the public semi-open space, the circulation core, and the vertical circulation element are located with respect to it. In addition, it continues to be the symmetry axis with more emphasis.

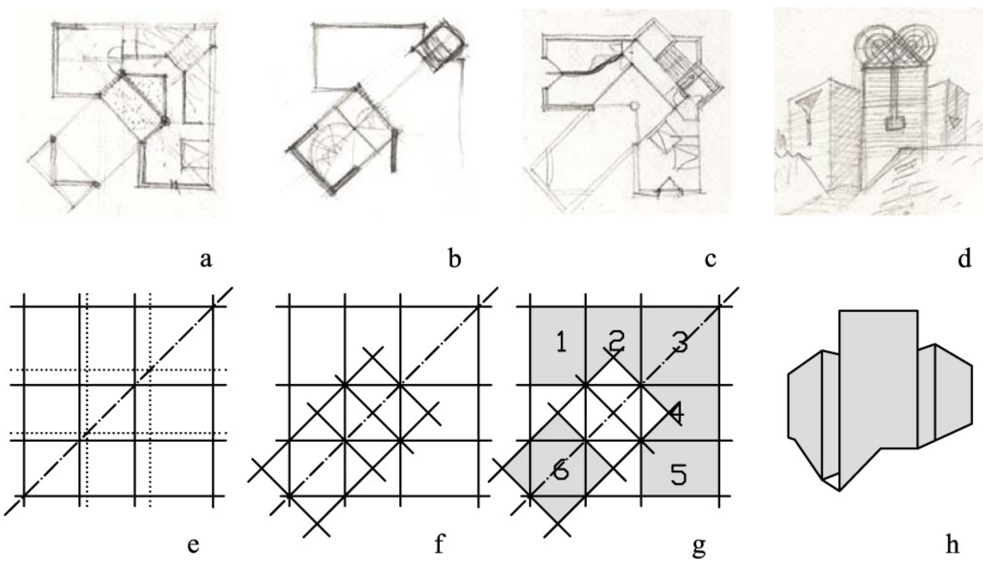



Figure 22 Variations from January (e-h are drawn by the author) (Botta 1989, 24-25).

Following this major change, one important variation from the previous stage is that the corner tower is rotated 45 degrees and it is now perfectly aligned with the diagonal-axis. It defines one end of the diagonal-axis where the other end is defined by the stairs. Now, both the tower and the stairs are better adapted to the conditions of the diagonal-axis. The tower is further scaled up to fit the cross dimension of the corner grid. The main entrance is also aligned with the diagonal axis, and relocated at the center of the square. Between the main entrance and the stairs resides the circulation distribution core where the circulation between the legs of the "L," vertical circulation, access between the closed spaces and the semi-open space, and between entrance and the inner spaces take place. Overall, the diagonal-axis is now the dominant formative idea, which is responsible for the organization and hierarchy of the programmatic elements and their relations with each other and the overall form.

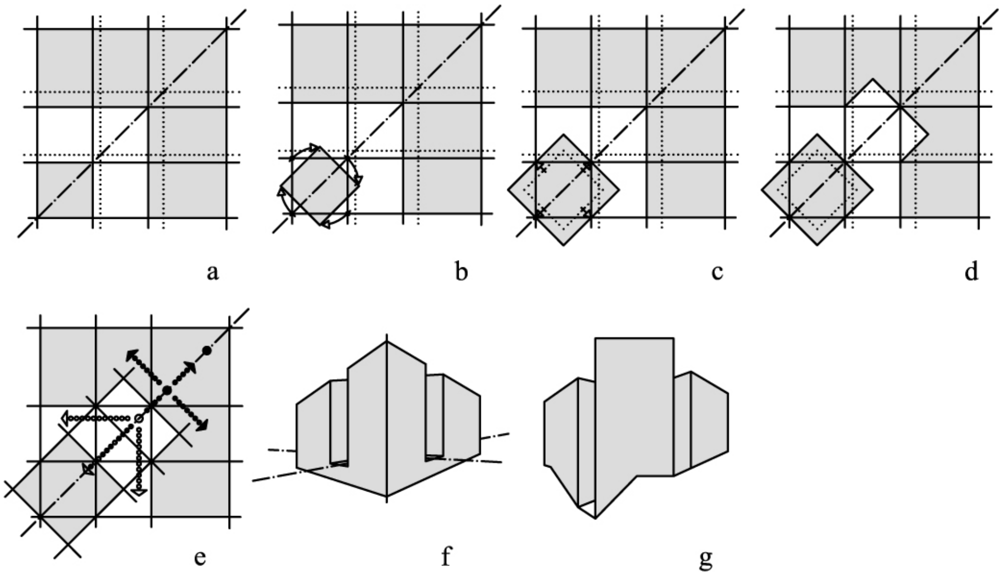



Figure 23 January 1984, hypothetical reconstruction of the formative operations (drawn by the author).

The rotation of the corner tower is one of the important changes, which seems to go against the conditions imposed by the overall rectangular solid effect and the square plan. To remind, these two ideas are not only dominant formative ideas that initiate the design investigation, contribute to the design formatively in this initiation stage, but also at the same time, they are resident formative and more important, selective elements that are dominant throughout the process. Therefore, this issue is worth to mention further.

In plan, it seems that, the variation gained by the rotation of the corner tower more or less disturbs the square plan, but still dominated by it, and the square plan is conceivable and its overall formative affect remains intact. This can easily be observed in the sketches where the new rotation is either checked or tested by the corner of the square or used as a formative starting point (Figure 22, a-c).

However, in the third dimension the situation is quite different. The overall rectangular solid effect disappears. It is true that rectangular solid is the starting idea, but now, it is not conceivable in the present overall three-dimensional form. Now, the spatial organization seems to be in control of the three dimensional form.

Now, let us assume that there are no recorded materials from the previous stages of the design process, and I start the investigation at this point. Without knowing the previous stages, I can easily identify the rectangular plan, the orthogonal grid, and the diagonal axis. However, this is not so for the rectangular solid. By just examining the perspective sketches provided, one cannot identify the existence of such a dominant idea. Now, the dominant formative idea could be defined as "a 45 degrees rotated tower, surrounded by an 'L' shaped solid block." But, still, in a closer examination, one can say that, there exists a rectangular solid, which the present idea descends from by modification and transformation. This situation also indicates a shift, while the evolutionary process stays intact.

When these ideas and sketches are solidified into technical drawings, it is seen that the central semi-open space is given more importance, and the corner tower is reduced in size to enlarge the semi-open space (Figure 25). However, in a closer examination, it is easily identifiable that the technical drawings are not merely solidified records of the investigations made in this stage. That is to say, there are also evolutionary changes which are recorded in the technical drawings but do not exist in the sketches.

The major change, which is not clearly determinable in the sketches but obvious in the technical drawings, is in the orthogonal grid, transformed back into nine square grid which is now responsible for both the spatial organization and the structural system. The question is, what were the conditions that eliminated the previous orthogonal grid, and what are the conditions that now enable once tried nine square grid reintroduced back into the design? The conditions which filtered out the perfect nine square grid in the previous stages were primarily related with the spatial organization (Figure 16, e-h). To remind, the idea first emerged as a part of a formal and spatial organization that is quite different from the present one. The mentioned variation is governed by a central schema dominated by the frontality and a weak orthogonal axis where the important ideas of the present variation, the “L” shaped spatial organization, the corner tower and the semi-open space did not exist. When, in November 1984, these ideas are first introduced to the design, the perfect nine square scheme is filtered out, or more specifically transformed to provide enough space for the main house block: The two axes of the grid are shifted to give more space, while transforming the original nine square grid. But, since all the elements which lead filtering out of the nine square grid are still intact, the question is, how it returned back into the design, or, more specifically, in what sense the conditions are changed to let it back? The answer to these questions is that, primarily, the nature of the ideas and consequently their formative, but perhaps more important, their selective implications have changed since then. For example, formerly the corner tower was not such a primary element. It was more of a byproduct of the “L” shaped main building block and the semi-open space. Even its function was not clear at that point. Now, it is one of the dominant elements of the spatial organization, and the overall form. If we compare the sketches of the corner tower in both stages, the difference becomes easily identifiable. This is also true for the semi-open space. In the former variation, it has not gained the status of a major element, but has the character of a crack in the main body. Now, like the corner tower, it is a major element. These are the changes in the nature of the elements, and consequently in the selective conditions they constitute. It must be noted that although important, these are not the only changes that let nine square back into the design and retain. There is an important idea introduced to design which also make it possible. The idea is to adapt the physical embodiment of the building to the conditions, without modifying or transforming the original idea behind it, or more specifically retaining it in the background as a dominant formative element. For example, two corner spaces at the two sides of the diagonal axis are made larger, offsetting their walls towards the semi-open space going against the grid (Figure 24, b). This change also demands a change in the structural organization, now the mentioned structural axes are also shifted from the order of the nine square grid. This shows the type of control which I mentioned previously. The center of the "L" shaped block is also chamfered inside, aligning it with the corner tower, and gaining more space (Figure 24, d).

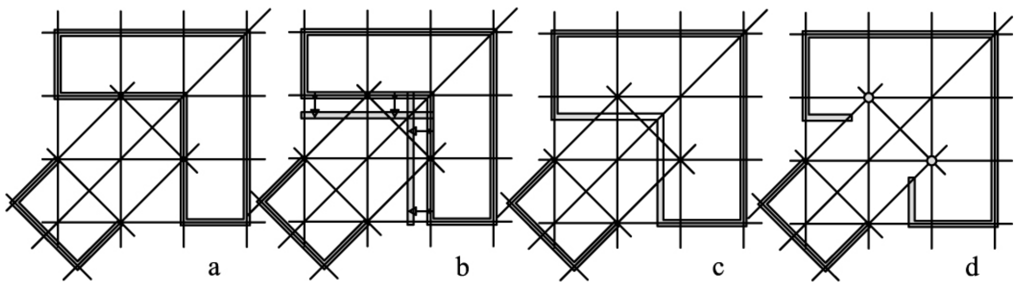



Figure 24 Transformation of the initial schema derived from nine square grid (drawn by the author).

From another point of view, this can be interpreted as a change in the formative and selective balance of the nine square grid; now, not strictly determining or forming the spatial organization, but selectively controlling it. If the drawings are examined, the nine square grid is easily identifiable at the background controlling the overall organization, while it does not strictly govern all aspects of it.

Now, the building is almost totally closed to the outer world, that is to say, there are almost no direct openings and access to outside. The spaces are introverted and they only directly relate to the inner semi-open space. This inner space is also bounded by the overall outer form, which further controls and restricts the direct relation. As it would seem, the entrance from the basement further lends support to this idea.

It must be noted that, from the earlier sketches it is obvious that, in the trials, there always exist the conditions of site, and the context, to a degree suppressed at the background, yet operational. But from the materials provided, it seems that this is the first time the proposal is fully and explicitly confronted with the building site.

The site is a rectangular, corner lot, lying along Northwest-Northeast direction. It is located at the crossing of two streets that bound it from the Southwest and the Southeast. The site is sloped towards the Southeast corner.

In the present variation, the building is located parallel to the longer sides, at the farthest location possible; drawn back from the borders of the site that are adjacent to the streets. At present, this seems to be the primary relation of the building with its physical context. Entrance to the building is taken from Southwest side, which is closer to the nearest street.

One unexpected thing is that the two-entrance idea is abandoned and replaced with one entrance for both cars and the pedestrians from the basement floor. This seems to be a forced idea, at least against the conditions coming from the immediate site. The actual level of the site just passes through the ground level of the building where all the public activities take place. Therefore, an entrance at this level would be possible, permitted by both the conditions proposed by the programmatic and spatial organization, and the site. It other words, a variation proposing an entrance on this level would perfectly pass the site conditions and the conditions proposed by the programmatic and the spatial organization. So what might be the conditions, and the source of these conditions, which filter such an idea? There are two sources, one physical or more specifically, related with the physical context, the others are ideational. The physical one is related with the street level that is one floor lower than the ground level of the house. The first ideational one can be described as "to give direct access to the house from the street level." The second one can be described as "keeping the physical and mental distance between the outer world and the inner space of the house." The selective conditions, which come out of these two sources, do not permit an entrance from the ground level of the house, since it is higher from the street level, and there is a need for many stairs. "Many stairs," cannot pass the selective filter of the "direct access from the street," therefore eliminated. Any direct entrance through the living space would also fail the second ideational selective control. However, no matter how the present alternative passes through these conditions, it fails from the others, which I have mentioned earlier. Another important thing to mention is the character of the entrance. It is almost a hole, just opened on the main solid, without any expression and without any particular emphasis. This conceptual condition further supports the idea of "keeping the physical and mental distance between the outer world and the inner space of the house."

From the final drawings, it is observable that the truss structure at the roof is also rotated and aligned with the diagonal axis. This can be interpreted as the intention to emphasize the diagonal-axis further, perhaps to expose it, but still it has no major affect on the outer form. This condition becomes clearer when the site plan is examined. One can identify the diagonal axis because of the roof structure but no relation exists between such an axis and the physical context. It is still a strong, dominant formative element, but only effective within the boundaries of the building.

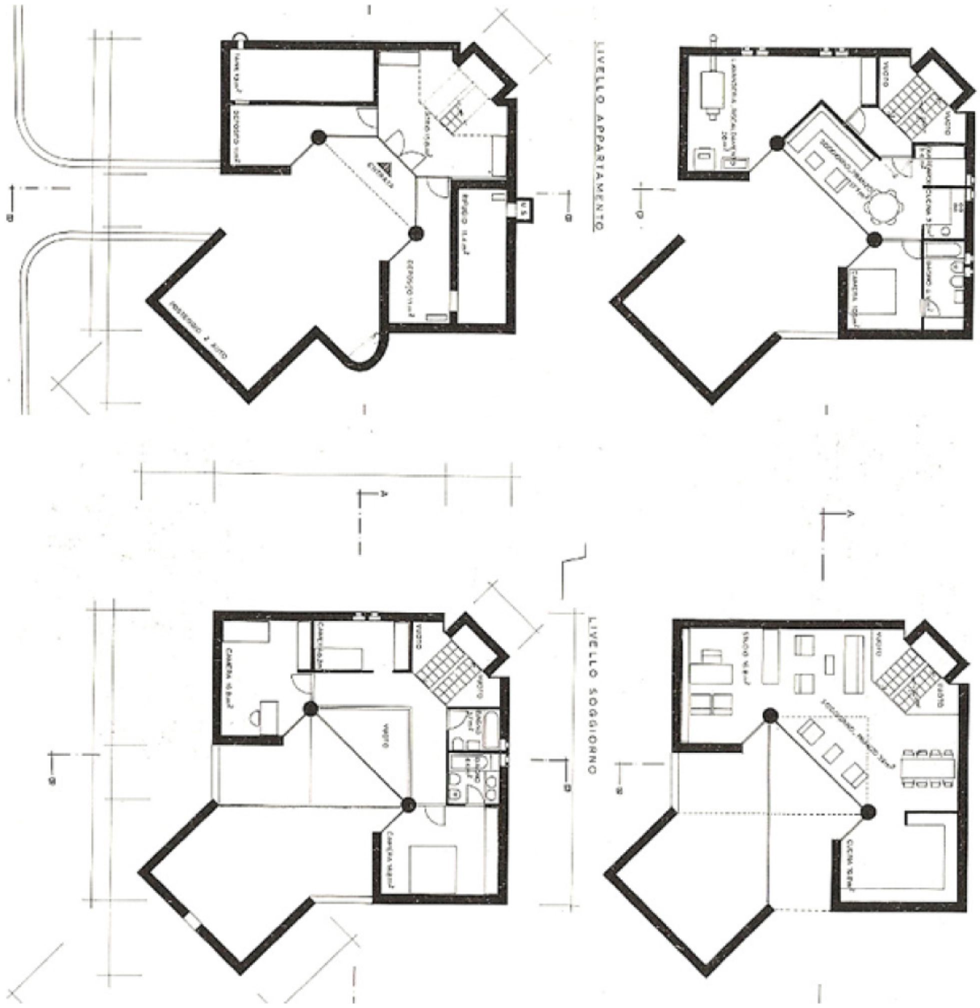


Figure 25 January 1984, technical drawings (Botta 1989, 26).

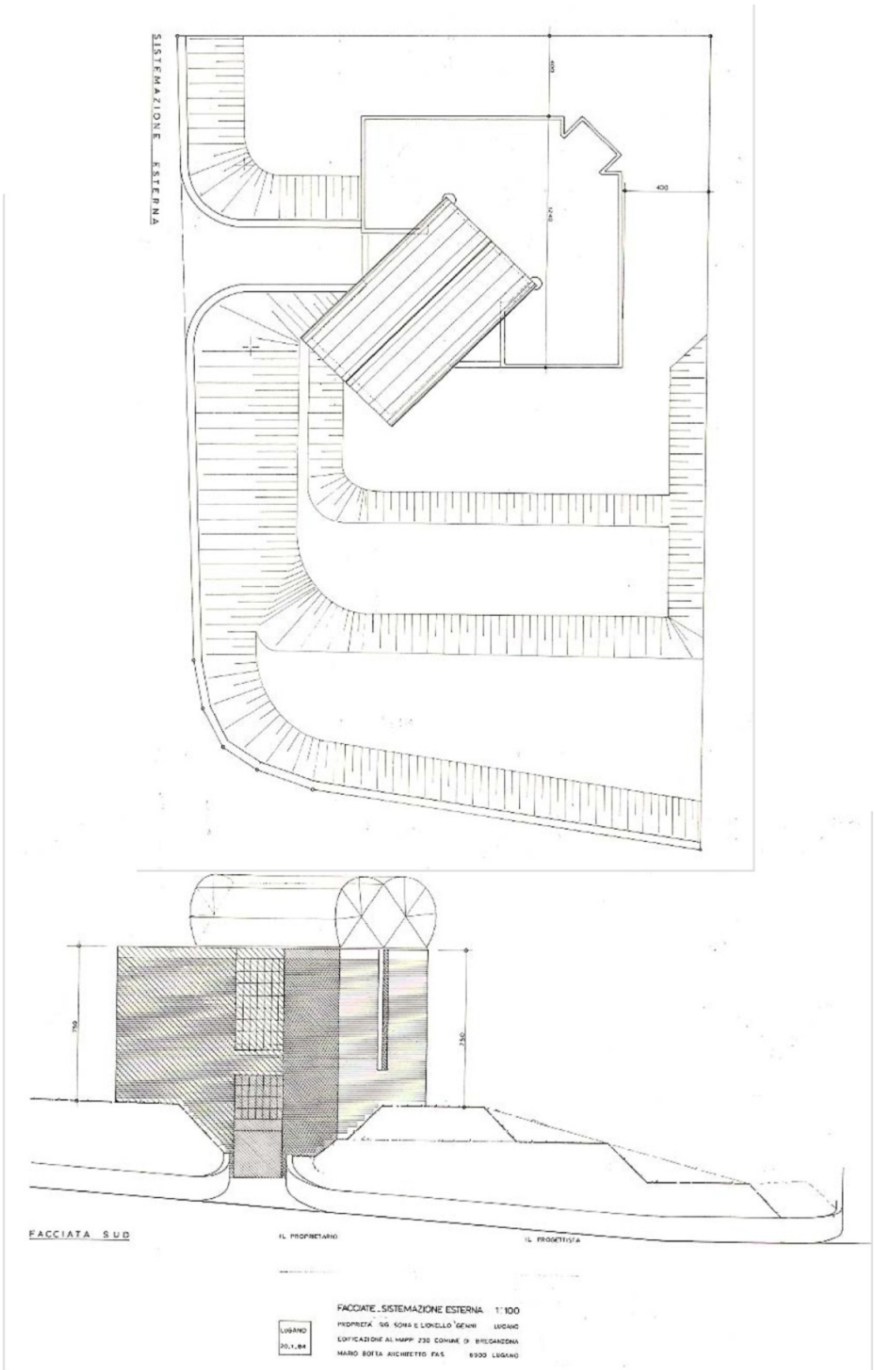
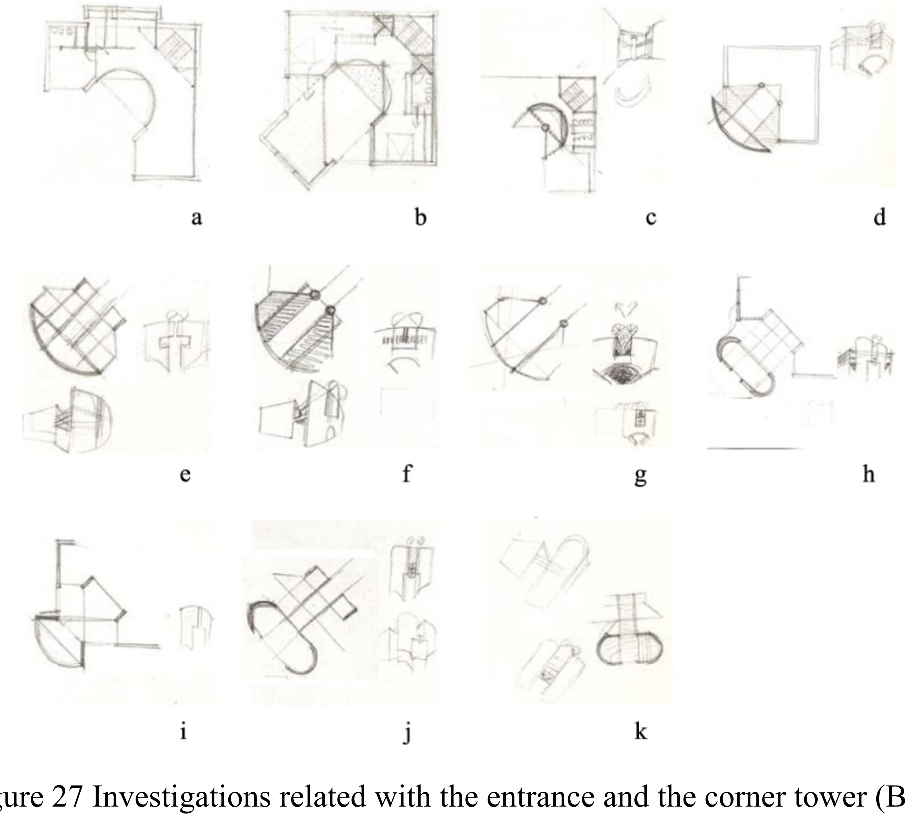



Figure 26 January 1984, site plan and the elevation from the Southwest (Botta 1989, 27)

**January – February 1984**

This stage particularly focuses on the diagonal axis, more specifically on the elements located along it. Specifically, these elements are the stairs, service spaces such as kitchen and toilet, main circulation core and the entrance (space), the terrace, and the corner tower. In these variations, location of the stairs seems to be solidified or finalized, yet its type remains unclear. The stairs are located at one end of the diagonal axis at one corner of the square plan. There are variations of the entrance, a group of them proposing a concave surface for entrance (Figure 27, a-c), another, between two columns (Figure 27, f-g). There are also variations of the corner tower, one retaining the rectilinear solid from the previous stage (Figure 27, b), or some introducing a convex surface at the outer surface (Figure 27, d-g, i) and another, two half-circles facing each other located in two sides of the diagonal axis (Figure 27, h, j-k).



a b c d

e f g h

i j k

Figure 27 Investigations related with the entrance and the corner tower (Botta 1989, 28-29).

In the sketches, emerges an idea of entrance from the corner of the rectangular solid, at the other end of the diagonal axis (Figure 27, d-k). This is the first appearance of this idea throughout the process. This introduction brings two important aspects together. First, now, the entrance to the house gains a very important and privileged position within the overall design, compared with the variation in the previous stage where it is almost just a hole on the solid, without any particular emphasis and importance. This seems to be a radical conceptual change. The transformation is related with and amplified by the new location of the entrance but equally with its relation with the dominant formative ideas. That is so say, the entrance is placed just at the corner of the square plan, on the corner tower of the solid, at the end of the diagonal-axis opposite of the stairs, and the main circulation core. Although it seems to be a minor change in the design at the moment, this is one of the major shifts in the design which would trigger many transformations. The first change is the externalization of the inner diagonal axis and a strong emphasis put on it. Until the present point, the diagonal-axis resides as a formative and selective idea, which is mainly responsible for the inner organization of the building. Now, with the introduction of the corner entrance, it is first, formally externalized, that is to say, now it is clearly conceivable from the outside, second, in a sense it gains formative and selective control over the external form. This change comes together with the idea of frontality. Now, the façade of the rotated tower, whether it is curvilinear or flat, gains the character of a "front," or a primary façade. Consequently, "entrance as just an aperture on the building," is filtered out and many variations are produced to replace it. These façade variations are selectively controlled by the idea of frontality and the nature of the diagonal-axis. In the variations, the diagonal axis is sometimes further emphasized by a slit opening over the entrance, or the entrance opening just extends towards the upper floors to gain the character of a slit. At this point, the "solid effect" is also operational and permits only openings that give support to this effect. The truss structure at the roof is retained in these variations, when required, transformed, and changed in each variation to emphasize the entrance and the diagonal axis.

It seems that now, the corner tower gains more autonomy from the main body of the building but still subsumed by the grid and particularly by the diagonal axis, that is to say, it is controlled by these formative elements.

**February 1984**

There are three distinct variations produced at this stage of design, represented or recorded on two groups of materials. I will examine them one by one in due order.

Similar to the one in the previous stage, the first variation mainly involves investigations on the entrance and the corner tower. It seems that the focus is largely on the entrance and the corner tower gaining importance within the overall design.

One interesting thing about the first variation is that one can barely determine a clear impression of the inner organization of the plan. At this stage, it is either suppressed or expressed as blur (Figure 28, a-c, f). One can only notice the location of the entrance, the semi-open space, and the stairs, and in one occasion, a rough sketch of the inner organization. This seems to be a strategy, involving temporary suspension of the formative and selective control of some of the dominant ideas, and eliminating the “noise” created by many elements such as the spatial layout. Perhaps it is this strategy; providing a loose condition that helps the introduction of new ideas. Nonetheless the square plan is still there, more powerful than ever, and the diagonal axis resides as an idea, recessed at the background.

In this variation, two cylindrical masses are introduced at two sides of the entrance and the entrance axis, replacing the former rectangular tower (Figure 28, a-f). They are like two small towers, capped at the top and latticed at the bottom. The masses are raised above ground level, somehow giving an impression of hanging on, or attached to the main body of the building. As it was stated earlier, there are a few selective conditions operational at this point. These two bodies are mainly checked or tested with respect to the conditions provided by the overall solid (effect) (Figure 28, d-f), the diagonal main entrance (Figure 28, d-f), the idea of frontality (Figure 28, e-f), and the square plan (Figure 28, a, c, e-f). The diagonal axis seems to be operational at the background, formatively controlling the new element. Almost in all sketches, the truss structure resides together with the two cylindrical bodies. It is retained from the previous stages. It stays at top of the cylinders supported at two sides lying along the diagonal axis.

The second variation mainly continues the variation created previously in January. However, in this variation, the particular emphasis is on the entrance and the corner tower rather than the whole design and the other parts. Perhaps this would mean that the inner organization and the overall form are somehow solidified at the point, at least come to a point that demands a more detailed study of some parts rather than major or essential changes.

One of the major elements apparent in this stage is the rotated corner tower retained from the previous stage, now divided into two identical halves by a vertical slit. This slit works as an opening at the upper floors, to the terraces; while on the ground level, it serves as the main entrance to the house. At the same time, as a whole it marks the entrance of the house. In this stage, this is the main idea around which further search, and investigations are intensified. Starting from this idea, one group of investigations particularly focuses on the characteristics of the split tower. Some variations of the tower are produced, by modifying the heights (Figure 29, a, c), by modifying the shape (Figure 29, e, g), by testing various textures (Figure 29, a, f, h, l), and so on. At some instances, the rectangular tower is replaced with two halves of cylindrical solids that are actually tested in the previous stage, reintroduced to the design at this point (Figure 29, e, g).

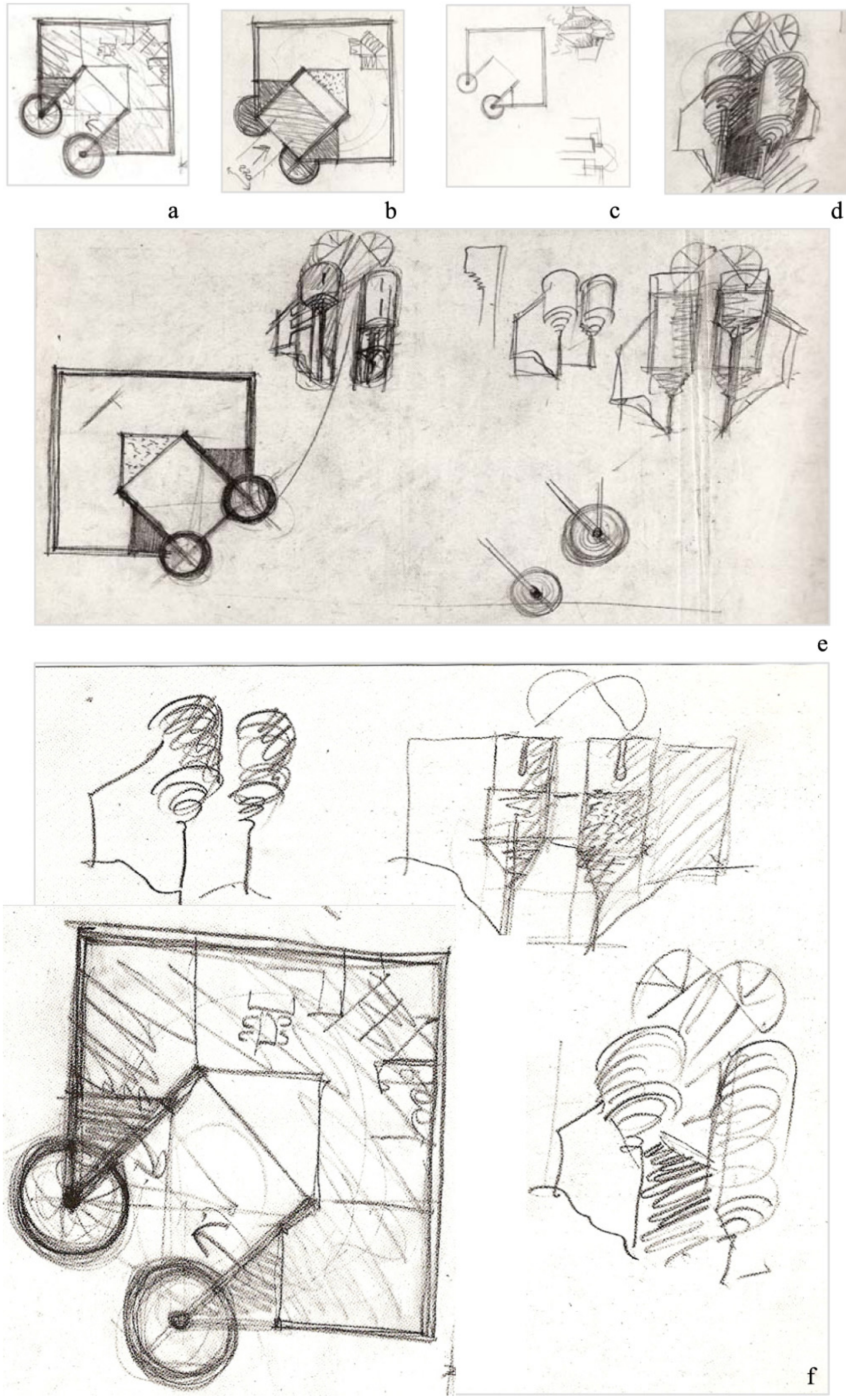



Figure 28 February 1984, variations (Botta 1989, 30-31).

In this stage in some variations, the entrance is subsumed under the idea of the slit, more specifically interpreted as a part of it. From another point of view, programmatically, the entrance is assigned to the functional and programmatic potentialities of the slit (Figure 29, a, h-l). However, in some other variations, the entrance is taken as an independent element, and it is particularly emphasized and worked on (Figure 29, b, d, f, g).

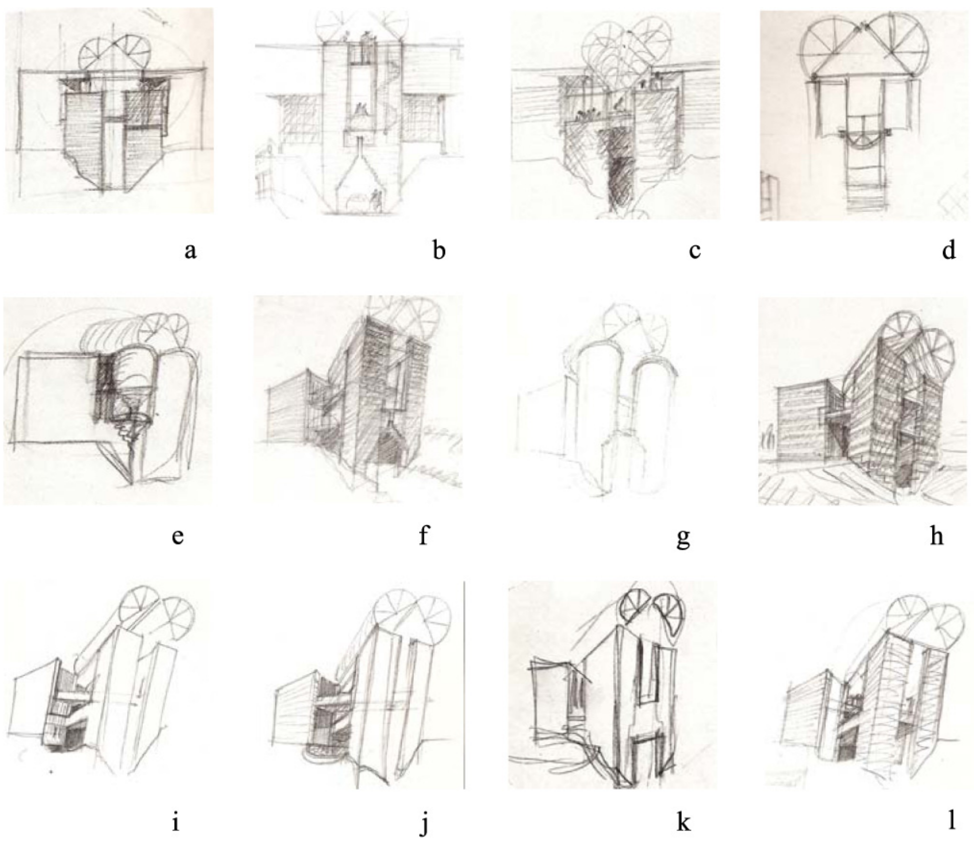



Figure 29 February 1984, variations concerning entrance and corner tower (Botta 1989, 32-35).

Another focus of the present stage of design is the relation between the corner tower and the main block of the house. The formative and selective ideas related with this issue can be viewed from two distinct but related points: these are the ideas concerning construction and structure, but at the same time, they are ideas about the form of the design. From the structural point of view, there are two main ideas addressing the present issue. The first idea conforms to the main structure of the orthogonal grid, except the rotated corner tower, in a sense, going against this structure (Figure 30, a-d). The second idea proposes a structural integrity of the corner with the main block by tying it to the structural elements (i.e. columns) at the center (Figure 30, e-h). This variation seems to be incompatible with the orthogonal grid structurally. In some variations, both options exist; that is to say, corner tower is tied to the main structure both orthogonally, following the order of the orthogonal grid, and diagonally, to the center columns (Figure 29, i-j). As it would seem, in both cases, the structural selective conditions are operational. That is to say, these variations are provided by the potentialities of the structural system and the materials, but also controlled and constrained by their specificities. These variations or investigations are not free from formal concerns. Otherwise, any of the aforementioned structural ideas would be possible. Formally, the variations mediate between the two ideas. In the first one, where the corner tower conforms to the orthogonal structural grid, the corner tower is perceived more as a part of the overall solid (Figure 30, a-d). In the second one, where the corner tower is tied to the structural grid by beams connecting with the center columns, the overall form is read as a more independent element, somehow giving the impression of "inserted" into the main solid (Figure 30, e-h). In the variations, which utilize both ideas, the main block and the corner tower are read as two separate blocks or entities, intermingled into each other (Figure 29, i-j).

Like the prior stage, the outcome of the present stage is transferred to the technical drawings. These are worth examining at this point.

In technical drawings, the nine square grid is retained, it is still identifiable as a trace at the background (Figure 31). The structural grid is derived from this trace (Figure 31, e). From the January version, many minor changes are made in the programmatic layout or in plan layout. To summarize, in this variation, the basement is reserved for storage, garage, and entrance. There is a floor between the ground level and the basement that accommodates service spaces such as the laundry, and the boiler room. At this level, there is also a small guestroom. The ground level is primarily reserved for the main living spaces for daily use such as the kitchen, the dining, and the living rooms. There is also a small bedroom at this level. Finally, at the upper floor there is a bedroom, a bathroom and a master bedroom with auxiliary spaces.

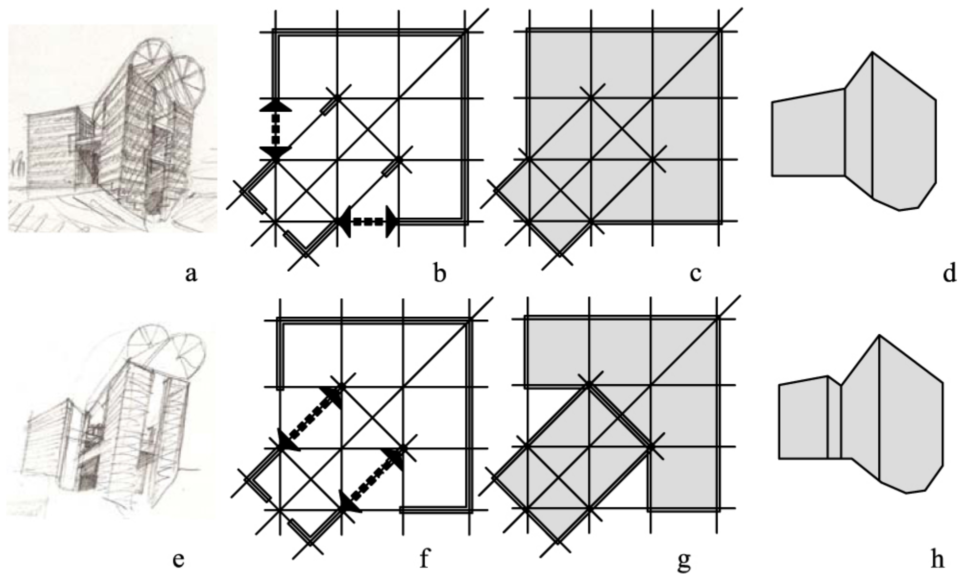



Figure 30 February 1984, comparative analysis of two variations of the corner tower and the entrance with the main building block (b-d and f-h are drawn by the author) (Botta 1989, 32-35).

Perhaps one can mention two differences between the trials produced in February and the technical drawings produced as an end stage. In the technical drawings, at the ground level, the kitchen is projected from the main body of the building. This is probably because the ground level is crowded with living facilities, and an extra bedroom is introduced at this level, not leaving enough space within the boundaries of the main block, and thus not permitting a suitable kitchen. In the present plan layout, if the kitchen was placed within the boundaries, then one has to pass through it to access the bedroom located at one end of the “L” shaped main block.

The second difference is the relation of the spaces with the semi-open space. Now the relation of the spaces with the inner semi-open space is more open and direct. This is achieved by replacing the two structural walls and the centrally located columns (Figure 32, a) with two rectangular pillars located at two sides of the entrance parallel to the diagonal-axis (Figure 32, b). In this sense, the “L” shaped block is now nearly fully exposed to the inner semi-open space. But the spaces have no direct opening and access to the outside world, since such openings are filtered out by the idea of “introverted organization of spaces isolated from the outer world.” That is to say, the idea of giving no direct opening and access to outside is retained in this variation.

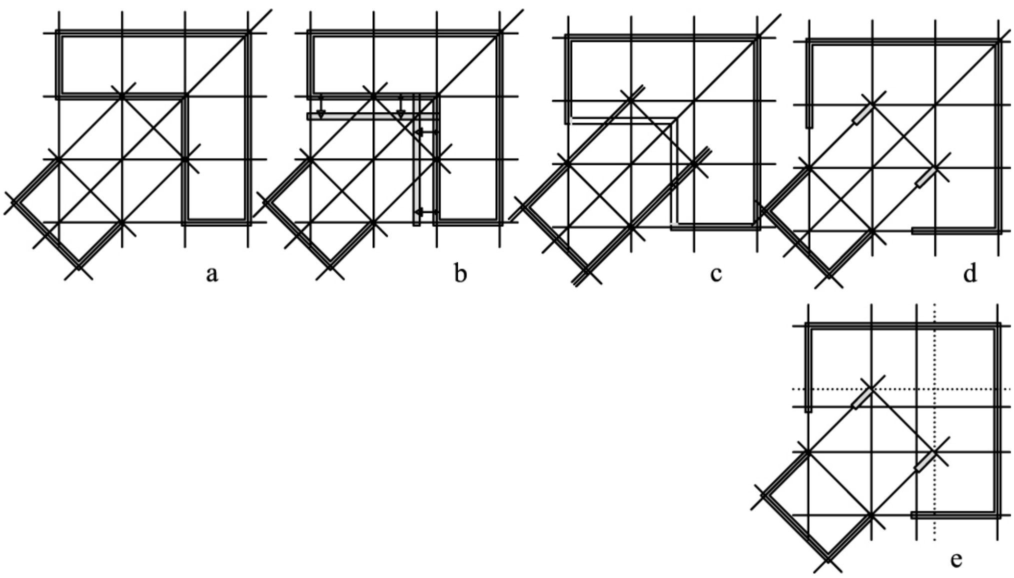



Figure 31 February 1984, hypothetical reconstruction of the formative operations and processes (All images are drawn by the author).

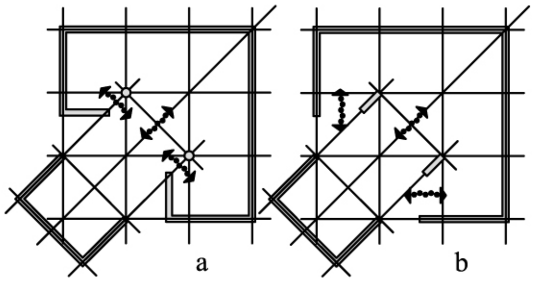



Figure 32 February 1984, hypothetical reconstruction of the formative operations and processes (All images are drawn by the author).


Figure 33 February 1984, technical drawings (Botta 1989, 36).

Like the previous variation, the building is located parallel to the borders of the site, at the farthest location possible from the streets. To remind, now the entrance is in the direction of the diagonal-axis under the corner tower. This axis is extended towards the South border of the site and the entrance to the building is taken from the southwest side where this extension crosses the street (Figure 34). Such an entrance seems to be the most suitable variation for the present conditions.

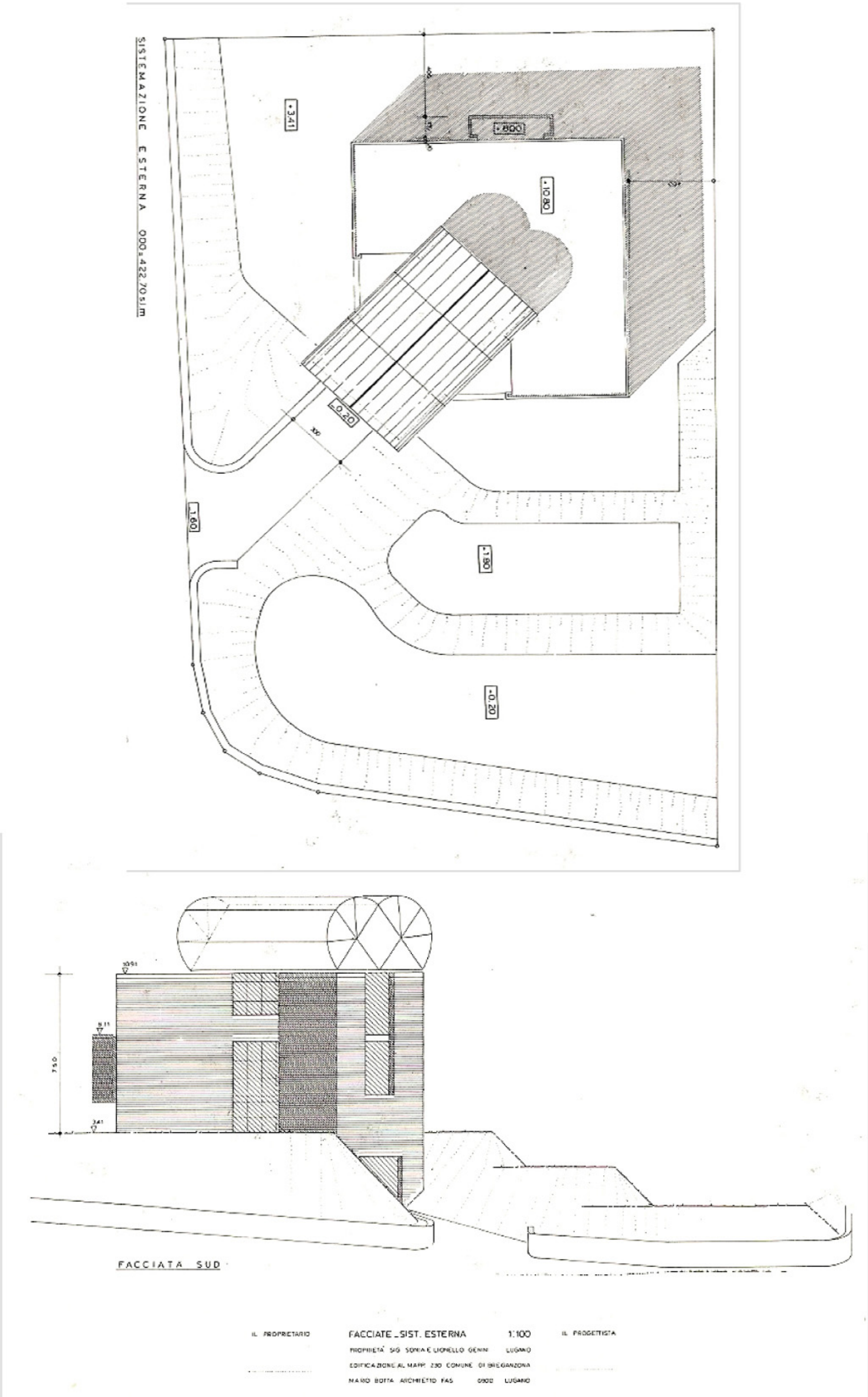



Figure 34 Site plan and the Southwest elevation (Botta 1989, 37).

**July 1984**

From the materials provided, it seems that this stage of design involves investigations concerning the overall outer form, particularly focusing on the corner tower, and the relation of the corner tower with the main body of the building. There are also variations concerning the entrance, as a part of the tower. In this sense, this stage of design can be related particularly to the variations produced in February (Figure 29, Figure 30).

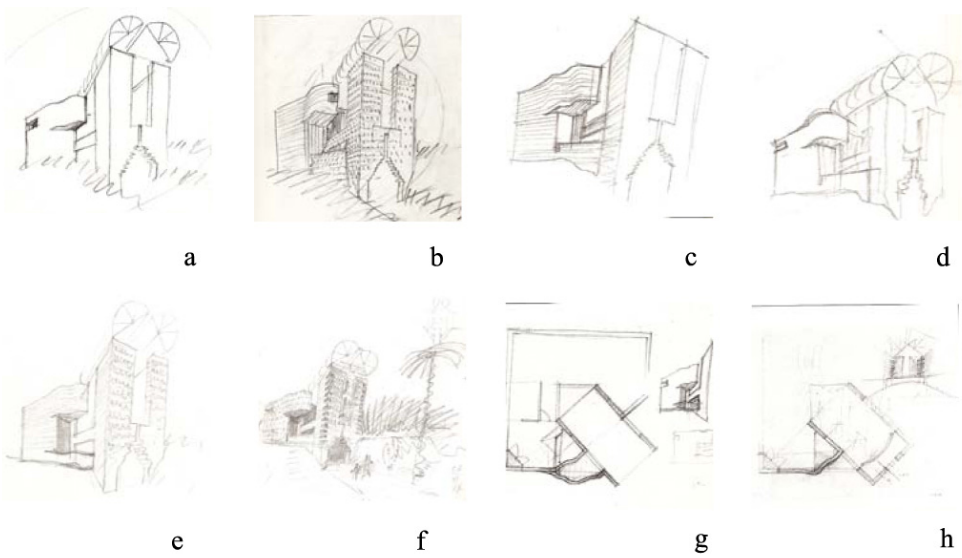


Figure 35 Variations: the relation between the main block and the corner tower (Botta 1989).

Perhaps the first thing, which is clearly noticeable, is that one branch of the main mass of the building gains a curvilinear form at the upper level to connect with the corner tower (Figure 35). There are a number of variations, with a single curve (Figure 35, b, d), multiple curves (Figure 35, a, c, e, f), with (Figure 35, a, b, d, f) and without (Figure 35, c, e) openings. The new status of the corner tower must be emphasized. In the previous variations, which are the products of the investigations concerning the connection between the corner tower and the main body of the building, the tower, and the main body, was taken with an emphasis on the main body. Such a relation can be expressed as "the tower is inserted into the 'L' shaped main body," or "the tower is connected with or taken as a part of the main body," which indicates the dominant status of the main body. Now, the corner tower seems to have gained more importance; it is taken as something to which the main body is connected. There can be another interpretation of this condition, which is equally plausible. The corner tower can still be interpreted as inserted into the main body, and owing to this insertion, physically transformed it (Figure 36). This interpretation, as it would seem, is more related with a certain effect, acknowledging and foregrounding the mentioned relation and transformation, while the former one is more about a changing relation between two ideas or elements of a design.

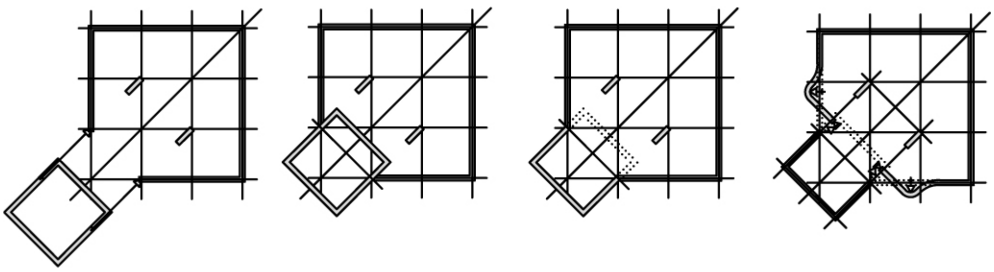


Figure 36 Transformation of the main block by the insertion of the corner tower (all images are drawn by the author).

Structurally, the idea of connecting the corner tower to the center pillars of the structural grid seems to be retained. This idea is identifiable in all variations produced in the present stage. The tower is connected to the main block at the upper level with beams. The structural idea is solidified into a design in such a way that it supports the character of the "tower" and aforementioned "inserted" effect. However, at the ground level, one can still follow the continuity of the main block intermingling with the corner tower (Figure 35, b-f). The idea is seems to be retained from the previous variations. However, it is not clear if this relation is structural or formal, but the latter seems to be more likely. That is to say, for example, in one variation, the connection is curvilinear, possibly not a beam or a structural element, raising the odds on the side of the latter possibility.

In some of the variations, a small aperture can be identified at the upper level (Figure 35, a, b, d). This can be interpreted as a trace of the ideas proposing direct apertures to the outside that can be identified in the former variations. However, they seem to remain as small apertures compared to the ones in the former stages of the process, considering strong selective aspects of two, now dominant, ideas of “keeping distance with the outer world, whether visual, mental, or physical,” and “the idea of introverted organization of spaces with no direct outer openings.”

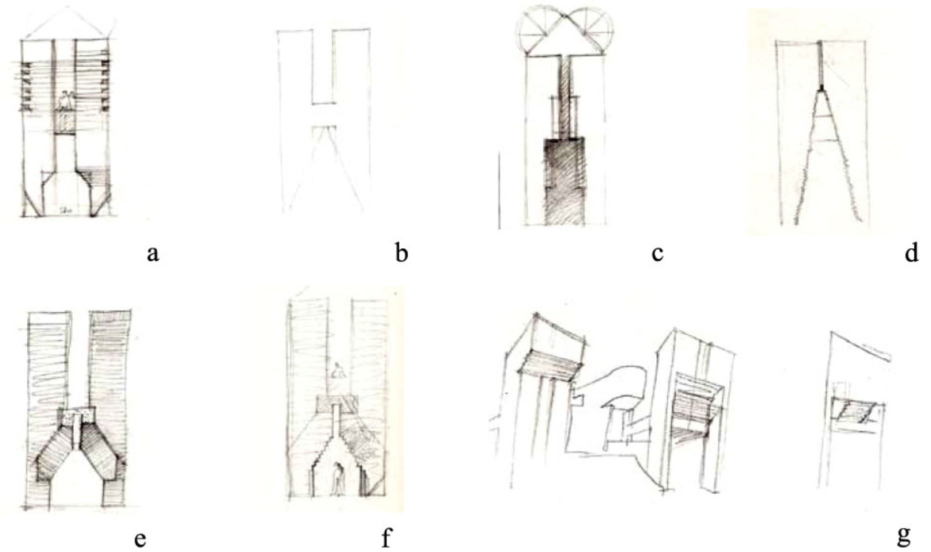



Figure 37 Entrance variations (Botta 1989, 40, 42).

There are a number of entrance variations, created at this stage. All the entrances are taken as a part of the slit dividing the corner tower into two halves vertically. In some cases the slit changes in width and height (Figure 37, c, d), depending on the entrance proposed. In some variations, upside-down wedge-shaped (Figure 37, b, d) and upside-down funnel shaped (Figure 37, e,

f) entrances are proposed. In one variation, the tower almost gains the character of a gate itself. It is transformed by the entrance, perhaps showing the dominant character of the entrance now even gaining formative control over one of most the important elements of the design (Figure 37, g).

**August 1984**

In this stage, there are a number of variations, which mainly deal with the garage and the entrances. Actually, this issue has been addressed in various earlier stages when the design is not yet so solidified. Now, it is in a sense revisited, and reconsidered in the relatively more solidified stage of the process. Before going into a detailed discussion of these, the first thing to say is the location of the house, now closer to the Southeast end of the lot, nearer to the corner where two streets meet each other. It is still located parallel to the Southwest and Southeast boundaries, but this time placed closer to the bounding streets. The building is located so that the diagonal axis just passes through the south corner of the lot. It seems that this condition of the site and the idea of diagonal axis are intrinsically affecting, -attracting- each other.

In this stage, in some variations, the garage is thought to be separate from the building (Figure 38, f, g, d, i, j), some of them quite apart from the main block (Figure 38, i, j). This is the first introduction of this idea throughout the design. Actually breaking apart once important programmatic element of the building is important, since it introduces a new, external relation, and connected with it, new formative ideas, and selective conditions. Most of the variations, whether the garage is outside or not, propose an access to the house from one corner or from one side of the building (Figure 38, a-h). Seeing such variations in this stage is interesting, considering the strong idea of accessing the building in the direction of the diagonal-axis, under the corner tower, which is quite well explored in the previous stage. In these variations, the diagonal-axis seems to be in control of the location of the building, not its main access. So, what might be the conditions, which weaken such a well-developed idea, and demand new alternatives? It seems to be primarily related with the site conditions, now, not permitting the idea of accessing the building in the direction of the diagonal-axis.

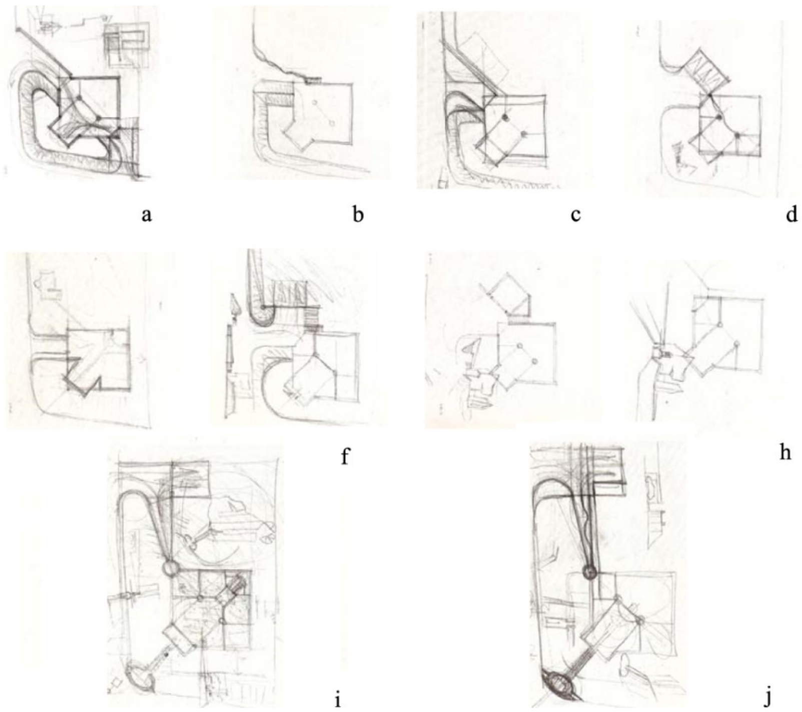


Figure 38 Garage and pedestrian entrance variations (Botta 1989, 44-45).

As it would seem, the mentioned variation is created when the building is located at a recessed position, back at the Northwest end of the site. Therefore, such a location does not filter out the idea of accessing the building in the direction of the diagonal-axis. Now, since the building is relocated at the South corner of the lot, such an entrance would not be possible considering the vehicular traffic. That is to say, it is not possible to enter the building site by vehicle from the corner where two streets cross as it is suggested by the idea. Only a pedestrian access would be possible in such a location and in such conditions. Consequently, perhaps it is this condition, which led to the split of the vehicular access and the pedestrian access that were often thought as one in most of the previous variations. Once the idea of splitting the pedestrian and the vehicle access is introduced, its conditions permit the reintroduction of the access to the house from the diagonal axis (Figure 38, i, j) (Figure 39, e). However, the split does not involve two different accesses to the house from two different locations, one by vehicle, and the other by foot. It leads to the radical detachment of the garage from the main body of the building, to be accommodated in a separate space. This is possibly related with the programmatic changes, and related with it, the spatial organization of the building.

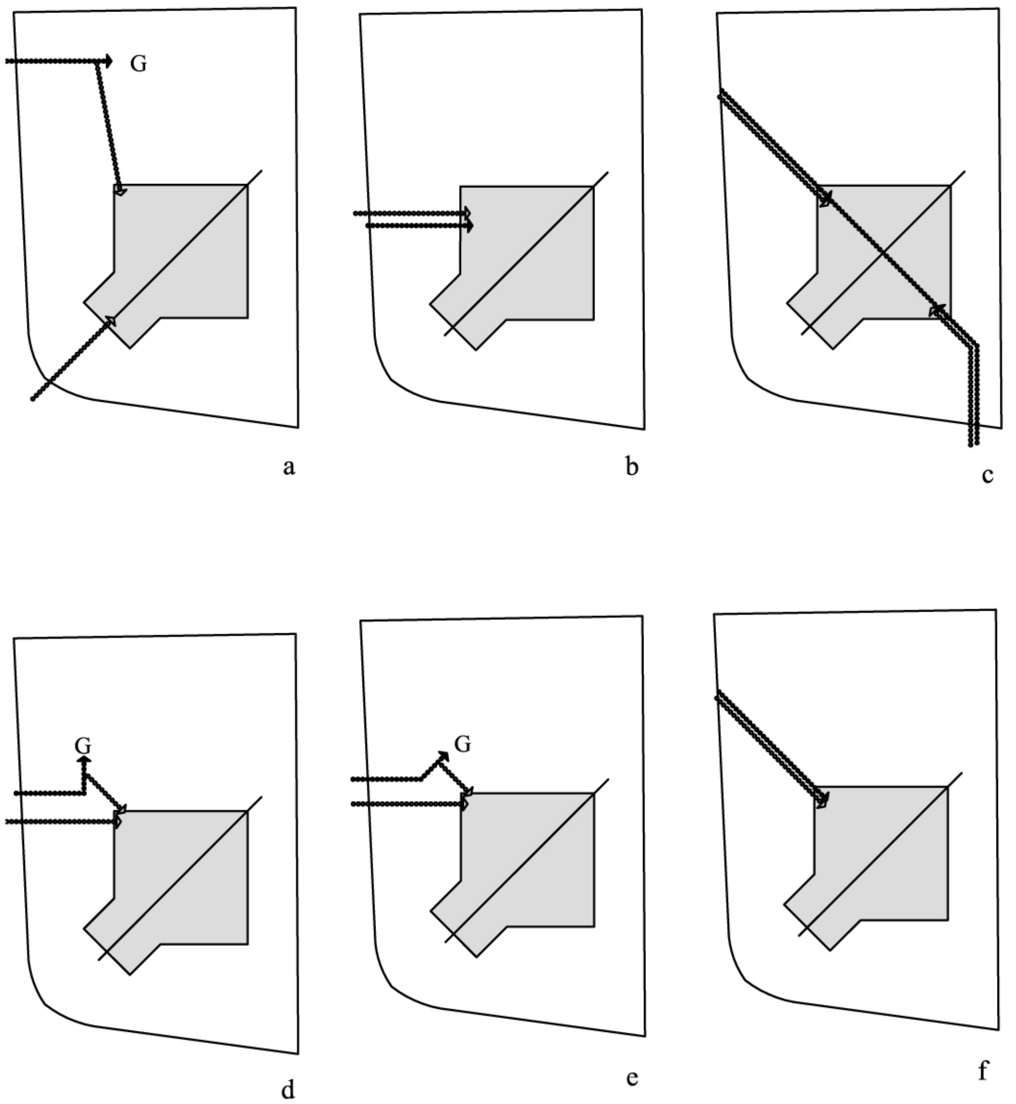



Figure 39 Analytical diagrams of vehicular access, garage, and pedestrian entrance variations (All images are drawn by the author.)

**September 1984**

This is the stage, in which the whole material is solidified into finalized technical drawings. It is just before the application projects are prepared.

The square plan is retained at the background, as the dominant formative element. The nine square grid is also retained, but once more transformed, by shifting the two middle axes towards each other (Figure 40, a). This, results in an orthogonal grid similar to the one that exists in the variations produced in September 1983. The “L” shaped main block and the corner tower are retained. The main block is thickened or expanded owing to the shift in the gridlines.

The diagonal-axis is retained and kept as one of the most important dominant and selective ideas, which are particularly responsible for the inner spatial and programmatic organization of the design. The entrance, the semi-open spaces such as the terrace and the portico, the inner court, central distribution core, stairs are all placed along it. It is also the symmetry axis of the building.

The main reference of the corner tower is now the cross dimension of the center square of the grid and the diagonal axis. The tower is not controlled by the governance of the orthogonal grid. The aforementioned two references only help to locate the tower and determine one dimension of it and without the control of the grid, in the direction of the diagonal-axis, there seems nothing to control its dimension selectively. In a close examination, such an element can be determinable; it is the distance between the first and third axes of the orthogonal grid (Figure 40, c). Reference to such a dimension is possibly related with the idea of keeping or proposing a “balance” in the plan; between the legs of the “L” shaped main block and the block of the corner tower.

The pillars of the previous stage (Figure 41, a) are replaced with two central columns located symmetrically at the two sides of the diagonal-axis, at the two corners of the center square of the grid (Figure 41, d). Such replacement is related with the new grid structure, and the consequent spatial scheme that would not let the pillars. As it would seem, the pillars will disturb the continuity of the court or the inner spaces (Figure 41, b-c). The corner tower is structurally tied to the grid by the center columns.

The spatial and programmatic organization is also transformed. The basement floor is reduced to almost one third of the base area of the building, dug into the ground, totally sealed off, and reserved for a refuge and a tank. The service spaces and the entrance are shifted one floor above, to the ground level. Such change is possibly related with the technical requirements and building codes, which demand a refuge, totally dug into the ground or sealed off, and perhaps which do not permit any other space together with it.

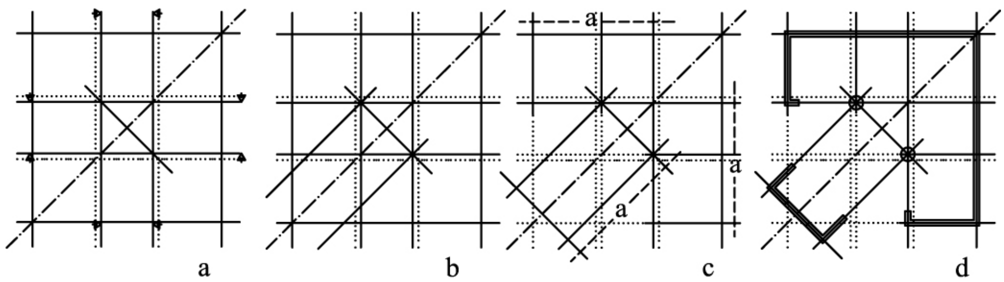



Figure 40 Formative operations (All images are drawn by the author).

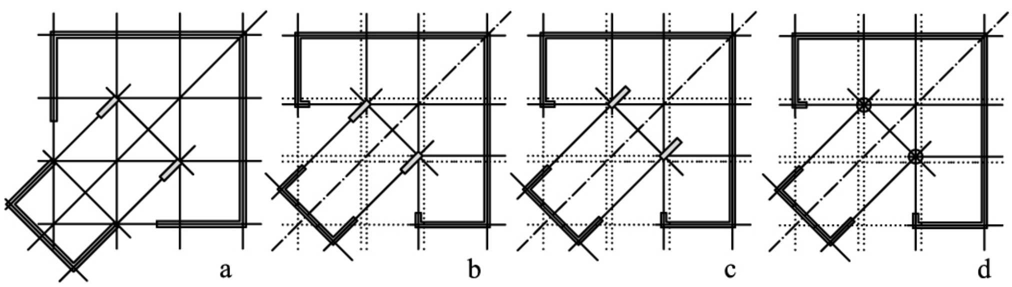



Figure 41 Formative operations (All images are drawn by the author).

The conditions of this variation do not allow car access to either of the floors, in the first case, since the space is totally sealed, and in the second, because of the ground floor level that is too high from the street level to be accessed by a ramp. While these variations are eliminated, what is left is to place the garage somewhere outside the main building, then let people into the building by walk. Consequently, a separate garage is proposed at the West end of the site, which is accessed directly from the street at the street level. A pedestrian path is introduced as a part of this element, which ties the garage to the building.

As it was stated earlier, the entrance is now from the ground level occupying the ground floor together with the services. It is located on the diagonal axis just opposite of the corner tower. Here is a portico in front of the entrance and then a gate just underneath the corner tower. These elements define a sequence of entrance, a physical and mental distance, which passes through various stages from public to private, from open to closed.

Following the replacement of the services and the entrance, the main living spaces are also moved one level up, to the upper floor. It must be emphasized that this is not merely because of the services occupy the ground level and there is no enough space, or it is not desirable to have the living spaces at this level. It is more related with the idea of "keeping the distance with the outer world" which is retained at this final stage as an important selective element. As it would seem, under the selective control of such an idea, entrance to the house and the living spaces cannot exist at the same floor.

At the upper level, there are main daily living spaces such as the kitchen, a sitting corner, and a working corner. All spaces open up to the inner court and have no major exterior openings. There is a terrace at this level, a semi-open space as an extension of the inner spaces, now aligned with the diagonal-axis, lying along it to the corner tower. The belvedere, which is located at the topmost level of the corner tower, is accessed from the terrace with steep stairs.

The upmost floor has two symmetrical spaces at two legs of the "L." The spaces are reserved for two bedrooms, each having its own auxiliary spaces. There are two windows located at two distant, external corners of the bedrooms. Contrary to the lower floor, there are no openings of these spaces to the inner courtyard. On the one hand, although minor and controlled, there are openings to the outside. Spaces at this level seem to have turned their backs to the inner court, and they barely have a relation with it. For example, the belvedere, which is located almost at this level, cannot be accessed from this floor. This situation in a sense goes against the idea of giving no major opening to outside and introverted organization of spaces.

Overall, the perfect symmetry of the plan is clearly noticeable.

As far as the overall three dimensional form is concerned, the rectangular solid which is the initial dominant formative idea cannot be clearly identified. However, the “solid effect” is somehow retained as a selective and formative dominant. There are very few openings on the main building block, which seem to be bitten off or carved into the solid, all supporting such an effect. The corner tower seems to be inserted into the main body of the building. This is visually supported by the curvilinear surfaces at the upmost level of the building, which seem to be exploded out because of such an insertion. This in turn supports the overall “solid effect” of the building.

The formative influence of the internal diagonal-axis on the outside of the building is retained and this influence can be read from the outside. The corner tower, its frontality, and the trusses at the roof are controlled by this element. This, in turn, adds to the frontality of the building. The entrance is marked by the tower, particularly by the slit dividing it vertically. However, the entrance is still visually and also physically controlled and protected.

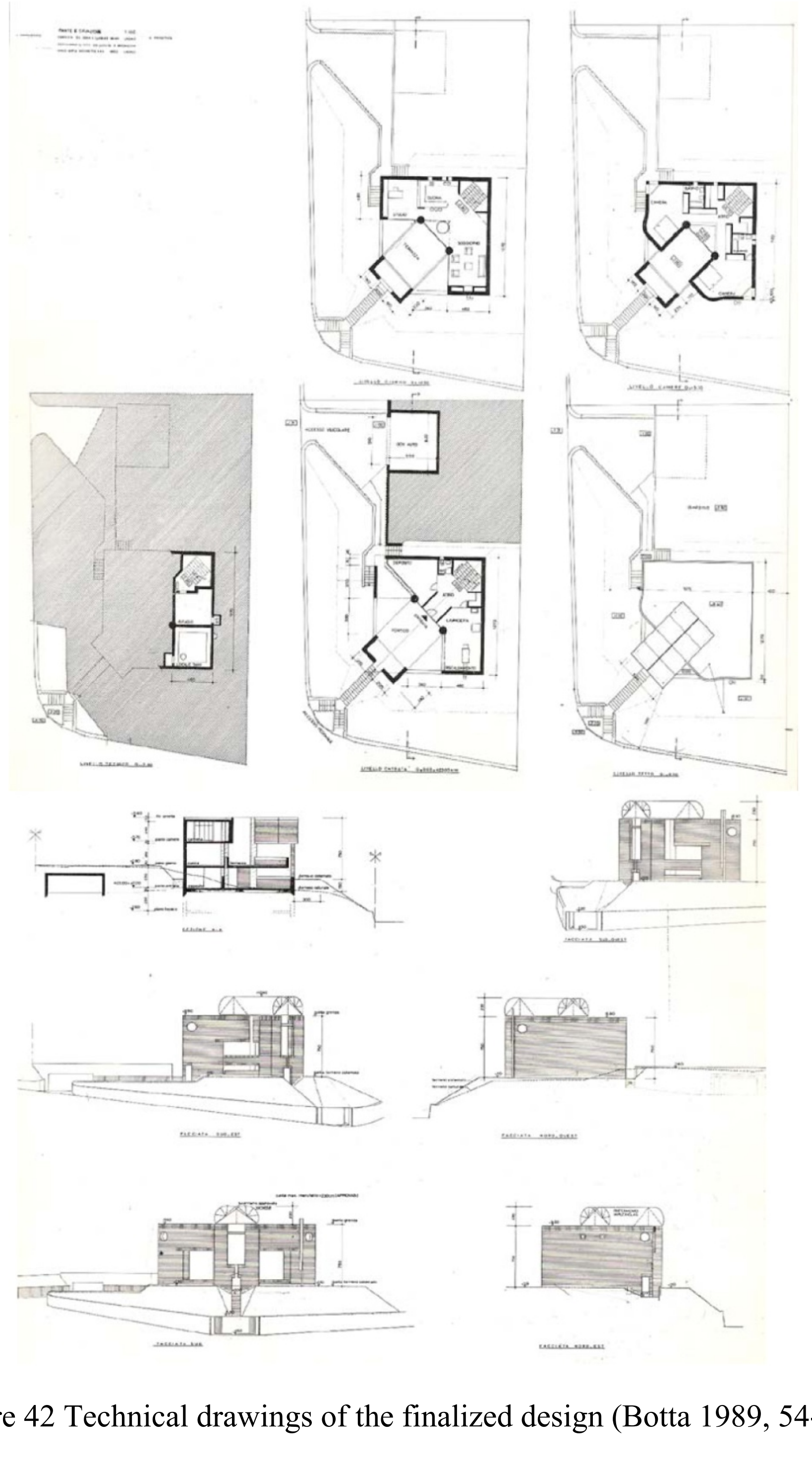


Figure 42 Technical drawings of the finalized design (Botta 1989, 54-55).

## 6.2 Conclusion to The Section One

In the first part of the chapter, I examined the material produced during the design process of a design of Botta. The investigations showed that there are many ideas, whether formative or selective, and whether dominant or subordinate that can be identified in these documents. Beyond identifying the thought content and their nature inherent in the mentioned material, I identified the evolutionary (or selectionist) relation between this content, namely the ideas. The investigation also showed that as a whole, the design process, as it is theoretically reconstructed from the recorded material produced during the design process, could be very well explained with reference to the evolutionary conception of the design process.

For example, it was shown that the design process is about variety reduction as it was suggested by the proponents of the conjecture/analysis model, but equally variety creation. In each stage, addressing various facets of the design, many variations are created and these variations are filtered with reference to some evaluative or selective conditions. It was also important to observe that during the process, the design did not merely proceed from a less detailed to more detailed (or refined) version. Each stage contained a set of less detailed and more detailed proposals. Combined with the previous finding, it showed that the process of forming/making and evaluation/selection do not only represent a single "developmental" line, from a less detailed towards a more detailed description of a design, but might also involve a series of interconnected parallel lines of search. There were also relatively minor trials, such as introduction (and evaluation) of a number of entrance variations, superimposed on the overall design. However, for example it might also be said that, various facets of the problem are left to later stages, while some are introduced to the design earlier. For example, specific to the examined design, the two dominant formative ideas are introduced at the very beginning of the design process. However, as it was identified, even these might be replaced with alternatives that are more desirable.

Apart from these findings, the method utilized in the investigations and the analysis showed the evolutionary models' potentials in the study of the past designs.

### 6.3 Section Two: Architectural Ideas

Despite their relation with the architectural tradition, Botta's designs do not involve a figural or stylistic continuity. We can see in them more of an evolutionary inheritance of ideas, and the reappropriation and reinterpretation of these ideas within the conditions of the specific designs. If one has to look for an evolutionary lineage in his designs, it should be primarily searched in such ideational terms.

Of course, such inheritance (of ideas) can primarily be attributed to his own designs, where such ideas are recorded. For example, many of the ideas invested in the design that is investigated in the previous section, can actually be observed in the earlier and latter designs of Botta. Such an inheritance can also be attributed to architectural tradition, whether vernacular, classical, or modern. Specifically, Botta acknowledges Kahn's, Le Corbusier's (Figure 44) and Scarpa's traditions, as the primary sources of his own schemata (Wrede 1987b, 64-69).

For example, the variations produced by the rotation of the corner tower at one stage of the design process are not just a result of a formal operation or a transformation merely based on such a formative act. As it would seem from the sketches, such a trial is controlled (both formatively and selectively) by an idea which particularly involves the external overall form of the building (Figure 43, b-c). The idea is "to have almost identical solids, radiating from a central core, repeated and rotated 45 degrees" (Figure 43, b).

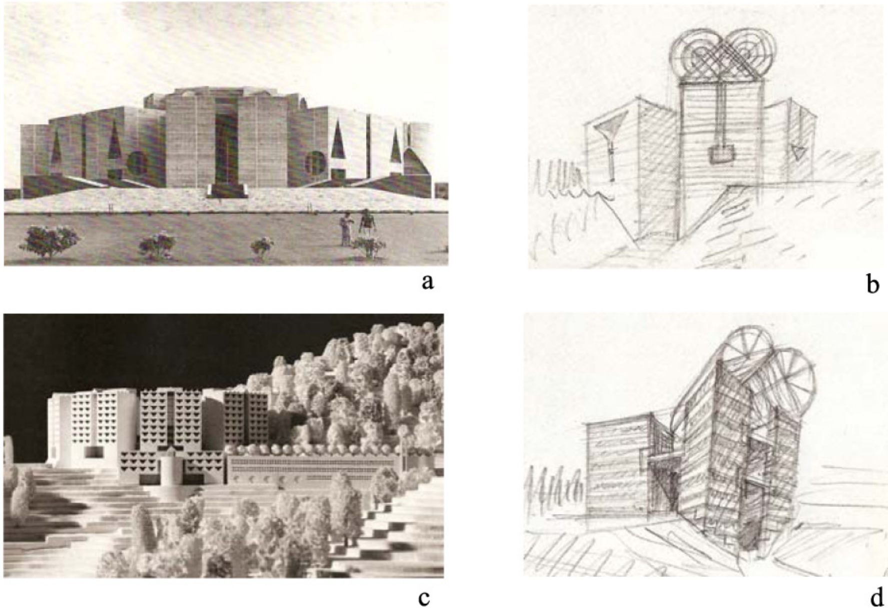
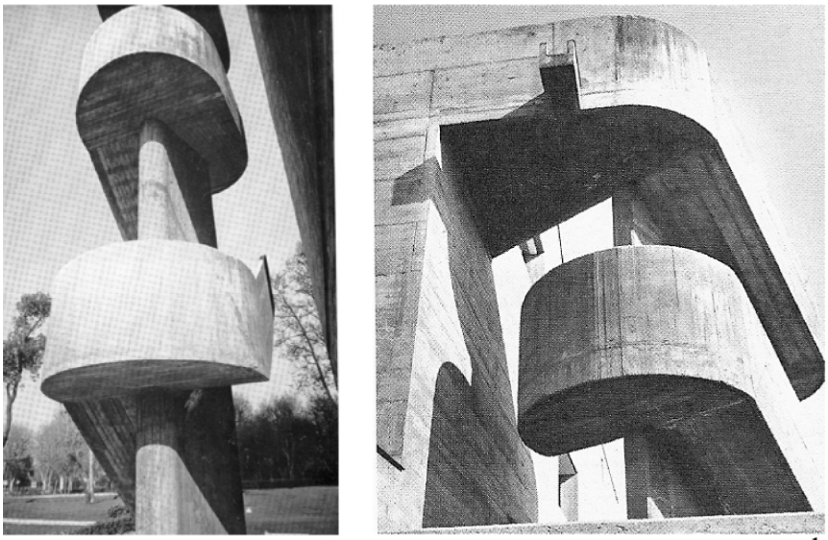


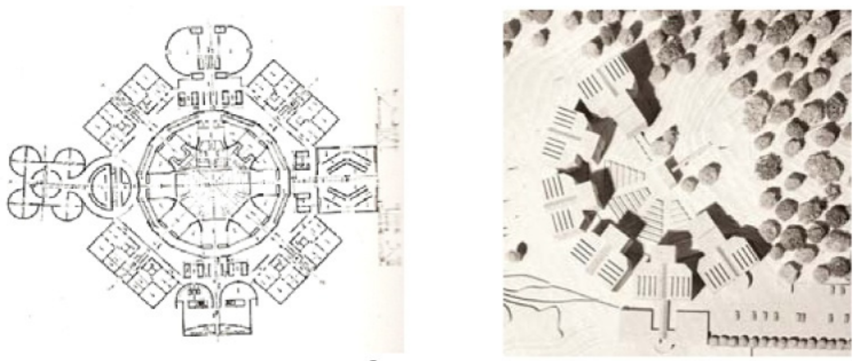

Figure 43 a, Parliament building, Kahn. b-d, Sketches of the variations produced during the design of the single-family house in Breganzona, Botta (Botta 1989, 25, 33) c, Project for nursing home, Agra (Co 1987, 41).



a b

Figure 44 a, Stairs from Marseilles Blocks, Le Corbusier, b, stairs from Single-family house in Stabio, Botta (Wrede 1987a).

Formally, in terms of the overall configuration of solids and the implementation of apertures on these solids, the mentioned idea can be identified in Kahn's Parliament Building in Dacca, Bangladesh, built between 1962 and 1974 (Figure 43, a) (Figure 45). However, in the Parliament Building, there are also the ideas of frontality, the axial entrance, and the vertical slit dividing and marking the entrance block. These ideas do not exist in the first variation produced in January 1984 (Figure 43, b). In the mentioned variation, the entrance is between the blocks, somehow hidden. The corner tower is marked by a vertical aperture, which can hardly be interpreted as a slit compared to the one in the Parliament Building. Still, these ideas are introduced later in the variation produced in February 1984 (Figure 43, c).



a b

Figure 45 a, National Assembly Building, Kahn (Brownlee and Long 2005). B, project for nursing home, Botta (Co 1987, 41).

Actually, the mentioned idea also exists in one of Botta's earlier designs, the project for a nursing home of 1980. This would mean that, although within quite different conditions, the idea is utilized and tested earlier by Botta himself. As it can be observed in the images, this project has much common with Kahn's National Assembly Building in Dhaka (Figure 45). That is to say, in both cases, the idea, which controls the external form, is supported by the idea behind the plan organization. This idea is to organize spaces around a central circular core, rotated and located on the axes radiating from it. In

Kahn's case, the schema consists of a number of different blocks, completing a full circle while in Botta's, the blocks are almost identical, completing a semi-circle (Figure 45).

We may say that, in evolutionary terms, the affect of a strong conceptual or ideational inheritance can be identified in his designs. In this part of the chapter, I foreground such an inheritance as an illustration of my second model.

### 6.3.1 Methodology

Two issues must be noted before continuing this task: First, it must be noted that, such an investigation cannot be fully exhaustive, that is to say the lineage of an idea cannot be fully identifiable or determinable. Second, one cannot fully know the actual design process of a design, therefore cannot determine all the formative and selective ideas that were operational in a design's creation. Therefore, when a design is examined, it is the final stage where only some of the formative and selective ideas can be identified.

Methodologically, in the present section, I determine and foreground some selected ideas from Botta's examined design, and then pursue my investigation around these ideas. In accomplishing this, first, I determine the nature of the idea in evolutionary terms within the specificities of the examined design(s), and then I continue to identify the variations of the same idea in different designs, whether designed after or before the mentioned design. I discuss the nature of the evolutionary change in the identified idea related with the specificities of different designs or of different conditions. I particularly look for what was retained as it is, and what was changed, why and in what sense.

Still, methodologically, I primarily search the evolutionary lineage of the ideas in Botta's own designs, but when applicable, in architectural tradition. The primary focus is Botta's own *œuvre* because of the limitations of the present study, which do not permit an exhaustive examination of all the evolutionary lineages in architectural tradition.

The section embraces the conceptual framework of the "evolutionary conception of architectural ideas" as its primary structure. That is to say, the discussions are organized around the architectural ideas, and their instances on various designs. In addition, these discussions are organized according to the category of ideas and the evolutionary structure provided by the "evolutionary model of architectural design." The drawbacks of such a methodology are apparent: since it is almost impossible to isolate an idea from a design and discuss it in this isolation without referring to other ideas, every new section entails the risk of some repetition. However, as it was already stated it is not only inevitable but also inherent in the nature of the content of the present study and the models it puts forward.

### 6.3.2 Investigation of the Lineage of the Selected Ideas from the Single-Family House in Breganzona

In the single-family house in Breganzona, there are various dominant ideas that are operational during the design stages. As it would seem from the examined material in the previous section, these ideas can be identified as the rectangular solid and the square plan, the diagonal-axis and the orthogonal grid. To remind, in Breganzona, these couples represent two discrete groups of ideas, one group responsible for the overall form, the other for the spatial organization. Actually, to have two distinct groups of ideas, which are responsible for inner organization or order, and the overall form, is itself an important formative dominant idea operational in the mentioned design.

#### The Square Plan

In Breganzona, the square plan is operational in the very beginning of the design process and throughout it to the end stage. It is a formative dominant, which informs and controls the overall form of the design. Actually, at the primary stages of the process, the idea works together with the idea of rectangular solid, which is the counterpart dominant, which also informs the overall form. These two dominants also provide selective conditions that control the design as far as any formative act fall into their domain of control. Perhaps the primary condition can be identified as “containment,” which delimits the outer boundaries of the plan or spatial elements.

The square plan as a dominant idea can be identified in many of Botta’s earlier or later designs. For example, in the single-family house and the housing development in Riva San Vitale, the single-family houses in Vacallo, Caslano, Pregassona, and Origlio, the square seems to be one of the dominant formative ideas. In these designs, too, the selective condition of “containment” is identifiable. This is the case even if in some designs the perfect square is transformed by various formal operations such as protrusions and recessions as seen in the single-family house in Pregassona, the housing development in Riva San Vitale and Origlio, or the circular units at the front part of the house in Origlio. That is to say, in all these designs, the idea remains intact and is clearly conceivable at the final stage, as the dominant, particularly emphasized and laid bare (Figure 46, Figure 47, Figure 48).

In the single-family house in Riva San Vitale, the square has a character of a container, providing a free space where formal, structural, or programmatic elements can be accommodated. A grid structure that seems to be responsible for the spatial organization, can be more or less identified, but it is not so strong (Figure 46, b). Perhaps a more plausible expression of the idea can be “a square container with a floating square staircase within it” (Figure 46, c) In this second interpretation, spaces are organized within the container, with reference to the spatial organization implied by the location of the staircase.

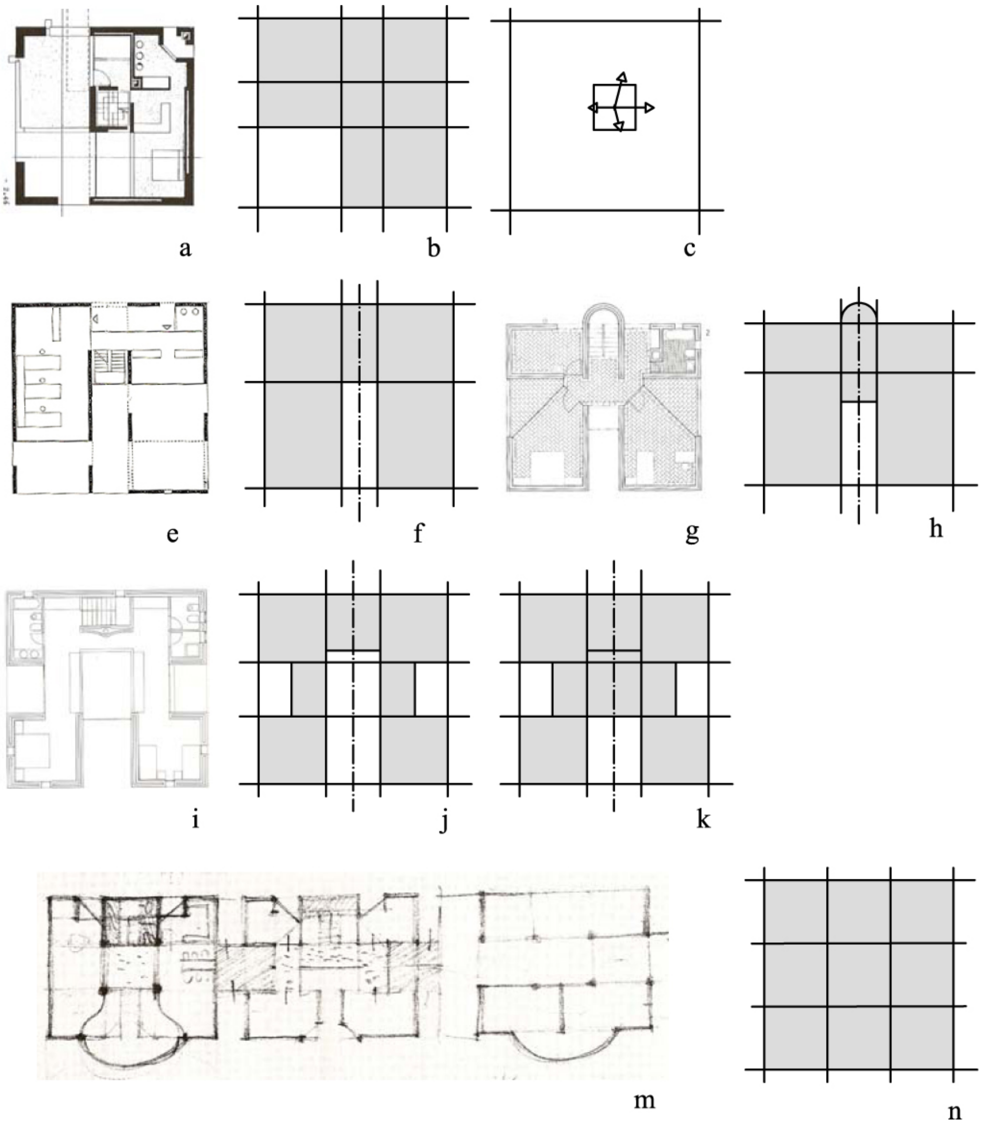



Figure 46 a-c, the single-family house in Rive San Vitale, e-f, the single-family house in Caslano, g-h, the single-family house in Pregassona, i-k, the single-family house in Origlio, m-n, study sketches of the housing development in Riva San Vitale (b-c,f,h,j-k,n are drawn by the author).

In the single-family houses in Caslano, and Pregassona, the square is cut into two halves by a narrow slit at the middle (Figure 46, e-h). Along the slit, the body of the square is carved in. This carved-in open space works as a spatial element that divides the building into two separate parts. Like the previous two designs, in the single-family house in Origlio, the square is cut into two halves by a slit at the middle and along the slit the body of the square is carved in (Figure 46, i-k). However, the carved-in space in this variation not only works as a dividing element but also as a gathering element that combines the two halves.

In all three designs, a cross axis can be identified. In terms of spatial and programmatic organization, the cross axis works as a formative dominant on which the programmatic elements such as the entrance, portico, inner court, staircase, and the main circulatory core is located. The axis also works as a symmetry axis. In Pregassona, and Origlio, the square is further carved in, to have loggias. Inner spaces open to these loggias. In Pregassona, the staircase protrudes from the main body, in a sense violating the ideal square.

An all three designs, the square plan is the formal basis where the design investigation starts from and modified later on with the formative ideas and the selective conditions. As an idea, it has a formative and selective control on the overall form and the spaces located within it.

In the housing development in Riva San Vitale the square plan seems to stay more or less intact, except the minor recessions and protrusions from the main body. It is a dominant, which is in control of the outer boundaries and the overall outer form of the blocks, but it has no control over the inner spatial and programmatic organization. There is an apparent nine square structural grid superimposed on the plan which seems to be primarily responsible for this. From another point of view, the square plan in these designs can be interpreted as an outcome of the nine square structure but not an independent idea or element itself. In this design, multiple units are controlled by the idea of serial or linear organization of repeating units. Actually, this important dominant is worth discussing further and will be investigated in the following sections.

In the single-family house in Vacallo, the square plan is an idea that informs and provides the formal basis where the investigation starts from. The main stages of the investigation can be hypothetically reconstructed as follows. The initial square is divided into four equal squares by a cross axis (Figure 47, b). A diagonal axis is superimposed on the resultant organization, dividing it further into two triangular parts (Figure 47, b). These parts are pulled apart from each other to have a slit in-between them (Figure 47, c).

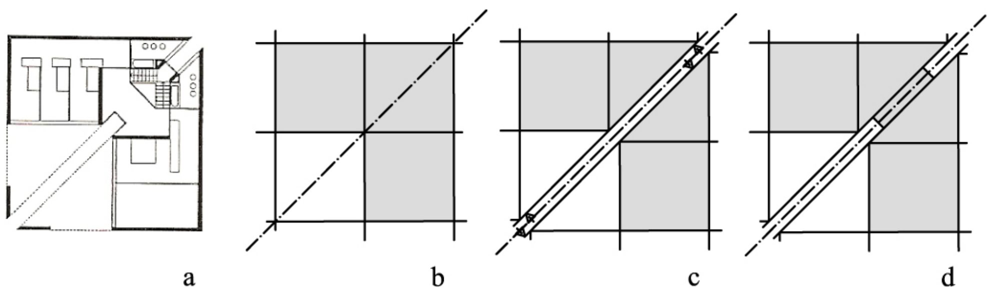



Figure 47 The single-family house in Vacallo (b-d are drawn by the author).

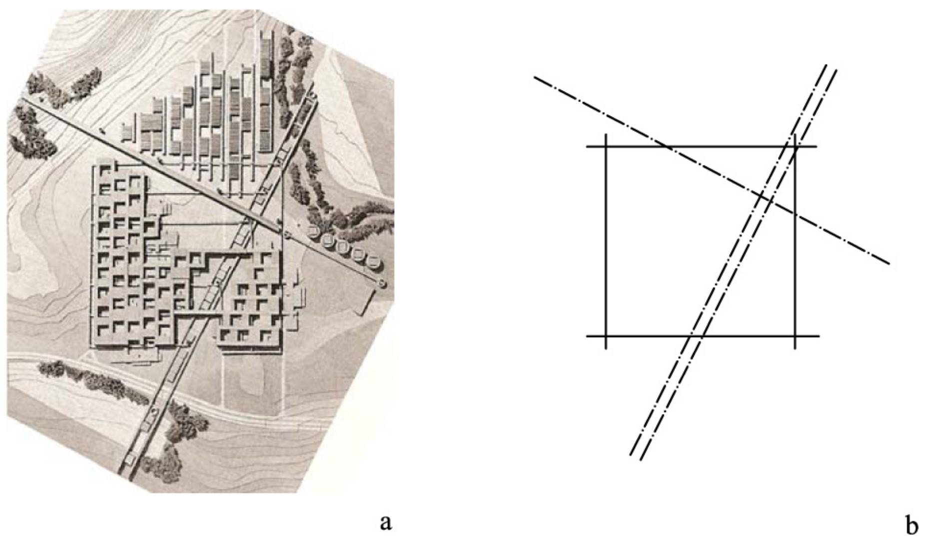



Figure 48 Project for the Master Plan of the New Polytechnic Institute (b is drawn by the author).

However, the resultant form can also be read as a square plan divided into two by a diagonal slit. In this interpretation, the square plan is a formative and selective dominant, which controls the overall form of the design.

The idea of square plan can also be identified in one of Botta's urban scale projects, the Project for the Master Plan of the New Polytechnic Institute. In this design, the square plan is the delimiting element that controls and limits the outer boundaries of the plan. A tilted cross axis is superimposed on the plan.

Certainly, the instances of the idea can be found in many designs outside Botta's *œuvre,* in architectural tradition.

The first design, which the idea can be identifiable, is Palladio's Villa Rotonda. For Wittkower (1962), the idea behind the plan organization of the Palladian Villas, hence Villa Rotonda is a square plan divided by four vertical and two horizontal gridlines (Figure 49, c). The plan of Villa Rotonda can also be read as having a square plan divided by two vertical and two horizontal gridlines, and a cross axis passing through the center of the square. In both cases, the overall organization is central and the spaces are organized around the central circular space. The square is the element that delimits and defines the outer boundaries of the building. The grid structure is responsible for the structural order and for the inner spatial organization.

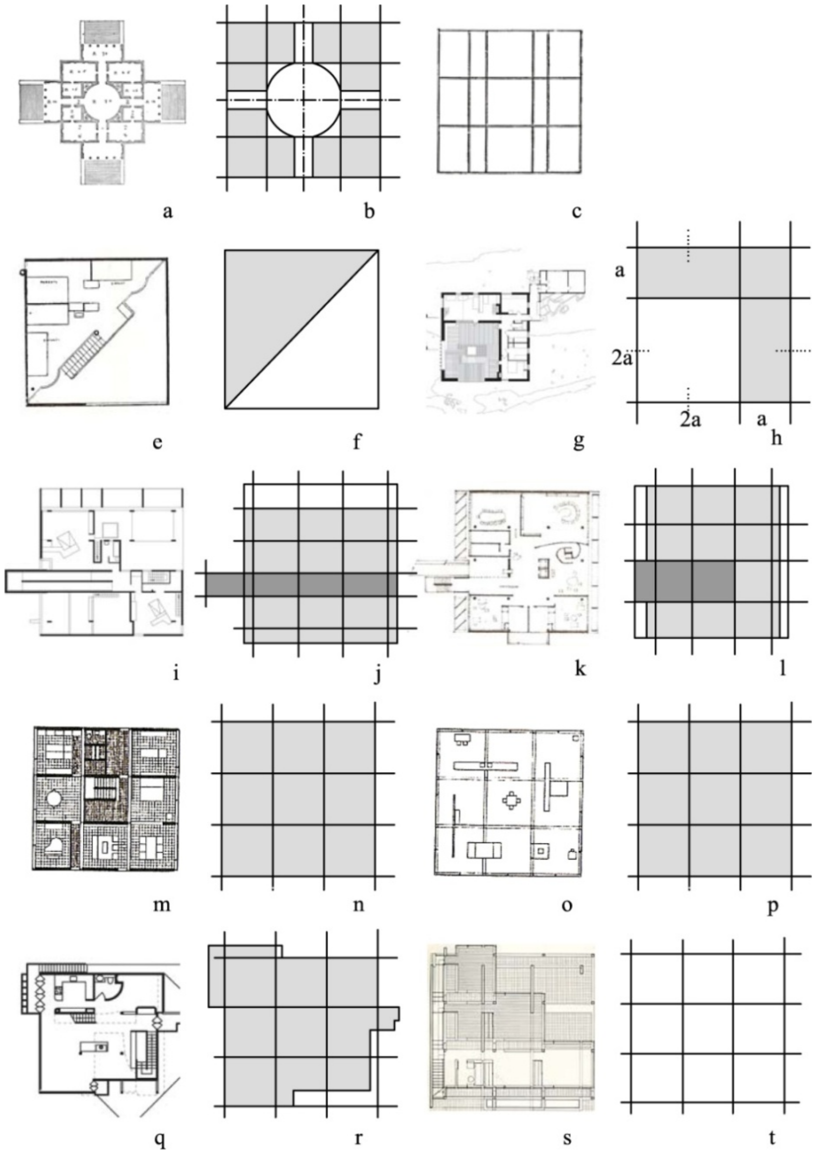



Figure 49 The instances of the square plan as the dominant. a-b, Villa Rotonda Palladio, c, Wittkower's diagram showing the common formative idea of Palladio's villas (Wittkower 1962, 73), e-f, Worker's houses, Le Corbusiser (Boesiger and Stonorov 1999a, 54), g-h, Experimental house, Alvar Aalto (Davies 2006), i-j, Villa Shodhan, Le Corbusier (Davies 2006), k-l, Millowners, Le Corbusier (Ching 1979, 145), m-p Texas Houses 4 and 5, John Hejduk (Caragonne 1995, 197), q-r Hanselmann House, Michael Graves (Davies 2006), s-t House II, Peter Eisenman (b-c,f,h,j,l,n,p,r,t, are drawn by the author)

In Le Corbusier's Worker's Houses, the idea is rather simple; an undisturbed square plan at the ground level, and a triangular space at the upper level achieved by a diagonal line dividing the square into two triangular halves (Figure 49, e-f). In this design, the square plan works like a container where anything can exist (or anything could be contained) within its boundaries independent from the building's outer form, whether formal, structural, or programmatic.

In Alvar Aalto's Experimental House, the square is divided from one third, by two gridlines, one cutting it vertically, the other horizontally (Figure 49, g). The resultant "L" shaped block is reserved for the house spaces, while the square part works as an inner court. In turn, the square plan surrounds and contains these two major elements.

In Le Corbusier's Villa Shodhan and Millowner's building, the condition is a little bit different (Figure 49, i-l). The idea of a square plan is identifiable in both designs with an orthogonal grid superimposed on the plans. Different from the previous design, here, the grid is primarily a structural grid, rather than a formal one aiming to divide the square plan into units, programmatic or spatial. From a certain point of view, the square plan and the structural grid can be interpreted as related, yet they are formative ideas that operate independently. This independence is important, since for example the structural grid is able to float freely within the area bounded with the square plan without obeying all of the conditions implied by it, such as the geometrical ones. In turn, the space delimited by the square plan can be relatively free of the formative control of the structure and the structural grid. But perhaps more important, these ideas, since they are now distinct, might be evaluated according to the selective conditions discretely, and one might fail while the other might still last. For the same reason, either of them can be substituted with another idea that has the potentiality to replace the existing one.

In John Hejduk's Texas houses 4 and 5 (Figure 49, m-p), the square plan and the nine square grid are apparent. However, in this case, the square plan is more of a formal outcome of the nine square grid. That is to say, nine square grid is neither superimposed on the square plan, say, to divide it into spatial units, nor it is an independent element that works together with it. As the single dominant, it controls both the inner divisions and the outer form, and primarily, the structure, without any contribution of the square plan.

In the single-family house in Breganzona, and some of the designs examined until this point the grid structure and the axis are the two dominants that are in control of the spatial organization and plan layout. They are superimposed on a square plan that controls the outer boundaries and the overall form of the building. The diagonal axis works as a symmetry axis, and at the same time, it has a selective and formative control over some of the programmatic elements such as the entrance, portico, stairs, common circulation distribution core, corner tower, and the inner court.

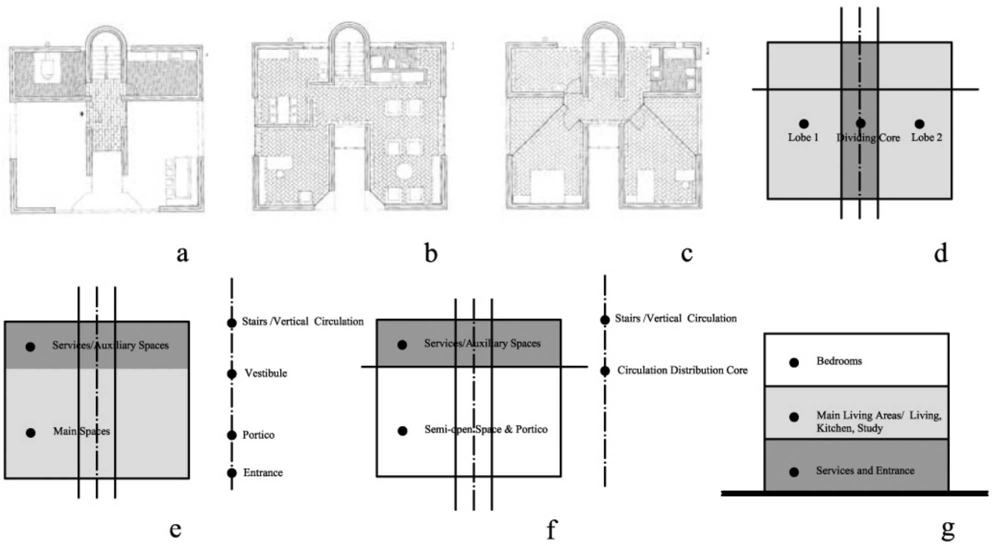



Figure 50 The single-family house in Pregassona (d-g are drawn by the author) (Pizzi 1993).

Actually, this condition itself, that is to say, having two dominant ideas, one in control of the inner spatial organization, the other, the overall form of the design, is an important formative dominant itself, the instances of which can be identified in many of Botta's designs.

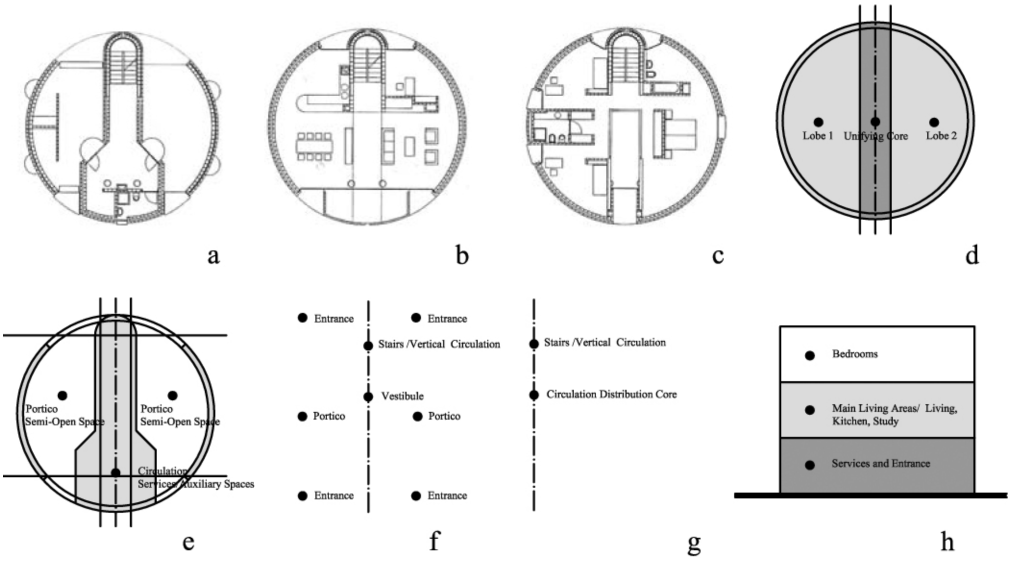



Figure 51 The single-family house in Stabio (d-h are drawn by the author) (Pizzi 1993).

For example, in the single-family house in Pregassona, a cross axis and a central spatial element divides the square plan into two symmetrical blocks (Figure 50, d). This division provides the primary condition for the following spatial organization. The square plan is further divided into two zones, where in each floor; one third of the square is reserved for services, auxiliary functions, circulation, and other similar service functions. The remaining spaces are the main spaces of the building such as the living room and the bedrooms. At the ground level, this space is carved out and left as an open space and a portico (Figure 50, e-f). The vertical arrangement of floors and the spatial layout follows a popular scheme in Botta's similar designs; the ground level is recessed to provide a semi-open space that is reserved for a portico, and service spaces such as the boiler room and the workshop take place at this floor. The main living spaces such as the living room and the kitchen are located at the upper level. Finally, the upmost level is reserved for the bedrooms and their auxiliary functions.

The single-family house in Stabio, too, follows a similar arrangement of functions and spatial organization. A variation is, as it is discussed more detailed in the following sections, the introduction of the idea of "transparency" at the ground floor that should permit the landscape pass through the house (Figure 61, b). Obviously, the overall form is now controlled by a circular plan. Still, the circle is also divided into two blocks by a central slit and a cross axis (Figure 51, d). Same as the previous design, the programmatic elements such as the entrance, the portico, the main circulatory core, and the stairs are located within the spatial element produced by the slit and they are organized along the cross axis (Figure 51, f-g). The other spaces are located at the two blocks at two sides of these central elements.

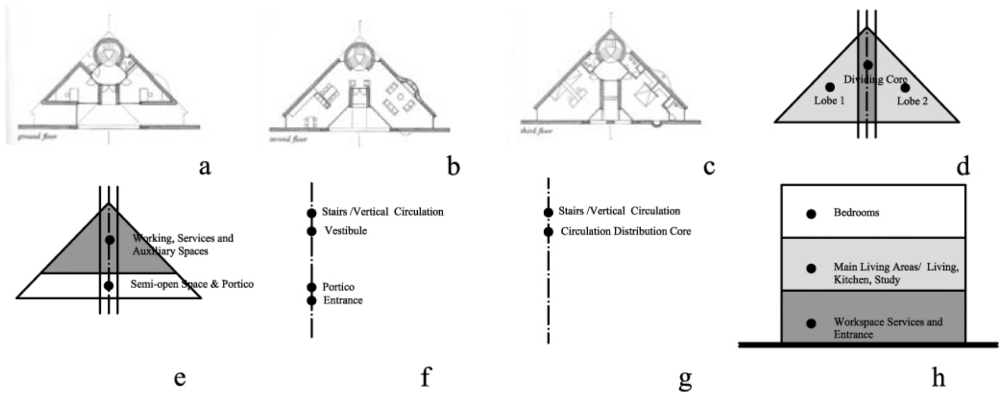



Figure 52 The single-family house in Morbio Inferiore (d-h are drawn by the author) (Pizzi 1993).

In the single-family house in Morbio Inferiore, the formative dominant is the triangle that controls the overall form of the design (Figure 52). The instances of the slit and the cross axis can also be identified in this design. Same as the previous two designs, the slit divides the triangle into two identical parts. Same as the scheme in the single-family house in Breganzona, the service spaces and the main spaces are located within two separate zones. In the present design, the service spaces are organized around the staircase, at one end of the cross axis. The remaining spaces are reserved for the main living functions. Same as the previous designs, the ground floor is recessed to give way to the entrance space and the portico.

**The Axis and the Square Plan**

The square plan and the axis are two important formative ideas in Botta's *œuvre.* They are utilized even in his urban scale projects. One of these designs is particularly important in the sense that it carries an instance of the formative idea of "mat building," more specifically Botta's own interpretation of the idea in his own design, intermingled with two important formative ideas of his own schema.

It is known that, before he meets Kahn in 1969, Botta worked with Julian de la Fuente and José Oubrerie in Le Corbusier's studio in Venice, on the Venice Hospital project (Co 1987, 287), and later in Le Corbusier's atelier at *Rue de Sévres* 25, in Paris. Possibly, these experiences are the primary conceptual source of his project of Polytechnic Institute in Lausanne of 1970.[48] Actually, this project can be interpreted as a part of a wider view of designing cities or large parts of cities which come into agenda at the time the project was designed. That is to say, in terms of the operational ideas, it has much common with the projects such as Le Corbusier's Venice Hospital, Berlin Free University, and the project for Frankfurt-Römerberg, designed by Candilis, Josic and Woods (Figure 54). From a certain point of view, the project can also be interpreted as Botta's own interpretation of such urban scale projects by utilizing the idea of a "mat building." Apart from the ideas of awareness and response to the immediate context (Figure 53, a, b), organic growth and expansion controlled by a set of principles (Figure 53, c, e), programmatic flexibility and open-endedness which are typical and common dominant ideas

[48] In this project, Botta worked with a group of Ticino architects; Tita Carloni, Aurelio Galfetti, Flora Ruchat, and Luigi Snozzi.

to all, it is interesting to see, for example the square plan and the crossing axes retained as two important formative ideas of Botta's designs, even in this scheme. The axes, which are perpendicular to each other, are used as the unifying and dividing elements, which split the complex into four distinct and unequal quarters. They also connect the complex with its physical context. The square plan bounds and marks the outer limits of the project, hence in a sense it selectively controls the growth. Actually, the idea retains its selective aspects also in this project as it is for many other projects by Botta.

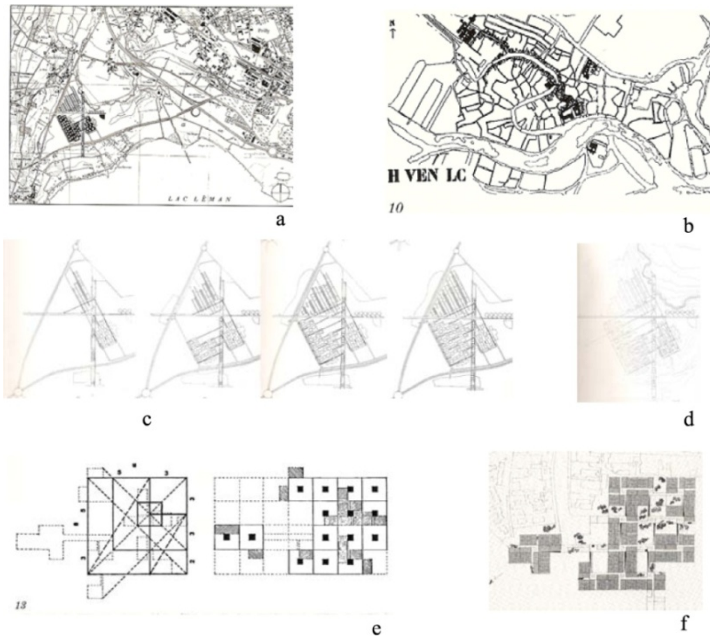



Figure 53 Top left and the middle row: Polytechnic Institute of Lausanne, Botta (Pizzi 1993, 16-19). Top right and the bottom row: Venice Hospital, Le Corbusier (Colquhoun 1981c, 36-37).

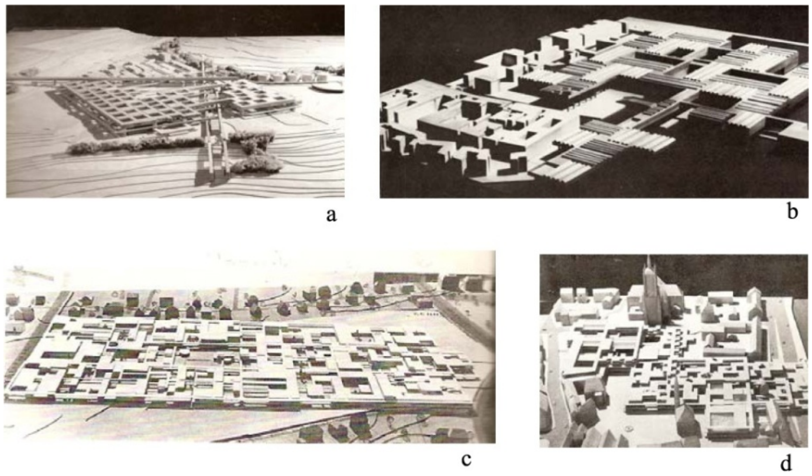



Figure 54 Top left, Polytechnic Institute of Lausanne, Botta (Pizzi 1993, 16-19), top right, the Venice Hospital project, Le Corbusier (Colquhoun 1981c, 36-37), bottom left, Berlin Free University, right, the project for Frankfurt-Römerberg, both designed by Candilis, Josic and Woods (Frampton 1996, 277).

**Serial Organization of Repeating Units**

As it would be remembered, in the housing development in San Vitale, multiple identical units are controlled by the idea of a serial or linear organization of repeating units. This is a formative control which affects the two dimensional organization of the square blocks and it does not affect their overall form. The idea is also operational in some of Botta's designs. In its instances in the designs such as the Gottardo Bank, the high school in Lacarno, and the junior high school in Morbio Inferiore, it mainly refers to linear or serial repetition of plan organizations or spatial layouts (Figure 55). In some cases such as the junior high school in Morbio Inferiore, the Gottardo Bank, and the restructuring of Klösterliareal, it refers to serial organization of identical masses (Figure 56, a-c). An instance of the idea can also be observed in Botta's furniture designs, such as the one designed for the Capuchin Church (Figure 56, d). As it would seem, in this second instance, the idea mainly refers to external or overall form rather than, say, a unit of the programmatic or the spatial organization.

The evolutionary lineage of the idea can be traced in some of Kahn's designs where the instances of the idea can be identified. For example, in Richards Medical Research Building and in the DeVore house, and the Kimbell Art Museum, there is a serial organization of identical units (Figure 57, a-b, e). In Olivetti-Underwood factory, the idea of repeating unit exists but the dominant idea of serial organization, which is responsible for the external order of units, is replaced with a grid (Figure 57, c).

Different from Botta's examined designs, in Kahn's mentioned designs, the units of repetition can be best described as structural units rather than, say, programmatic or formal units. Still, in both group of examples, what is observed is an instance of the same idea, which reveals an evolutionary lineage of ideas existing in various designs.

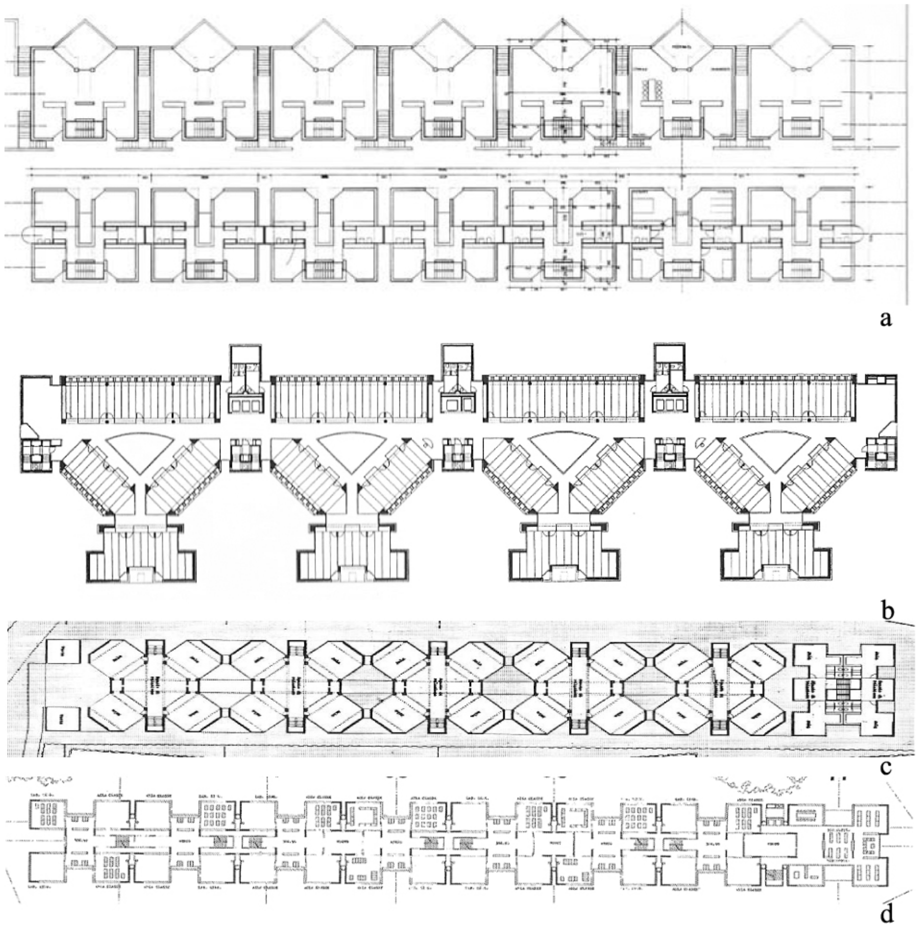
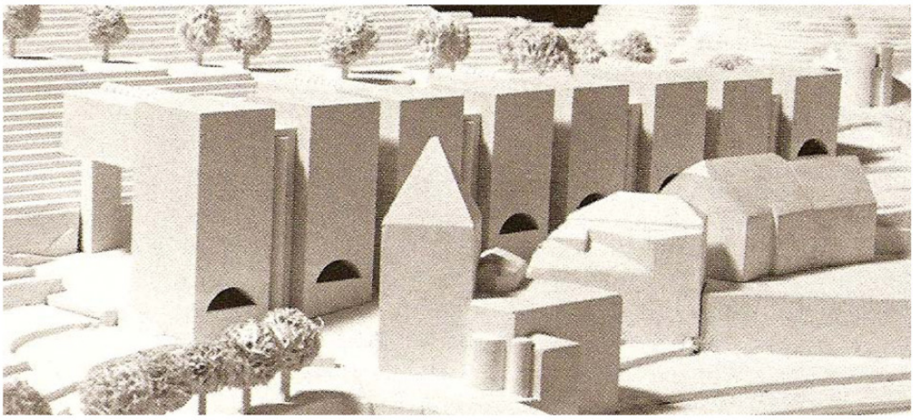


Figure 55 Serial organization of identical units in Botta's designs. a, house development in Riva San Vitale (Co 1987, 181), b, Gottardo Bank (Jodidio 2003, 64), c, high school in Lacarno (Co 1987, 111), and d, the junior high school in Morbio Inferiore (Pizzi 1993, 38).

a

b



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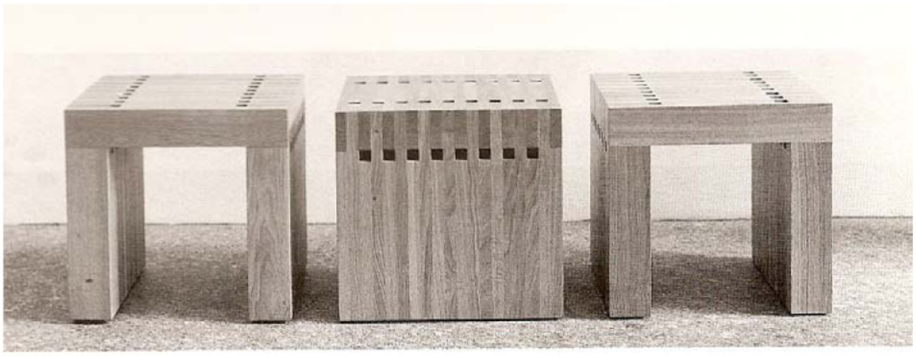

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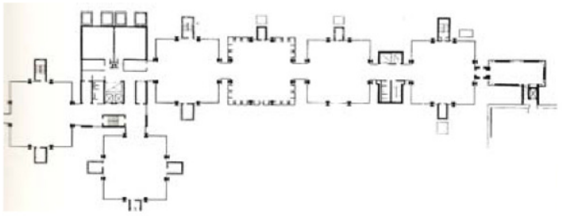
Figure 56 Serial organization of identical units in Botta’s designs. a, the junior high school in Morbio Inferiore (Pizzi 1993, 41), b, the Gottardo Bank (Co 1987, 237), c, restructuring of Klösterliareal (Pizzi 1993, 208), and d, the Capuchin Church furniture (Pizzi 1993, 209).



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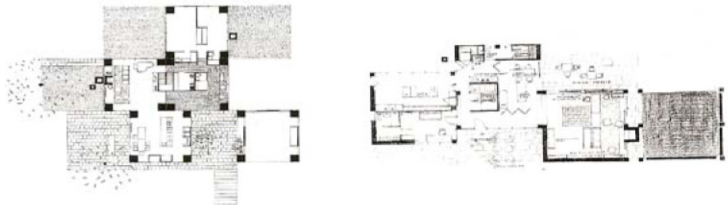

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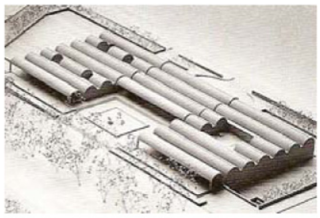


e

Figure 57 The instances of the idea of repeating units in Kahn's designs. a, the Richards Medical Research Building, b, the Adler house, DeVore house, c, the Olivetti-Underwood factory, d, the Indian Institute of Management, e, the Kimbell Art Museum. (Brownlee and Long 2005)

## The Solid Primitives

As it was stated earlier, in Breganzona, the idea of rectangular solid and the idea of square plan are two dominants that are operational in the very beginning and throughout the primary stages of the design process. As the square plan, the rectangular solid is a formative dominant that informs the overall three dimensional form of the design.

In Botta's own *œuvre* the rectangular solid is frequently used as a dominant. Apart from those that are examined in the previous section (Figure 56), to state a few, instances of the idea is operational in the single-family houses in Pregassona, Origlio, Caviano, Riva San Vitale, Cadenazzo, Ligornetto, Viganello, and Massagno (Figure 58). Actually, more generally, in Botta's *œuvre* the idea to use solid primitives as the dominant is not limited to rectangular solids. For example, the cylinder and triangular prism are the dominants in the single-family houses in Morbio Inferiore and Stabio, residence, offices and shop complex in Lugano-Paradiso, and Watari-um Contemporary Art Gallery (Figure 59).

Here, the related ideas are referred to as solids or solid primitives, because they can be more identified with the overall "solid" effect in the designs. That is to say, the "solid" effect is one of the important formative implications of the idea that is operational in many of Botta's designs.

In these designs, solid primitives are often utilized as the starting point for design investigation, and they are transformed by the introduction of minor or subordinate formative ideas and elements. However, at the final stage, the initial formative dominant is nearly always acknowledged, together with most of the transformative ideas and operations superimposed on it. In return, the formative and selective control of the dominant is identifiable on these subordinate ideas and elements.

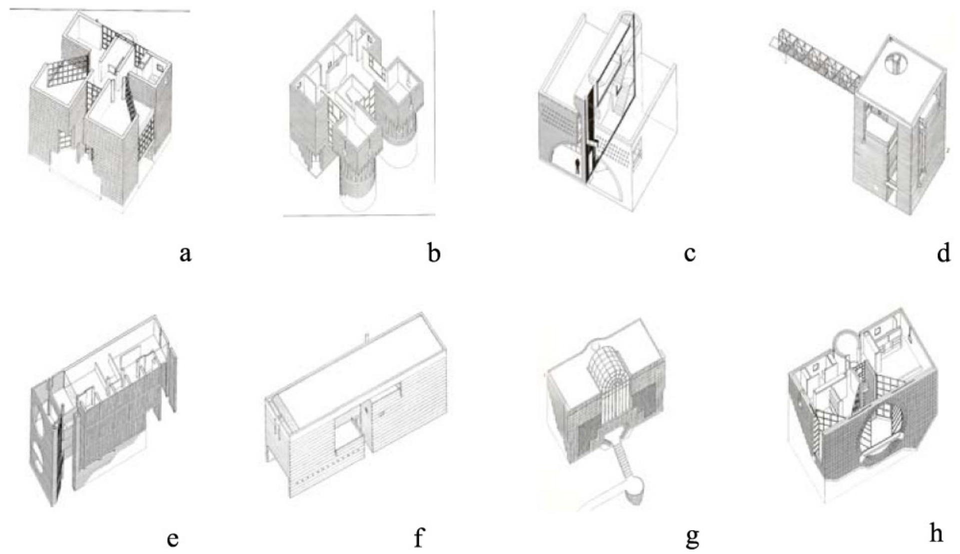
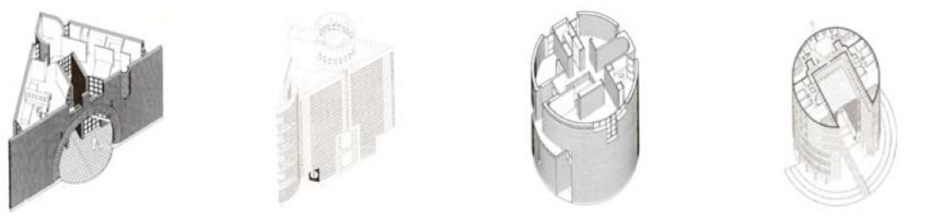



Figure 58 the single-family houses in a, Pregassona, b, Origlio, c, Caviano, d, Riva San Vitale, e, Cadenazzo, f, Ligornetto, g, Viganello, and h, Massagno (Pizzi 1993).

In the single-family house in Pregassona, the rectangular solid is divided into two identical blocks by a slit (Figure 58, a). At the front façade, the slit cuts deep into the solid, almost half the depth. A triangular truss covers this cut at the roof. The slit widens at the second and the ground levels at the front façade. Inside the building, this slit turns into a central space, which works as a circulation core at each level. Consequently, on the axis of the slit, there is a cylindrical staircase protruding from the main body of the building at the rear facade. Almost two third of the ground floor is carved out and left as a semi-open space. This is done by preserving the overall integrity of the solid and keeping the “solid” effect intact. At the upmost level, there are two lateral rectangular apertures opening to loggias that are achieved by triangular recessions from the main body.

In the single-family house in Stabio, the cylinder is the solid primitive, which is also divided into two blocks by a slit. Different from the house in Pregassona, within the building, the slit turns into an internal space, which works as a common uniting spatial element (Figure 60). At all levels, it also functions as a main circulatory core. Located on the axis of the slit on one end, there is a cylindrical staircase subsumed under the main body of the building. At the ground level, the core defined by the slit is reserved for entrance vestibule and the stairs. Two sides of the core is carved out of the cylinder and left as blank. This provides physical and visual permeability and transparency, which could be compared to that achieved in Villa Savoye. However, different from Villa Savoye, the idea of permeability is accomplished while keeping the overall cylinder form intact and by particularly acknowledging it at the ground level rather than raising the whole body above the *pilotis*. Actually, an instance of the idea can be observed also in *Maison Cook*, another design of Le Corbusier (Figure 61).



a b c d

Figure 59 a, the single-family house in Morbio Inferiore, b, the residences, offices and shops in Lugano-Paradiso, c, the single-family house in Stabio d, the Watari-um Contemporary Art Gallery (Pizzi 1993).

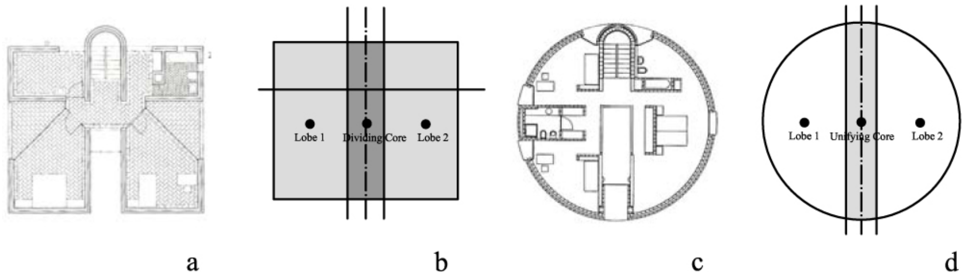



Figure 60 a-b, the single-family house in Pregassona, c-d, the single-family house in Stabio (b-d are drawn by the author).

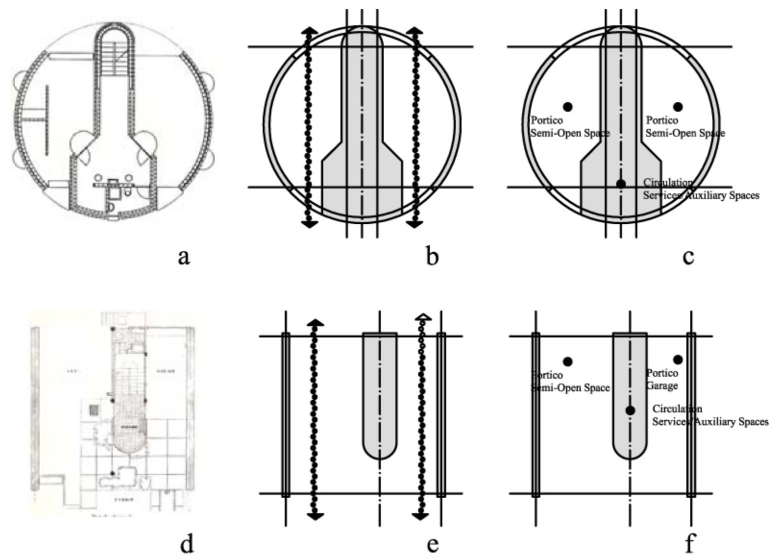



Figure 61 a-c the single-family house in Stabio, Botta, d-f *Maison Cook*, Le Corbusier (b-c, e-f are drawn by the author).

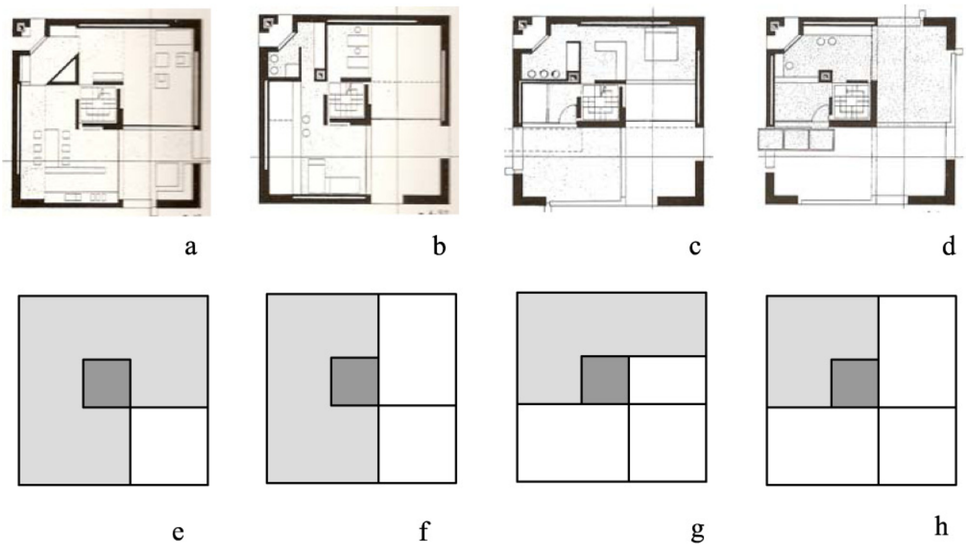



Figure 62 the single-family house in Riva San Vitale (e-h are drawn by the author).

The single-family house in Rive San Vitale can be read as a rectangular solid carved by deep apertures (Figure 58, d). Actually, within the boundaries of the rectangular mass, there is an "L" shaped solid part, reserved for closed living spaces. It surrounds a square inner court carved within the rectangular solid, rising from ground to the roof. Towards the upper levels, the "L" shaped block progressively recesses at two lateral legs of it, giving way to loggias (Figure 62). All inner spaces of the house open either to these loggias or to the inner court and they have no major direct openings to outside. This provides a visual and physical distance from the outer world, which is, as it will be remembered, an instance of one of the important ideas operational in many of Botta's designs. There is a circular aperture at the roof, an oculus, which gives way to the chimney to rise above the roof. This aperture is an instance of an idea that also exists in Pavillion *l'Esprit Nouveau*, designed by Le Corbusier. In this design too, a circular aperture is opened at the roof to take sunlight into the inner court while letting a tree raise through and above the roof (Figure 63). As it would be remembered, there was such an aperture in the single-family house in Breganzona, this time located at the top of the staircase.

The rectangular solid can be identified in the single-family house in Ligornetto as one of the dominant formative ideas. Different from the single-family house in Rive San Vitale, the solid is laid horizontally and it stays on a rectangular foundation rather than a square one. Still different from the previous design, there is no inner court. The solid seems to be initially divided into two equal halves. Each half is reserved for living spaces. Same as the previous design, towards the upper levels, these two blocks progressively recess at their sides facing the slit, giving way to loggias (Figure 64).

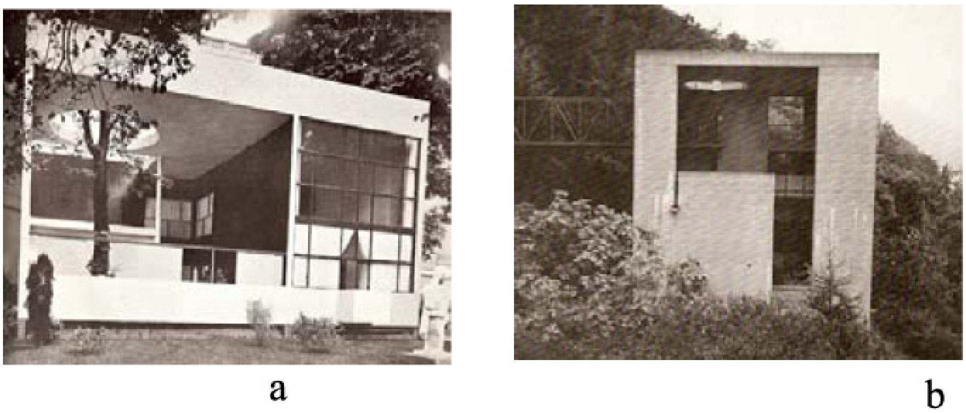



Figure 63 a, Pavillion *l'Esprit Nouveau*, Le Corbusier (Jeanneret 1953, 99), b, the single-family house in Riva San Vitale, Botta (Wrede 1987a, 24).

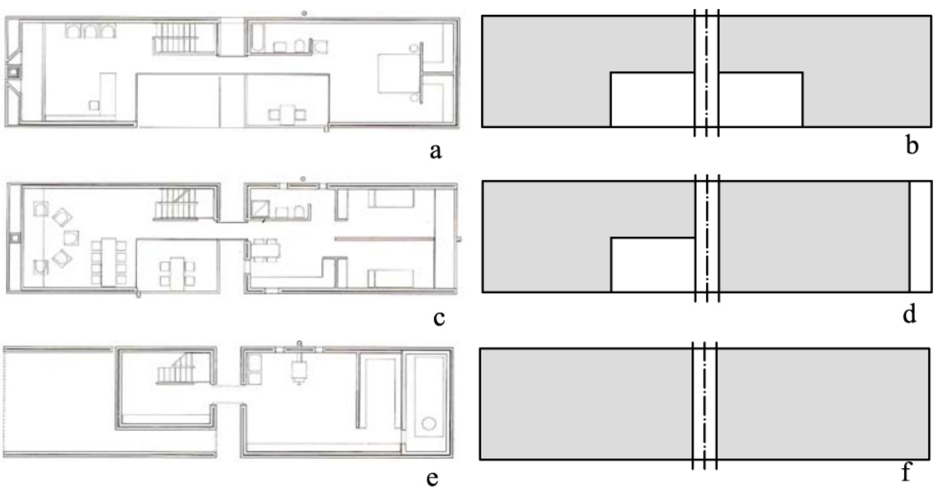



Figure 64 single-family house in Ligornetto (b, d, f are drawn by the author).

These formal operations create a semi-open space similar to the one in the single-family house in Riva San Vitale. This space opens to the outer world by a large aperture, which clearly acknowledges the initial rectangular solid as the dominant formative idea. Actually, all the ideas and formative operations behind the design are controlled by this dominant, to the degree they fall into its domain of control. In turn, these ideas and operations conform and support back this dominant. As it was already stated, apertures are such elements. In the single-family house in Riva San Vitale and Ligornetto, apertures are formed so that they support the overall “solid” effect of the designs (Figure 65, a-b). If closely examined, so do the parapets of the loggias and the gutters. That is to say, for example, gutters not only function as water draining elements, but they are so formed so that they continue and emphasize the carving (effect) of the major aperture, and consequently they support the overall solid effect (Figure 65, c-d). In this sense, gutters are under the selective control of the apertures and of the overall solid effect respectively. In turn, they contribute to the formative implications of the mentioned ideas.

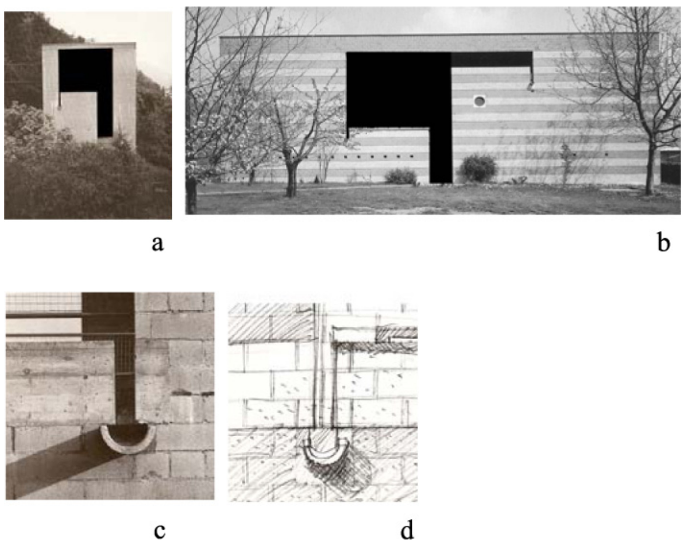


Figure 65 Apertures and gutter details. a-c, the single-family house in Riva San Vitale, b-d, single-family house in Ligornetto (in a-b, the apertures are emphasized by the author).

Instances of these ideas can be identified also in the designs of Kahn and Scarpa. For example, in Galli Tomb designed by Scarpa, the apertures deeply cutting into the main body further support the overall solid effect of the tomb (Figure 66, a-b). Gutters in Salk Institute are formed under the selective control of the large apertures, so that they not only function for water drainage but also for supporting back the overall formal effect governed by this dominant (Figure 66, e-h).

In the single-family house in Ligornetto the "solid" effect is so strong that it does not, say, permit a chimney or an antenna embedded within the main body itself. As it would seem, these elements are attached to the main body, further supporting the overall solid effect. This idea can also be identified in Worker's Houses, a design of Le Corbusier (Figure 67), and also in various other designs of Botta.

This is expected since in worker's houses, the idea of rectangular solid is used as a dominant that provides conditions similar to the one in Ligornetto, which consequently do not permit a chimney to exist within the main body, but only attached to it externally.

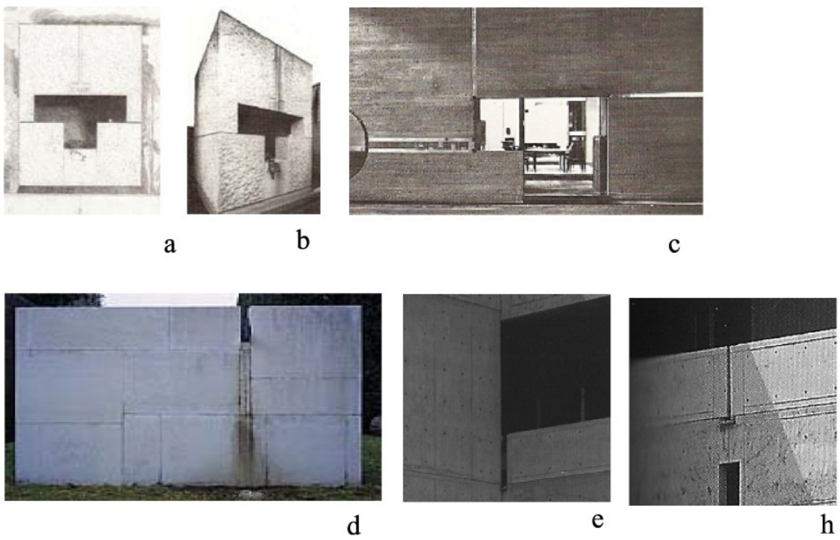
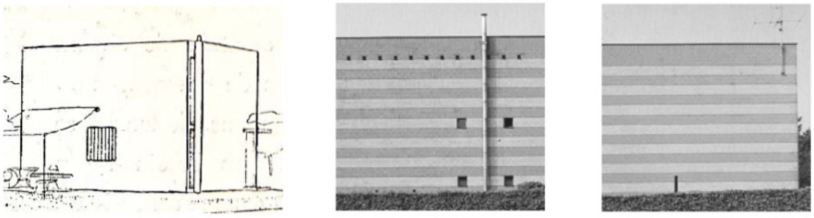



Figure 66 a-b Galli Tomb, c, Gavina Showroom, d, Veritti Tomb, Scarpa (Co and Mazzariol 1985), e-f, Salk Institute, Kahn (Brownlee and Long 2005).



a b c

Figure 67 a, Worker's Houses, Le Corbusier (Boesiger and Stonorov 1999a, 54) , b-c, the single-family house in Ligornetto.

Seeing the instances of these ideas in Le Corbusier's designs is not unexpected. Actually, these are two of his "compositional ideas" (Figure 68). One of these ideas clearly expresses the idea of rectangular solid as a formative (dominant) idea, the other, carving, and extraction as a means of formative operation to transform the initial solid.

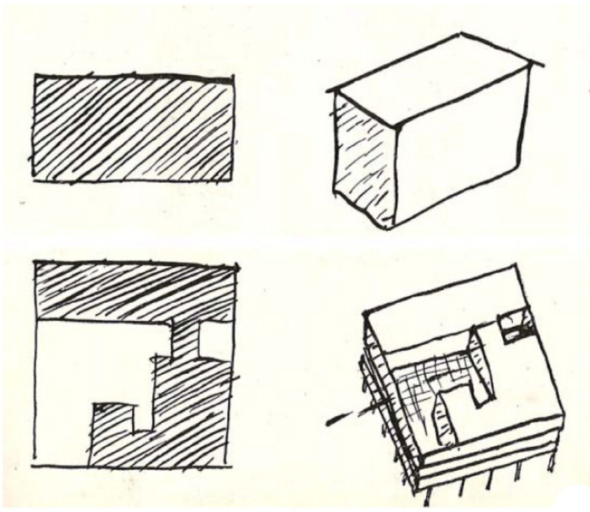
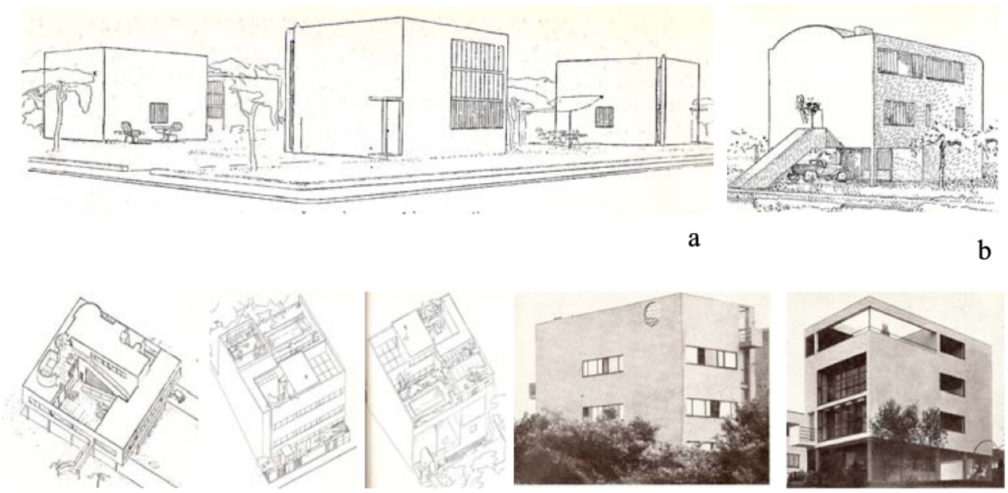


Figure 68 Le Corbusier (Boesiger and Stonorov 1999a, 189)

Rectangular solid as a formative dominant can be identified in many designs of Le Corbusier, sometimes together with the idea of carving and extraction as a formative operation (Figure 69). For example, in Villa Savoye and Villa

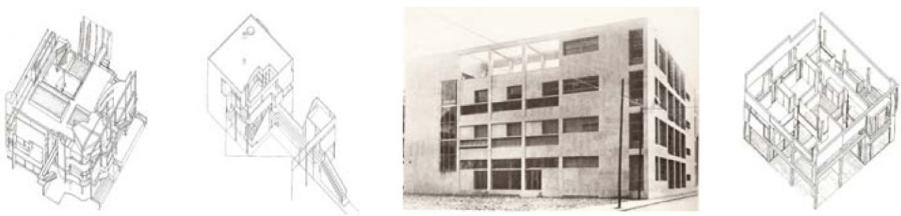
Meyer, the solid is carved out to give way to internal open spaces, namely loggias or courts. A vertical slit can be identified in Guiette House. There are deep apertures in the two houses in Weissenhof, carved out of the main body of the building, strongly acknowledging the overall solid affect. In these designs, strip windows can also be interpreted as horizontal slits.



a b

c d e f g

Figure 69 a, the Worker's Houses, b, the Artist's House, c, Villa Savoye, d-e, Villa Meyer, f, Guiette house, g, two houses in Weissenhof (Boesiger and Stonorov 1999a).



a b c d

Figure 70 a, Synderman house, Michael Graves (Colquhoun 1981d, 172), b, Hanselmann house, Graves (Colquhoun 1981d, 176), c, Casa del Fascio, Giuseppe Terragni (Colquhoun 1981d, 174), d, House II, Eisenman.

Instances of these ideas can also be identified in other designs in architectural tradition. For example, in Synderman house and Hanselmann house by Graves, Casa del Fascio by Terragni, the rectangular solid is a dominant formative idea. The idea of carving out the solid is also apparent in Graves' mentioned designs. Different than Botta's and Graves' examined designs, in Casa del Fascio, the structural grid, which is mainly responsible for the structural and inner spatial order, has also a formative affect on the overall form. That is to say, in Casa del Fascio, the overall rectangular solid and the solid effect remain intact while they are (trans)formed by the superimposition of the structural grid. In the house series by Eisenman, the situation is a bit different. In these designs, although the overall resultant form is a rectangular prism or a box, the form is mainly informed by the idea of structural grid and the formative operations superimposed on it, rather than primarily the idea of the rectangular solid itself. That is to say, the rectangular solid in these designs is a resultant form rather than a formative idea.

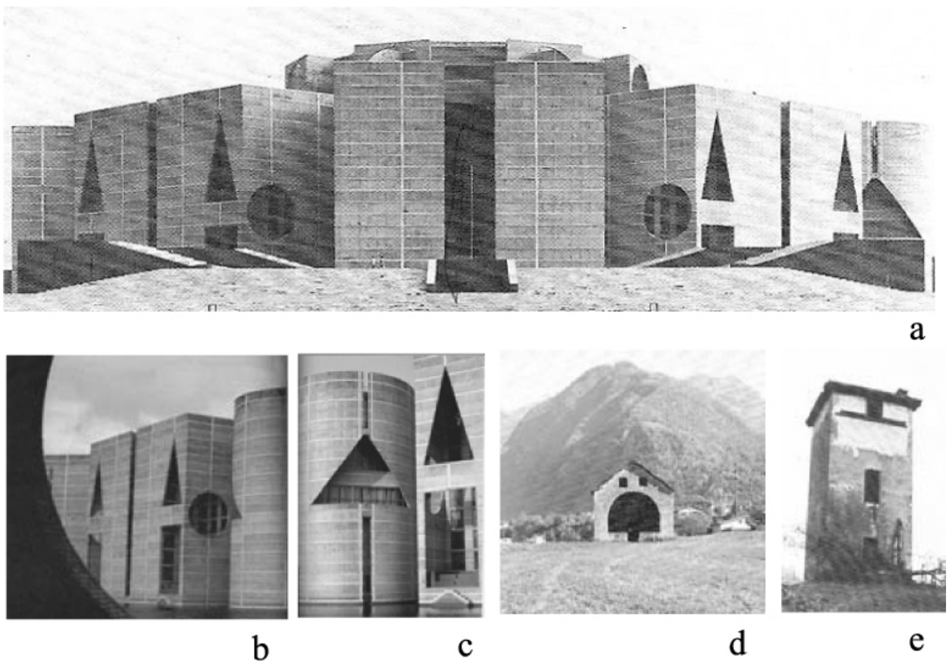



Figure 71 a-c, Parliament building, Kahn (Brownlee and Long 2005), d, Chapel in Roveredo, e, bird-hunting tower in Agra (Wrede 1987c).

As it is stated in some occasions (Wrede 1987c), vernacular tradition is one of the important source of the ideas invested in Botta's designs. In evolutionary terms, this means that there can be lineages of these ideas descendant from vernacular. Consequently, it is expected that the idea of rectangular solid might have such a lineage (Figure 71, b-c).

As it was discussed earlier, in a number of occasions, there are many evolutionary lineages of ideas where instances of an idea can be identified in both Kahn's and Botta's designs. The idea of rectangular solid is one of these, the instances of which can be identified in some designs of Kahn. Perhaps, one of such designs is the National Assembly Building, which clearly illustrates one segment of the lineage of the idea in Kahn's design. But, perhaps more important, the idea behind dealing with the apertures in this design reveals another evolutionary lineage.

**The Aperture**

Apertures in Botta's designs can be grouped under three categories, at least those are also informed by the dominant idea of solids, whether rectangular or otherwise. These are small or minor openings (Figure 73), large or major openings, or more specifically apertures, and finally slits (Figure 72). These categories also represent three distinct ideas of dealing with openings in a design. Common to all is their dependence upon the "solid" as the dominant. Actually, this is the reason for interpreting them as apertures rather than openings or windows. Actually, other instances of these apertures can be observable in many designs examined until this point.

Actually, slits can also be categorized as large apertures, but by nature, they differ from them because of their major formative contribution on the overall form, and on the inner spatial organization. For example, there is an instance utilized in the Lambert Bank, where the vertical slit divides the front façade of the building into two halves (Figure 72, g). This is a major transformative operation, which turns the front part of the building into two towers. Actually, the slit continues to cut through the rectangular solid body of the building by creating a spatial element within the building (Figure 72, h). This is also the case in the single house in Morbio Superiore. In this design, too, a slit divides the main body of the building into two halves, creating a space within the building (Figure 72, e-f).

However, the single house in Morbio Superiore, the slit ends with a large rectangular aperture, an illustrative example of the second category given above. Actually, the aperture is a part of the triangular recession or carved out space in the main body of the building, which creates a loggia. This provides a semi-open space within the main body of the building, which establishes a physical and visual relation with the outer world, and this is the space where inner spaces open (Figure 72, d). This organization very well passes the selective condition of the idea of "keeping the distance with the outer world," or the idea of physical, mental, or visual "isolation."

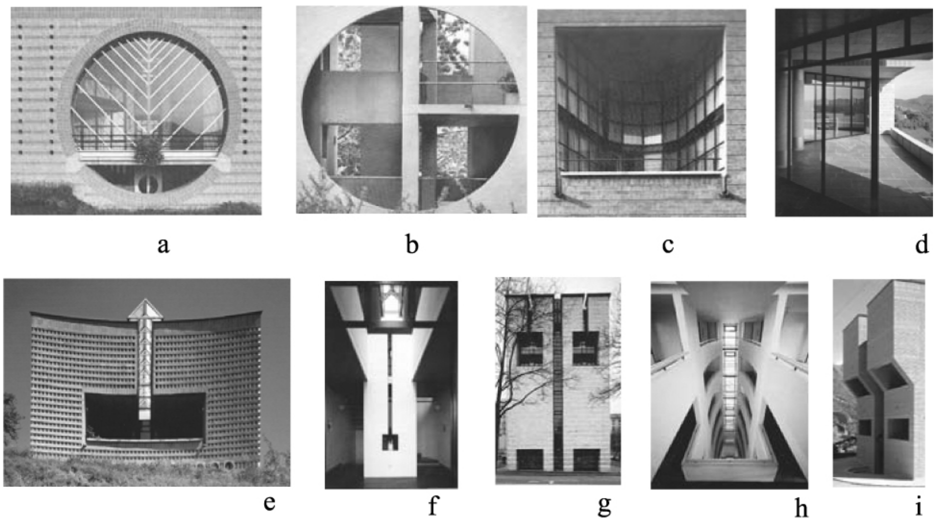



Figure 72 Large apertures and slits from various designs of Botta. (Pizzi 1993, Co 1987)

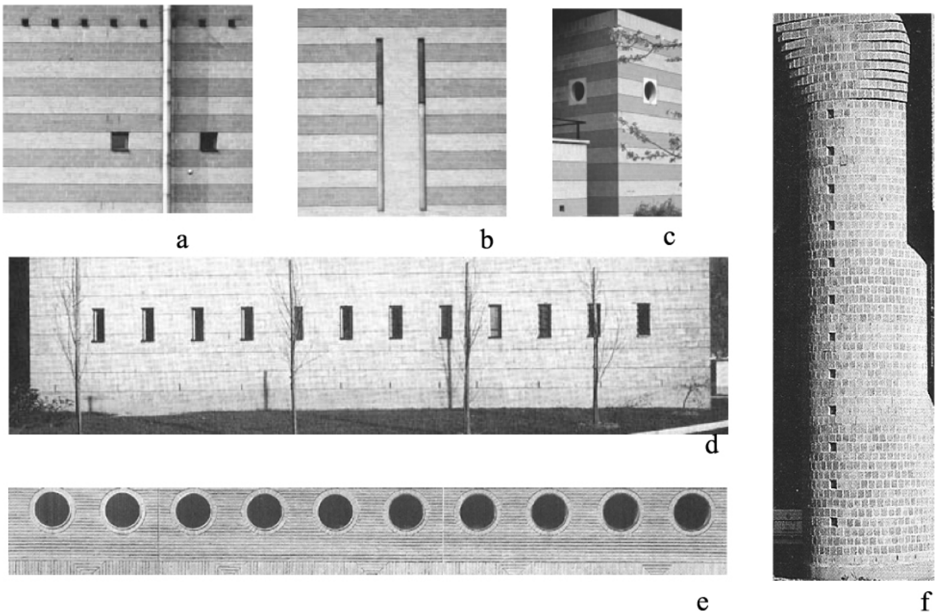
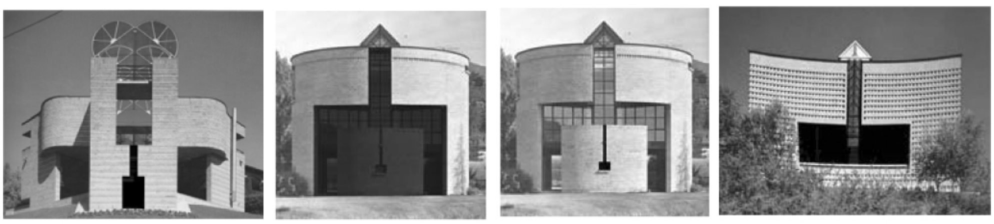



Figure 73 Small apertures from various designs of Botta.

Small openings also carry the characteristics of an aperture carved out of a solid mass. They are often utilized in the conditions that demand decent ventilation and light, but at the same time visual and physical isolation and protection. For example, in the single-family house in Ligornetto, a row of small apertures provide light to the master bedroom (Figure 73, a). In the same design, there are two narrow vertical slits, located at two sides of the fireplace, and two circular apertures opening to internal open space and the outside world, providing visual relation and light (Figure 73, b-c). In the Craft Center, a row of rectangular apertures provides light to the working areas at the ground floor (Figure 73, d). The same serial organization with circular apertures can be identified in Ransila 1 Building while a vertical organization of series of small openings can be identified in the staircase of the single-family house in Stabio (Figure 72 e-f).

After this short summary, at this point, I will pursue one specific type of aperture, which shows a rich range of instances and variations in evolutionary terms.

The aperture can be described as, “a vertical slit ending with a rectangular aperture at the bottom” (For example see Figure 75, b). It represents a certain idea of dealing with apertures of which many instances can be observable in Botta’s designs. The description represents the majority of the instances, where in some cases the aperture might be a perfect square (Figure 75, a-d), a triangle (Figure 78, a), or a circle (Figure 76, c). As it was stated, this aperture can be identified in many designs of Botta, but in terms of variations with different programmatic implications, depending upon the conditions and the specificities of the mentioned instance confronts (Figure 75). In this sense, we can mention three major instances: In the first one, it is utilized as a relatively major formative idea (nevertheless not a dominant), which has a formative effect on the overall form. It might also a part of an overall spatial organization, such as an inner atrium, or a semi-open court, a slit or a loggia. In the second instance, it is more of a small aperture on the main body of the building (Figure 75). It may repeat to constitute a series of openings (Figure 75, d-e) or may be a single aperture (Figure 75, a-c). Finally, it may be embodied as an incision (Figure 76, d-e), a figure on a surface, or sometimes as the form of an appliance (Figure 76, a-c).



a b c d

Figure 74 Apertures from various designs of Botta (Pizzi 1993, Co 1987).

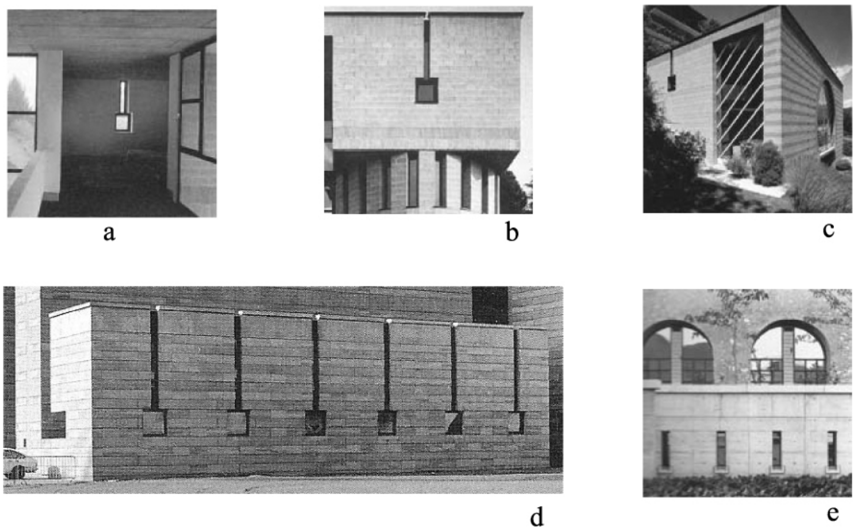
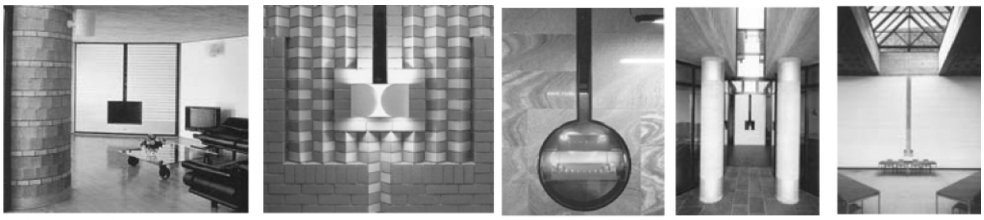



Figure 75 Apertures from various designs of Botta. (Pizzi 1993, Co 1987)



a b c d e

Figure 76 Apertures and incisions from various designs of Botta. (Pizzi 1993, Co 1987)

For example, in the single-family house in Morbio Superiore, the element is used on the wall that separates the living room and the stairs. The vertical slit is applied on the wall as an incision, and the aperture at the bottom as a niche. When viewed from the loggia, the incision continues the axis of the major slit, which divides the building into two halves at the middle (Figure 76, d). In the Capuchin monastery, it is also applied on the wall as an incision, which continues the line of the skylight. However, in this case, the element seems to have also a spiritual content; it is almost like an apse, or perhaps an altar (Figure 76, e).

The instances of the element can be identified in the designs of Kahn. As it was illustrated earlier, it is observable in the gutters of Salk Institute (Figure 66), and an interesting instance of the idea is the water-collecting element in the same building.

a b

Figure 77 Details. Salk Institute, Kahn (Brownlee and Long 2005).

We can identify the element in the variations produced during the design process of many designs even if it is not retained in the final solidified design. That is to say, in some cases, the element lasts until the end of the process and thus can be identified in the final product, in some cases, it is transformed, and in some others, it is totally eliminated depending upon the selective conditions. For example, in the single-family house in Breganzona that was examined in the previous section, the element is first introduced as an aperture on the facades of the building, but it did not last. It is reintroduced as an aperture on the corner tower. In this instance, it functions as an entrance and at the same time marks the entrance. It also helps the externalization of the diagonal axis of the plan on the overall three-dimensional form.

This element never becomes a major selective or formative idea or a dominant, but rather remains as a formative material. This is related with the selective and organizational capacity of it. However, at least in some cases, it becomes an important formative element. For example in the single-family house in Morbio Superiore, it is not embodied as just an aperture on one façade of the building, but it actually cuts into the solid deep, almost two third of it, and divides the building into two blocks. This is a major (trans)formative operation. Such a major formative operation is also observable in the element's instances in other designs, such as the single-family houses in Stabio, and Pregassona.

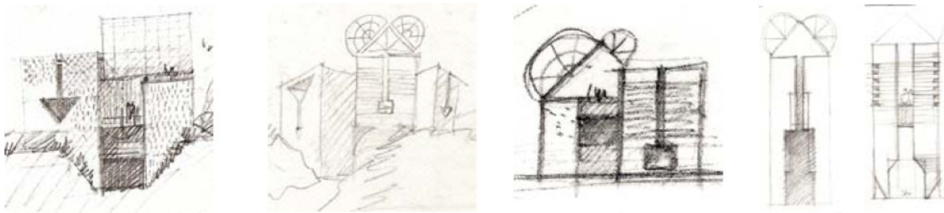


Figure 78 apertures in the single-family house in Breganzona (Botta 1989).

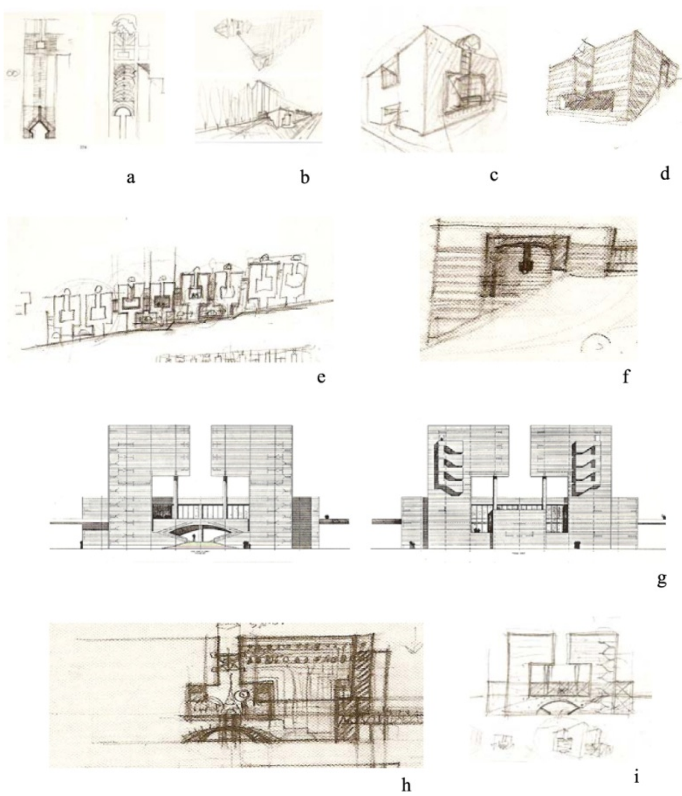



Figure 79 a, Ransila 1 Building, b, the project for a nursing home, c, the single-family house in Pregassona, d, the municipal gymnasium, e, the row houses in Pregassona, the single-family house in Morbio Superiore, g-i building on the TGV station. (Pizzi 1993, Co 1987)

## The Skylight, Framed View, and Loggia

Apertures and slits in Botta's designs are often related with three minor or subordinate formative elements. First is the skylight, an element that is usually aligned with the dominant axis and often perceivable from the front façade of the building. Actually, it has the character of a formative idea, once utilized, might have a number of functions. For example, in the single-family houses in Breganzona, Pregassona, Stabio, Viganello, Morbio Superiore, Origlio, Daro-Bellinzona, and in the public gymnasium in Balerno, the skylight marks and indicates the main entrance and externalizes the dominant internal axis (Figure 80, a-g, i-j). In the single-family houses in Breganzona, Viganello, and Daro-Bellinzona, it shelters the central loggia while in Pregassona and Origlio, the entrance portico (Figure 80, a, d, g, b, f). In the single-family houses in Stabio, Morbio Superiore, and in the public gymnasium in Balerno the skylight follows the slit which divides and carves out the main body of the building, and covers and provides light for the inner space formed by this operation (Figure 80, c, e i, j). In the larger scale designs such as the Home for the Elderly in Novazzano, the Craft Center in Balerna, and the Housing in Monte Carasso, the skylight defines the main outdoor space together with the main body of the building, and shelters the defined space (Figure 80, k-m).

In Botta's designs, I have already mentioned the idea of "isolation" and "distancing," between the inner spaces and the outer world. Some of Botta's designs, especially houses are introverted and have few direct openings to the outside. Slits, internal loggias and courts, unifying internal spatial elements, generally work as interfaces or mediating elements between the inside and the outer world. Despite the dominant selective nature of these elements, and their resultant introverted and isolated forms, in many cases, deliberately organized apertures provide an excellent visual relation from inside out, by framing the environment, and the landscape. This refers to an important idea in some of Botta's designs, single-family houses in Riva San Vitale, Massagno, Breganzona, Morbio Superiore, and Stabio to state a few (Figure 80).

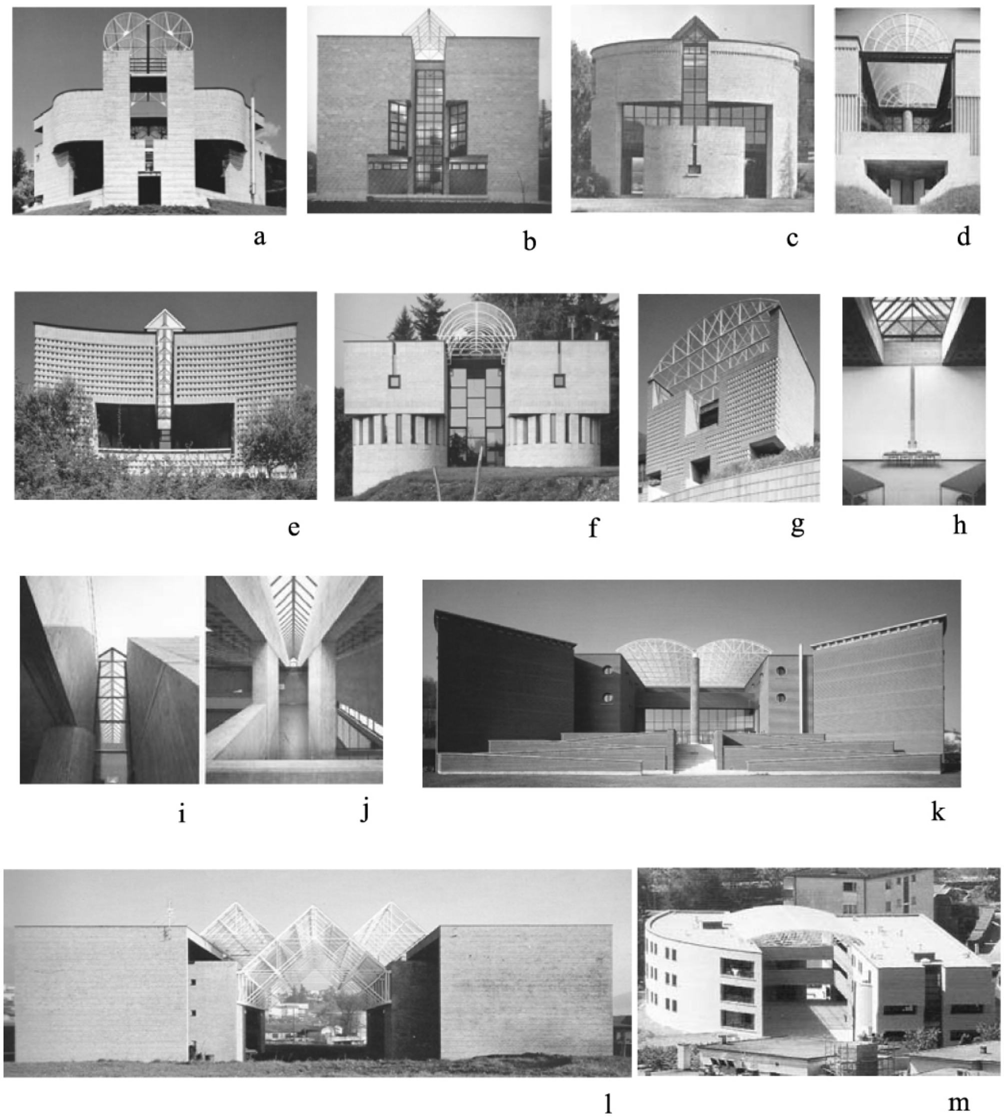
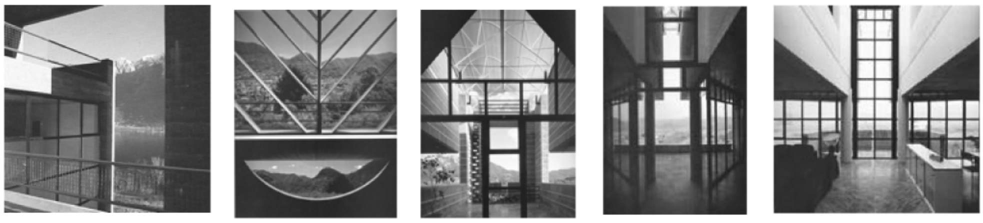


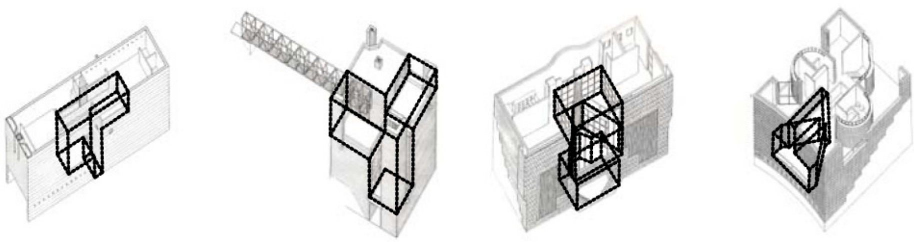

Figure 80 Skylights in the single-family houses in a, Breganzona, b, Pregassona, c, Stabio, d, Viganello, e, Morbio Superiore, f, Origlio, g, Daro-Bellinzona, h, the Library of the Capuchin Covent, i-j, the public gymnasium, Balerna, k, the Home for the Elderly, Novazzano, l, Craft Center, Balerna, m,Housing in Monte Carasso. (Pizzi 1993, Co 1987, Jodidio 2003)



a b c d e

Figure 81 Framed views in the single-family houses in a, Riva San Vitale, b, Massagno, c, Breganzona, d, Morbio Superiore, e, Stabio (Pizzi 1993, Co 1987).

Finally, loggias, as it was stated earlier, are carved within the main body of the buildings, providing semi-open spaces mediating between the inner spaces and the outer world. A loggia might be a part of another element such as a slit as in the single-family houses in Ligornetto and Morbio Superiore, or an internal court as in the single-family house in Riva San Vitale (Figure 82). In some cases such as the single-family house in Pregassona, it is an independent element. Although it is a subordinate idea, it often has a major (trans)formative affect on the overall form of the designs.



a b c d

Figure 82 The loggias. The single-family houses in a, Ligornetto, b, Riva San Vitale, c, Viganello, d, Morbio Superiore.

### 6.4 Conclusion to the Section Two

In the second part of the chapter, to illustrate my second model, I sought an evolutionary lineage of some selected ideas and elements by following their instances in the designs of Botta and in architectural tradition. I particularly tried to identify and investigate variations of ideas and related elements in different designs and discuss how they differ, how they were reappraised and interpreted in different conditions. The investigations showed that each element and the ideas they relate to might be reappraised or interpreted differentially in each new design, with reference to the differing conditions.

As a whole, as it would seem, the work done in this chapter is not only a means of illustrating and exemplifying the proposed models, but also, is a means of producing architectural knowledge,  perhaps more important, illustrating how to do it.

# CHAPTER 7

# CONCLUSION

The present study set out from a problem situation that can be observed in the theory and the practice of architecture. One of the conditions that define the problem situation was a type of prevailing "formalism," constituted by a set of approaches that can be identified by their emphatic concern with "form," whether this concern is related with forms created by "free expression" or mindless repetition, or a tendency towards creating forms that no one has ever seen before or dealing only with what was popular or fashionable. This condition occupies an important part in some of the recent debates in architecture. Common to these debates were their identification of a lack of concern for architectural program in the present practice of architecture indicating architecture's resignation from its urban and social responsibilities, hence its public role reduced to the "symbolic or emblematic."

However, program was not without its proponents. As it was emphasized by Vidler (2003), there was a tendency constituted by a set of approaches –some of which are experimental– identified in the idea and practice of architectural design, towards recasting program back into the agenda of architecture. Nevertheless, to the degree, "preoccupation with form" tends to follow a "formalist" line; to that degree "preoccupation with programme" tends to follow a determinist line, especially when such a preoccupation is established upon a certain view of architectural design, and a certain epistemology and ontology. It was not unexpected that in their evaluation of the present condition in architecture, while Vidler (2003) warned for a danger of (digital) determinism, McLeod(2003) has gone further to identify the already inherent “biotechnical determinism” in the neo-avant-garde tendencies in architecture similar to the one in the general doctrine of Modern Movement. That is to say, the present condition was indicating that an “inductivist” view of design and a positivistic epistemology and ontology seem to be persisting in the present idea and the practice of design, at least in some circles, where the (generation of) architectural form and architectural program are conceived with respect to the provided theoretical/conceptual framework. In the present study, this was identified as a major problem that deserve to be dealt with.

It was proposed that such a problem requires a wider view of the architectural phenomena, and to address it, there was an urge for a major theory or model of architectural design, established upon a rigorous epistemology and ontology that should be applicable to architecture and architectural phenomena. This was set as the ultimate goal of the present study.

The present study contributes to this goal by developing and proposing two complementary evolutionary models for reconceptualizing architectural ideas and the architectural design process. In developing the evolutionary models, the study refers to some studies from architectural theory, design research, evolutionary epistemology, and Popper’s three-world ontology as its theoretical/conceptual foundation. Yet from a certain point of view, the present study can be interpreted as the application of some of the key ideas from evolutionary epistemology and three-world ontology to the field of architecture, particularly to certain traditions, while reconsidering both within the specificities of the present problem situation. To evaluate and illustrate the proposed models and the associated theses, two case studies are employed.

This chapter presents a review of the study and the evolutionary models, followed by a short discussion on their implications and future extensions.

## 7.1 Review of the Study

The thesis can be reviewed under three major parts.

In the first part, which consists of Chapter 2 and Chapter 3, involves the conceptual framework of the present study. The second part, which consists of Chapter 4 and Chapter 5, is about the proposed evolutionary models, and associated theses, which was followed by the third part of the thesis that contains Chapter 6 that employs two case studies for the illustration of the proposed theses and models.

**Conceptual Framework and the Context of the Study**

In chapter 2, I introduced some key ideas from Evolutionary Epistemology, as they are conceptualized in the works of Popper (1965, 1972a, 1980), Toulmin (1972) and Campbell (1956a, 1960, 1974). I particularly focused on three-world ontology, and issues of tradition, progress, teleology, problem solving, process, and method, conceptual inheritance and change as they were conceptualized in these studies. I also examined the way the selection theory is interpreted and advanced in evolutionary epistemology.

In chapter 3, I introduced and critically examined some studies of Pevsner (1961) Summerson (1957), and Banham (1957, 1989, 1961), Anderson (1965), Rowe and Koetter (1978), Colquhoun (Colquhoun 1983, 1981a, 1981b), and Rowe (1996). I particularly focused on the issues relevant to the problem situation, such as tradition and utopia, program and paradigm, evolutionary and revolutionary conceptions of architectural design, and connected with them, the issue of design method and design process. Particularly related with the issue of architectural design (process) I also introduced the "conjecture/analysis" model of design as it was primarily conceptualized in the studies of Hillier, Musgrove and O'Sullivan (1972) Ledewitz (1985) and Darke (1979).

I identified an evolutionary pattern within these studies, and sometimes, notions that could be included within a selectionist schema. I identified two issues central to these studies: The first was about epistemology, about tradition and about architectural ideas. The second was about design method, design process, and designs (or works) themselves. I particularly focused on these issues and critically reconsidered them, and this reconsideration provided the theoretical/conceptual basis of the present study and also its context.

**Evolutionary Models and the Associated Theses**

The two complementary evolutionary models and the associated theses can be summarized and reviewed as follows:

● It was emphasized that, at any point in time, architectural tradition provides an “intellectual content” that works as a basis for both the present practice and the future progress and changes. With reference to the evolutionary epistemology, this is called the “conceptual inheritance” in architecture that bounds up architectural design in two ways. First, such a “conceptual inheritance” is central to the creation of new designs (or works), and new thought contents or ideas associated with this creation. Second, and perhaps more important, the mentioned “conceptual inheritance,” is essential to the critical evaluation of any design (or work), already existing, new, or possible.

● As a part of the “conceptual inheritance,” it was proposed that the evolutionary or selectionist pattern can be identified in the existence, life, and change of architectural ideas. It was suggested that in architecture, such existence, life and change has an evolutionary nature. This was conceived as the “evolutionary conception of the architectural ideas.” In this conception, instances of ideas in different designs are viewed as different interpretations of an idea adapted to those specific conditions. These occurrences were interpreted as “variations” of an idea representing the idea’s lineage. It was emphasized that such instances and occurrences are important since they are a means of inheritance of the ideas, and continuation of their lineage. It was also emphasized that from a different point of view, such inheritance and continuity is also dependent upon how an idea was embodied (or reappraised or interpreted) in a work.

● Architectural designs (or works) were conceived as the carriers of architectural ideas. In this conception, a design (or a work) was viewed as a vehicle of conceptual inheritance, from which architectural ideas and concepts can be distilled, learned, and made one's own schemata, to be later reinterpreted and reused for the creation of new designs or works.

● As a part of the proposed models and theses, an expanded conception of architectural ideas was proposed. In this conception, all the "thought contents" that architectural design processes and architectural designs (or works) might pertain are conceived as architectural ideas, with distinct characteristics. This was quite a wide scope that apparently included the programmatic and utopian content of architecture, conceived as architectural ideas. As a part of this proposal, the evolutionary or selectionist pattern was identified within the relations between architectural ideas. It was argued that in architecture there might be a tendency to view such relations by employing reductionist, mechanistic or deterministic structures. However, such relations could be viewed in the light of the selectionist schema that might provide a better, a non-reductionist, a non-mechanistic and a non-determinist account of them.

● With reference to the evolutionary conception of problem solving as it was conceptualized in the works of Popper and Campbell, it was suggested that the knowledge of "earlier solutions" might provide "shortcuts" in design reasoning in the design process. Owing to their associations in previous experiences, ideas might be remembered or related with a certain issue or a condition. This in turn makes them available for new designs, and consequently for the new problems and the new conditions. Furthermore, perhaps more important, such knowledge provides a basis for the critical evaluation and selection of any design, already existing, new, or possible. However, it was also underlined that, even if in such conditions, ideas or thought contents are not by default connected with each other, and the above-mentioned evolutionary or selectionist character of the relation between them remains intact.

● While emphasizing the evolutionary or selectionist pattern inherent in the design (process), it was suggested that within the specificities of architecture, the design process follows the procedure of "formation/making and evaluation/selection.” In this conception, “formation/making” refers to conceiving, construction, or making of an architectural design while “evaluation” refers to the critical evaluation and selective elimination of what was conceived, made, and constructed. Formation/making of a design is informed by the ideas, and it also concerns physical making of the design (i.e. sketching, modeling, and so). Such making, as it was stated is a means of externalization of the ideas that precede the physical activity of making. Evaluation/selection, on the other hand is “selectively” controlled by what is called the “selective conditions” constituted by the “physical conditions” and by the ideas, entities both intrinsic and extrinsic to the design. It was also suggested that the selectionist schema is not only identifiable behind the design process as a whole, but also many relations within it, such as the relations between the ideas, between the ideas and the physical world, and the mental world and so on. This was the essential structure of the “evolutionary model of architectural design.”

● As a part of the “evolutionary model of architectural design,” corresponding to the stages of the processes of “formation and evaluation,” ideas were categorized under two groups. Ideas, which have a characteristic to contribute to the creation of a design by “forming” or “transforming” were characterized as formative or constructive ideas. Ideas, which have the characteristic to contribute to the creation of a design by “evaluation,” or in evolutionary terms, by “selection,” were characterized as selective ideas. These ideas are further categorized as dominant or major ideas, and minor or subordinate ideas according to the nature of their contribution to the design and to the degree of their control over the process.

● With reference to the evolutionary model of architectural design, an architectural work (or design) was conceived as a unique object, artificially “made” as a solution to a specific architectural problem or a set of problems, “formed” as a result of deliberate application of a set of formative or constructive ideas, and a set of selective conditions. It was interpreted as a “cloudy” and “dynamic system” or structure consisting of interweaving layers of thought content with evolutionary relations with each other. From the evolutionary point of view, a design was conceived as a “variation,” solidified at some point of an evolutionary process that is informed and affected by many formative and selective ideas, as well as formative and transformative operations. It was suggested that in the examination of a design, to the degree what a design consists of and how these come together are important, to that degree what was operational during its conception and construction.

**The Case Studies**

Two cases studies were employed for the illustration of the proposed models.

For the first model, the sketches and the drawings produced during the design process of Mario Botta’s single-family house in Breganzona are investigated. The examinations mainly concerned hypothetical reconstruction of the design process and the reasoning behind it by using the conceptual framework and the structure provided by the model. The investigations showed that the model and the structure it proposes are applicable to the phenomena and such an application yields a valuable material, and it is instrumental for understanding a work and its design process. The examinations further demonstrated that the evolutionary and plastic relation between the architectural ideas could also be identifiable in the examined case.

For the second model, some architectural ideas from the single-family house in Breganzona were selected and the evolutionary lineage of these ideas is identified and examined in their instances and variations in different designs (or works) in both Botta’s own *œuvre,* and in architectural tradition. The evolutionary changes in the utilization of these ideas in new designs, consequently in new conditions, their inherited and changed characteristics in each instance were identified. This investigation further illustrated how an idea was reappraised and reinterpreted in different conditions.

## 7.2 Implications and Possible Future Extensions of the Models

The evolutionary models and the associated theses provide a framework that has a wide scope of applicability. In general, they might have implications for issues that are related with tradition, architectural knowledge, and architectural ideas, issues related with the design process and the designs. However, their implications for various specific issues could be summarized as follows:

● Apart from their power for explaining architectural phenomena, the models and the related conceptions of the architectural designs can be used as a conceptual and methodological basis for studying past architectural designs, and developing methods and tools towards this end. The models and the related theses also provide a rigorous conceptual basis for architectural criticism. These issues were manifest in the case study that isrelated with the single-family house in Breganzona. Furthermore the methodology conceptualized and applied in the examination of the single-family house in Breganzona deserves a special mention. It was a special methodology proposing a particular focus on and the study of the recorded material during the design process of the work (or design) instead of the actual process itself. Here the material is taken as the means of externalization of the "thought contents" or the ideas during the design process, hence conceived as the carriers of such content. Second important aspect was the hypothetical reconstruction of the process that made or let the preconceptions of the one who makes the examination to be projected onto the examined material, hence lead to the production of content-rich and unique readings.

● Related with the previous issue, the models can be used as a basis for developing models, methods, strategies, and tools to be used in architectural education. For example, as the carriers of architectural ideas, past works are the important sources, from which these ideas could be taken and made one's own. This reminds a well-established tradition in architecture, the study of past works in the pedagogy of the design studio.[49] However, as it was stated in the previous paragraph, the evolutionary model and its views of the architectural works imply a special type of investigation, a powerful one that at least goes beyond a conventional formal analysis of past designs. To a degree, this was also manifest in the analytical studies in the Chapter 6.

● The models and the conceptual framework they provide can be utilized as a theoretical and conceptual basis to re(view) relatively new issues and phenomena introduced to architecture. For example, the framework provided by the "evolutionary model of architectural design process" presents a rigorous basis for viewing the utilization of computer software for the design process, the issue of computational creation of form, and other such issues that in their recent practice, seem to be prone to turning into determinist or formalist[50] approaches.

● The models can be used for addressing already existing issues in architecture. For example, the notion of "selective conditions" apparently has the potential and much to offer to Vidler's call for an expanded conception of the architectural program and a "new environmentalism."

[49] As it is stated by Akın (2002, 40) in fact, studying past works use to be an important part of the pedagogy of architectural design instruction, particularly in the studio setting. From a wider perspective, "schools of educational thought," such as Renaissance, *Ecole des Beaux Arts, Bauhaus*Post-Modernism, and Deconstructivism relied on corpus of designs as one of the important component of their pedagogical model, employed as a supplement to "the learning experience of the students during the course of their formal training."

[50] See footnote 13 of the Chapter 1.

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# APPENDIX A

# GLOSSARY

**Architectural Ideas**: The “architectural ideas” are the architectural correspondent of the “thought contents” or “objective contents of thought.” In this conception, all the actual and possible “thought contents” which architectural designs, and architectural design process might involve, are conceived as architectural ideas (Also see thought contents).

**Dominant:** The **“**dominant” or the “dominant formative idea” refers to architectural ideas that have a high formative or organizational capacity and a dominant formative role in the design process, in the formation of a design. Such ideas have a major formative control over the design, and a control over other ideas. The concept might be roughly interpreted as the architectural counterpart of the concept of dominant or *dominanta* as it was conceived by Russian Formalists. In Russian Formalism, the “dominant” refers to “preeminent component or group of components,” which insure “…the unity of the work … as well as its ‘perceptibility’…” (Erlich 1981, 199).

**Formative Idea:** The “formative idea” is a notion proposed by the present study as a part of the evolutionary model of architectural design. A formative idea stands for the architectural ideas that have a formative contribution to the formation of a design. Formative ideas can further be divided into two sub-categories, as “dominant” or “major” formative ideas, and “subordinate” or “minor” formative ideas.

**Selection Theory:** It is a generalized version (or interpretation) of Darwinian “mechanism” or “pattern” of evolutionary change which refers to “variation and selective retention," or more generally, to "trial and error-elimination," with the particular emphasis on the "selection" or "error-elimination."

**Selective Conditions:** The "selective conditions" is a notion proposed by the present study as a part of the evolutionary model of architectural design. It mainly refers to the "conditions" which are constituted by the physical world, world of ideas and the design itself which are operational in the evaluation/selection stage of the design process.

**Selective Idea:** The "selective idea" is a notion proposed by the present study as a part of the evolutionary model of architectural design. A selective idea stands for the architectural ideas that have a selective/evaluative contribution to the formation of a design. It is a part of the selective conditions, which are operational in a design process.

**Three-World Ontology**: This is an important part of Popper's (objectivist) evolutionary epistemology, which conceives the universe as consisting of three distinct but interacting sub-universes or sub-worlds: The physical world, the mental world and the world of the products of the human mind or the world of ideas.

**Thought Contents**: The "thought contents" or the "objective contents of thought" mainly refers to constructs or conceptions of the human mind. It is an important concept belonging to Popper's epistemology and a part of his three-world ontology, which corresponds to "ideas."

## VITA

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| 2004-Present | METU, Department of Architecture | (35. Madde) Res.Asst. |
| 1996-2003 | ESOGÜ, Department of Architecture | Res.Asst.- Instr. |
| 1993-1996 | ART Mimarlık (Own office) | Architect |
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Professional Experience (~15 years)
~4 Years of professional practice (project and applications)
~11 Years of teaching practice (4 years in M.E.T.U. 7 years in ESOGÜ-Eskişehir)
~11 years design studio critic (continuing in the 4th year studio with Prof.Dr.Yıldırım Yavuz and Dr.Fuat Gökçe)
~5 years in computing, programming and related.

Areas of interest

Computer programming
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1.Anay, H., “A Critical Approach to the Use of Computers in Architectural Design,” *Digital Design: A Quest for New Paradigms*, proceedings of the eCAADe Conference. Lisbon-Portugal, 2005.
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3.Anay, H., “On the Relevance of Karl Popper’s Epistemology for Architectural Education,” *Built Environment and Information Technologies* Proceedings of the CIB PGRC. Ankara-Turkey, 2006.
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8.Anay, H., “Studying past architectural works in creative architectural problem solving” in *Emerging Trends in Design Research* Conference Proceedings of the IASDR. Hong Kong SAR-China, 2007.

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Journal Papers
1. Anay, H., Özten, Ü., “Dijital Dönüşüm: Osmangazi Üniversitesi Mimarlık Bölümünde bir Paperless Studio Deneyimi Değerlendirmesi,” in *Yapı Aylık Mimarlık Kültür ve Sanat Dergisi* 274, 2004 (In Turkish)
2. Anay, H.,, “Sayısal Tek Görüntü Düzeltme Tekniğinin Mimari Belgelemede Kullanımının Değerlendirilmesi: Lefkoşa, Mısırlızade Han Örneği,” in *Yapı Aylık Mimarlık Kültür ve Sanat Dergisi* 312, 2007 (In Turkish)