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ANALYSIS AND EVALUATION OF THE DESIGN PROCESS OF MARIO BOTTA'S SINGLE-FAMILY HOUSE IN BREGANZONA

Hakan ANAY[1]

ABSTRACT: *This study involves analysis of the sketches and the drawings produced during the design process of a house designed by Mario Botta and evaluation of the process itself. The conjecture/analysis model of design is assumed. The main outcome of the study is the findings, observations, and interpretations related with the nature of the analyzed design process. It is expected that the concerned outcomes will provide a basis, a departure point for the reconsideration, advance, and a consequent evolution of the assumed model, and a basis for further research following the same line of inquiry.*

Keywords: *Architectural Design Process, Design Method, Conjecture/analysis, Evolutionary Epistemology, Mario Botta*

MARIO BOTTA'NIN BREGANZONA'DAKİ TEK-AİLE EVİNİN TASARIM SÜRECİNİN ÇÖZÜMLEMESİ VE DEĞERLENDİRMESİ

ÖZET: *Bu makale Mario Botta tarafından tasarlanmış bir evin tasarım süreci boyunca üretilmiş eskiz ve çizimlerinin çözümlemesini ve tasarım sürecinin değerlendirmesini içermektedir. Çözümlemede, conjecture/analysis olarak bilinen tasarım modeli kabul edilmiştir. Çalışmanın ana çıktısı incelenen tasarım sürecinin doğasına ilişkin bulgular, gözlemler ve yorumlardır. Bu çıktıların başlangıçta kabul edilen conjecture/analysis modelinin yeniden değerlendirilip, gelişmesi ve evrimleşmesinin yanısıra, bu çizgide geliştirilebilecek başka araştırmalar için bir temel, bir başlangıç noktası oluşturacağı düşünülmüştür.*

Anahtar kelimeler: *Mimari Tasarım Süreci, Tasarım yöntemi, Conjecture/analysis, Evrimsel Epistemoloji, Mario Botta*

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I. INTRODUCTION [2]

Conjecture/analysis is accepted as an important paradigm of design in design methodology circles. It was first introduced in 1972 by Bill Hillier, John Musgrove and Pat O'Sullivan in their seminal essay titled "Knowledge and Design" [2]. Their rigorous analysis and application of Popper's evolutionary epistemology to design methodology was followed by the succeeding articles including Jane Darke's "The Primary Generator and the Design Process" [3] and Stefani Ledewitz's "Models of Design Studio Teaching" [4]. These studies constitute a line of inquiry, or more specifically a tradition that come down to the present day, and recently represented and advanced by Bamford's review titled "From Analysis/Synthesis to Conjecture/Analysis: a Review of Karl Popper's Influence on Design Methodology in Architecture" [5], and an earlier article titled "Design, Science and Conceptual Analysis" [6].

The present study can be interpreted as a continuation of this tradition. It is based on the idea that the model can be reconsidered, advanced, and evolved. It primarily aims to provide a basis, a departure point towards this ultimate aim.

With this respect, in the present study the design process of a house designed by Mario Botta was analyzed with reference to the conjecture/analysis model of design. Actually, what was analyzed is not the actual process itself, but rather the material; the sketches and the drawings produced during the design process.[3] By nature, it is a formal/conceptual analysis.[4]

The essay consists of three parts. Apart from the introduction, the first part contains a summary of the conjecture/analysis model of design. The second part involves a detailed analysis of the "material" produced during the design process. The essay ends with the statement of the observations and conclusions drawn from the analysis as well as a number of interpretations and suggestions towards the stated aim.

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[2] *The conceptual and theoretical basis of the present study mainly refers to my doctoral disseration titled "Two Evolutionary Models for Reconceptualizing Architectural Ideas and the Architectural Design Process," [1] completed in Middle East Technical University, under the supervising of Assoc. Prof. Dr. Emel Aközer.*

[3] *Actually, such an approach was due to the applied method(ology) with reference to the "objective approach," for the analysis and understanding of the "products of the human mind" of which theoretical and conceptual framework was originally formulated by Karl Popper [7], as a part of his Evolutionary Epistemology. The common epistemological and ontological basis of the applied method(ology) and the conjecture/analysis model of design must be emphasized.*

[4] *For one of the old and well-known methodological application of such an analysis, see Peter Eisenman's doctoral dissertation titled The Formal Basis of Modern Architecture [8] of 1963.*

II. CONJECTURE/ANALYSIS MODEL OF DESIGN: A SHORT SUMMARY

As it was stated the epistemological roots of the conjecture/analysis model of design was based on Karl Popper's evolutionary epistemology. Popper [9] 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 or modify what was proposed. In this sense, the procedure or process of science (or scientific discoveries) essentially involves trial and error, or more specifically conjectures and refutations.

The model is transferred to architecture with a particular emphasis on the preconceptions and "conjecturing." In Hillier, Musgrove and O'Sullivan's words, "… design is essentially a matter of pre-structuring problems either by a knowledge of solution types or by a knowledge of the latencies of the instrumental set in relation to the solution types…". Conceiving approximate solutions early in the design process helps the designer to "understand the problem," and these approximate solutions work as departure points to initiate the design process, something to work with, to develop, and to evaluate. Two important aspects of the model can be identified in Hillier, Musgrove and O'Sullivan's formulation: First is related with the "evolutionary" or "selectionist" aspect of the process owing to its roots in Evolutionary Epistemology: "… 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". Second is related with the "developmental" aspect of the process: "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" [2]. In this sense, the "solution in principle" conceived early in the process is "… progressively developed and refined (or discarded)" [3].

Actually, conjecture/analysis should not be taken as a design method, but rather as a model of architectural design, which refers to a process or a procedure that has its own specificities.

III. ANALYSIS OF THE DESIGN PROCESS[5]

The selected case for the analysis is the single-family house in Breganzona, one of Botta's relatively late designs (Figure 1). The primary rationale behind the selection of this design is that every stage of its design process is recorded, and the provided material is enough and relevant to support the present argument and in developing a fruitful, content-rich discussion.

Figure 1. *Single-family house in Breganzona August 2008 (Photo by Meltem Anay).*

As far as one can follow from the materials provided, design of the single-family house in Breganzona begins in September 1983 and ends in October 1986. In the present analysis, the sketches and drawings; the "material" produced during the design process is taken as a means of externalization of the ideas operational during the process. As it was already stated, what was examined in this section is not the actual process itself, but rather the material produced during

[5] *The analytical drawings in this section are selected from the drawings originally prepared by the author for his doctoral dissertation, and they are retouched and reorganized for the specificities of the present study. It must also be emphasized that a more comprehensive and detailed study of the single-family house in Breganzona takes place in the mentioned dissertation. The building was visited and examined in the summer of 2008 and the photographs of the building are taken at that time by the author and by Meltem Anay. The original sketches and drawings used in the present analysis are taken from Mario Botta: Una Casa [10].*

the design process. In turn, the process, which is the subject of the examination, actually relates to a set of “hypothetical reconstructions” that might not correspond to the actual design process.

III.1 September 1983

The initial formative idea is a rectangular solid, almost a perfect cube, and in plan, a perfect square (Figure 2, a-e,k). These two complementary ideas work as the primary formative elements with which the design investigation begins. At this stage of design, both the square and the rectangle control the outer boundaries of the design, and its overall form. On the other hand, 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. The organization gives four perfect squares, with equal sizes, located at each corner of the square, and a cross-axial space in-between these squares (Figure 2, m). Resultant centrality and the perfect symmetry of the plan are noticeable (Figure 2, n). This inner 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 2, j,o). There are two important operational 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 it filters out the incompatible ones. For example, the apertures on all four sides remain as “slits” seeming to be carved out of the initial mass, which do not destroy the overall mass effect of the design. 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. However, neither axis is given primary importance at present. There is, also, a diagonal axis in the plans but only barely identifiable (Figure 2, a-e,l,m). 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.

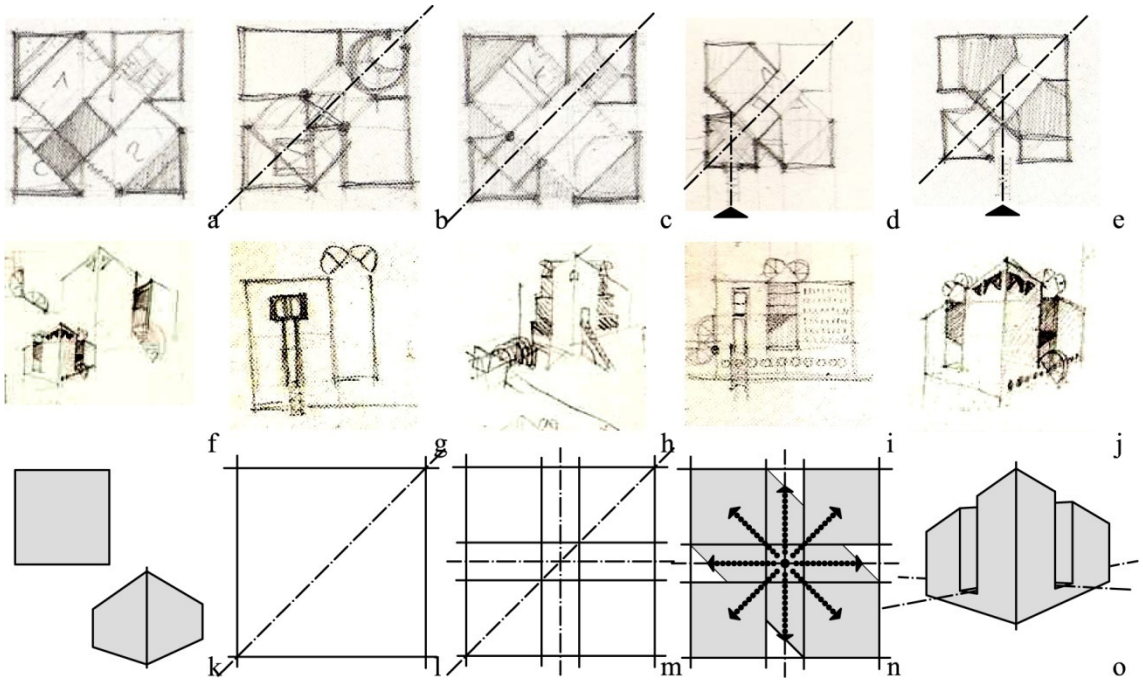

Figure 2. *September 1983 (a-e retouched, k-o drawn by the author).*

There are a 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. There seem to be two competing variations, one circular, and the other rectangular (Figure 2, a-b). This is the first formative intervention that disturbs the orthogonal symmetry and the centrality of the original schema both spatially and programmatically. Another identifiable element is the entrances. At present, there are two variations. One of the variations proposes an entrance at the middle of one of the facades, right into the cross-shaped inner space (Figure 2, e). The other variation introduces an entrance through the rectangular space that is located in the opposite corner of the stairs (Figure 2, d).

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.

III.2 September-October 1983

While leaving the major formative ideas of rectangular solid and 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 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 (Figure3, a-c). 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 (Figure3, a). This element violates the selective condition implied by the initial major formative idea: the perfect rectangular solid effect. At this stage, the idea of external frontality is introduced. This is a new idea that puts the primacy on one of the façades. 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 element 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 (Figure3, a). 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 (Figure3, f-j). 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.

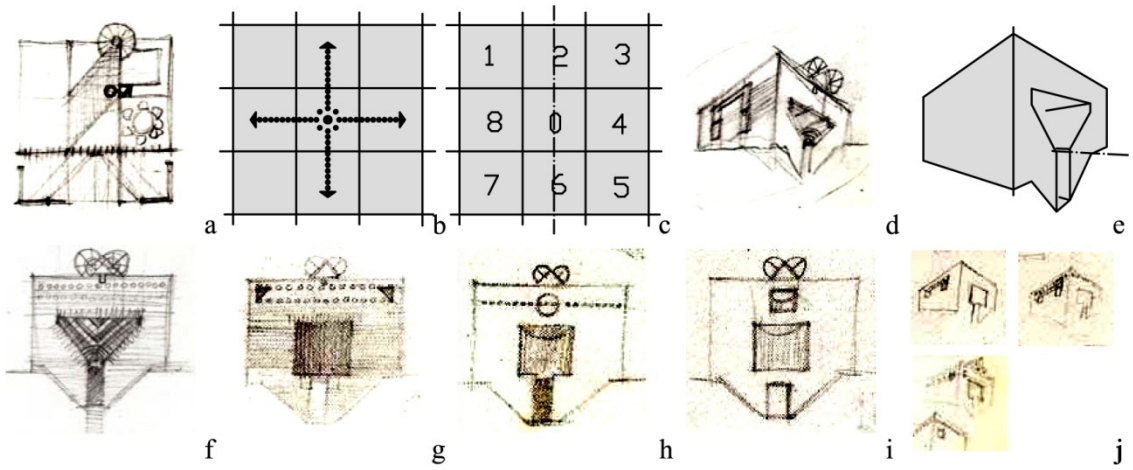

Figure 3. *September-October 1983 (b-c, e drawn by the author).*

III.3 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 4, b). 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. 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.

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 4,j). From a certain perspective, the overall appearance is quite similar to the one produced in the initial stage of the design process.

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. 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 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, 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, the other is reserved for living spaces, and the corner is used for service spaces such as kitchen(s), bathrooms, and stairs. 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 variation occurring primarily based on the 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 (Figure 4, d,i,l-o). 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 (Figure 4, n). Introduction of this idea marks an important formative and evolutionary change in the design.

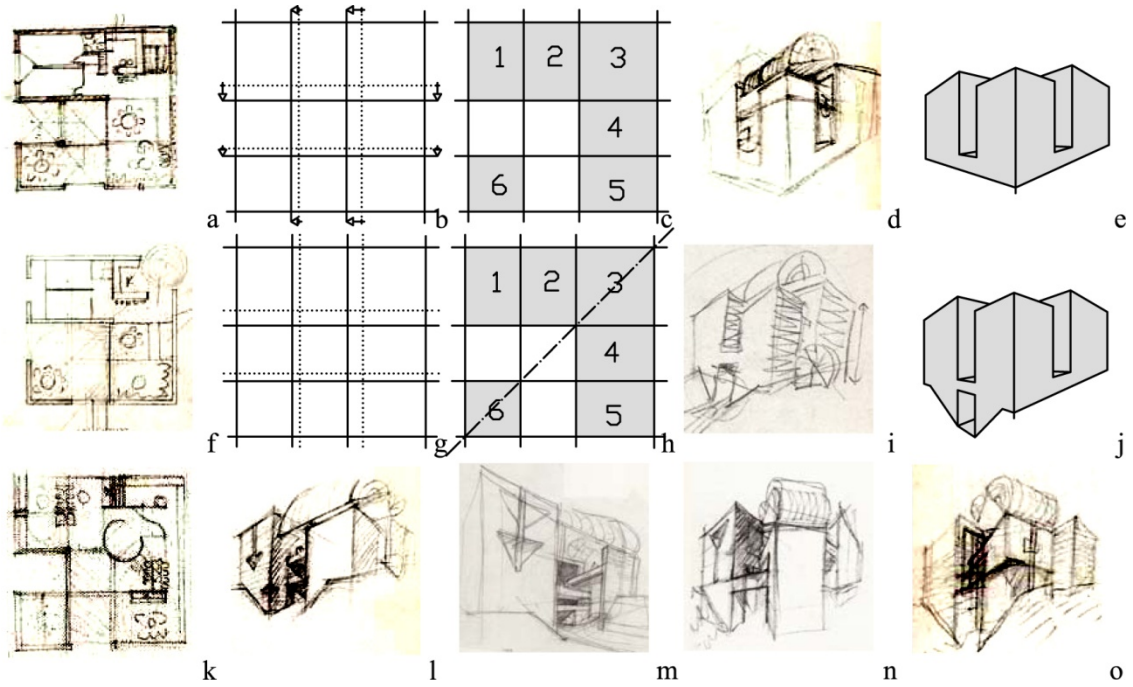

***Figure 4**. November-December 1983 (b-c, e, g-h, j drawn by the author).*

III.4 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 4, g). The major spatial organization, the "L" shaped sequence of cells, the "L" shaped semi-open space, and the corner tower are preserved. 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 4, k), or at the outer one (Figure 4, f). In both cases, stairs gain a central position, and become a key element in the plan organization. A return to a conventional programmatic organization is also observable. In these variations, two-entrance scheme is also retained, one entrance for cars, the other for the pedestrian access.

III.5 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 as a 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.

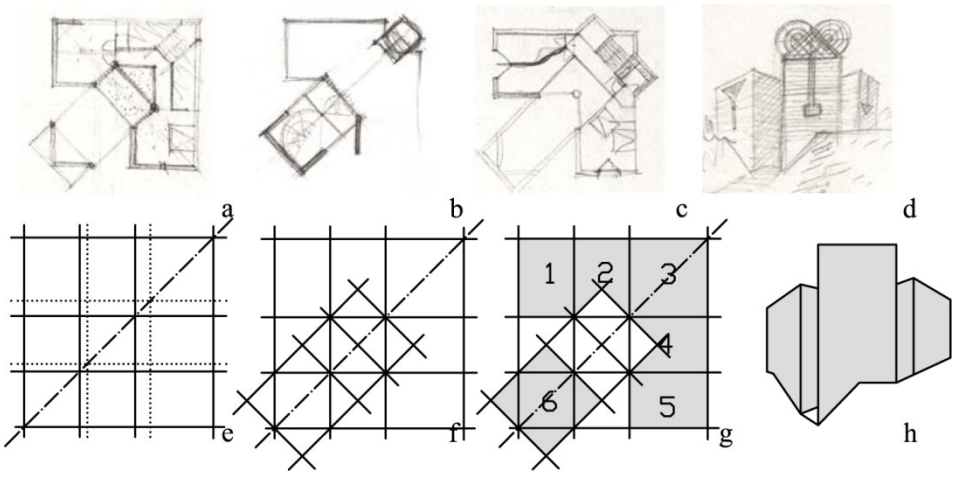

***Figure 5**. January 1984 (e-h drawn by the author).*

Following this major change, 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. The tower is 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 5).

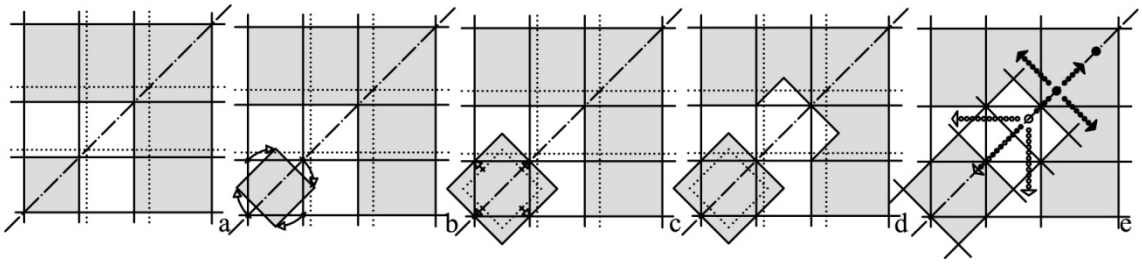

Figure 6. *Hypothetical reconstruction of the formative operations January 1984 (drawn by the author).*

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. 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 6, a-c). However, in the third 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.

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 7, a). The technical drawings are not merely solidified records of the investigations made in this stage. There are also 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. 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 7, c). 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. The center of the "L" shaped block is also chamfered inside, aligning it with the corner tower, and gaining more space (Figure 7, e).

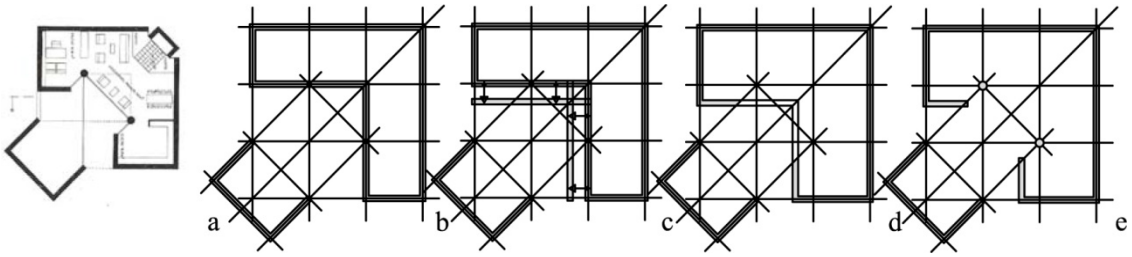

Figure 7. *Transformation of the initial schema (Drawn by the author).*

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 relate to the inner semi-open space. The double-entrance idea is abandoned and replaced with single entrance for both cars and the pedestrians from the basement floor. The house is only indirectly accessible. The idea operational at this point might be expressed 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 this idea, do not permit any direct entrance to the house. The entrance is almost a hole, just opened on the main solid, without any expression and without any particular emphasis.

III.6 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. In this variation, 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 8). 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 4). They are like two small towers, capped at the top and latticed at the bottom. The masses are raised above the ground level, somehow giving an impression of hanging on, or attached to the main body of the building. The diagonal axis seems to be operational at the background, formatively controlling the new element.

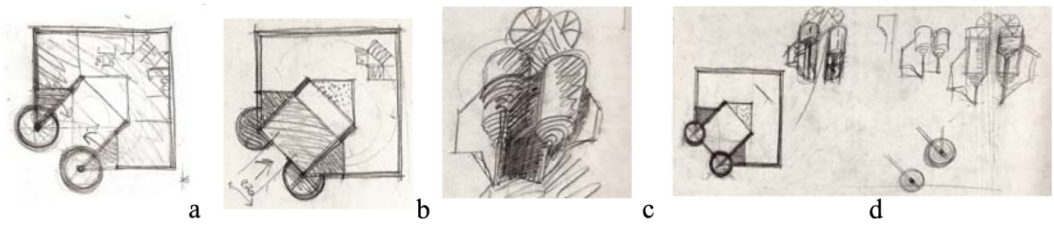

Figure 8. *February 1984 variations.*

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, by modifying the shape, by testing various textures, and so on (Figure 9).

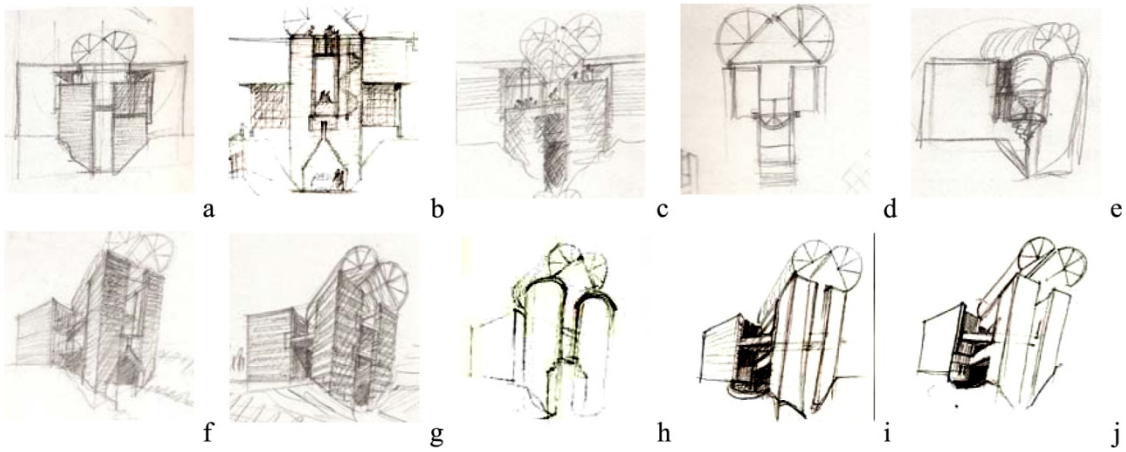

Figure 9. *February 1984, variations concerning the entrance and corner tower.*

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 10, 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 10, 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. 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. 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. 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.

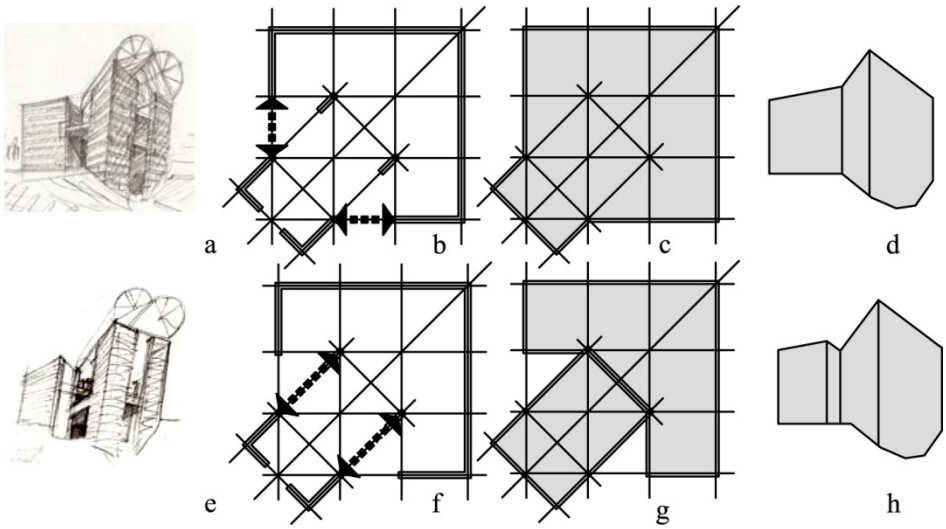

Figure 10. *February 1984, comparative analysis of two variations of the corner tower (b-d, f-h drawn by the author).*

III.7 July 1984

From the materials provided, it seems that this stage of design mainly 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 entrance variations.

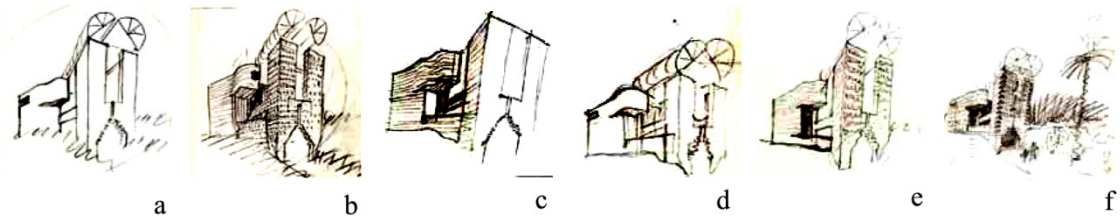

Figure 11. *Variations: the relation between the main block and the corner tower.*

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 11). There are a number of variations, with a single curve, multiple curves, with and without 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, an element that physically transforms it (Figure 12). 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.

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. The idea 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.

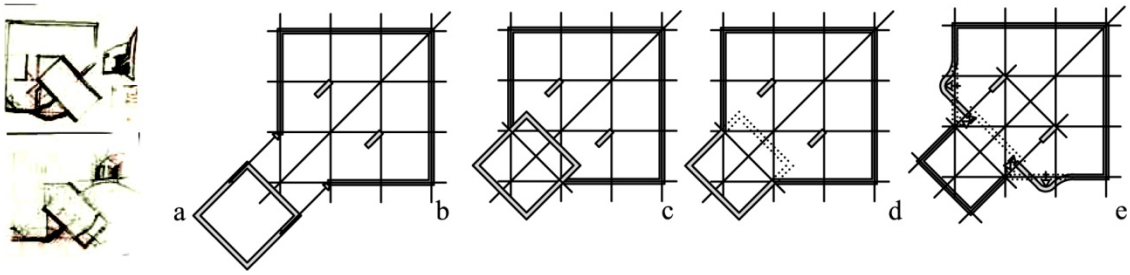

***Figure 12**. Transformation of the main block by the insertion of the corner tower (b-e drawn by the author).*

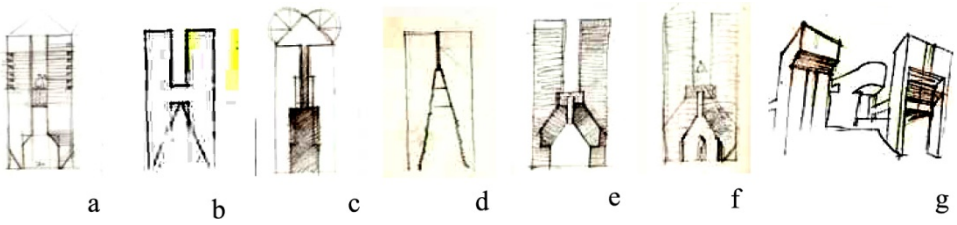

***Figure 13**. Entrance variations.*

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, depending on the entrance proposed. In some variations, upside-down wedge-shaped and upside-down funnel shaped 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 13).

III.8 September 1984

The whole material is solidified into finalized technical drawings in this stage. 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 15 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.

Figure 14. *Technical drawings of the finalized design.*

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 15). 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.

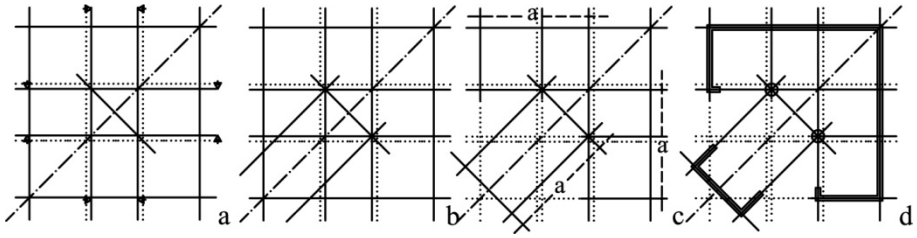

Figure 15. *Formative operations September 1984 (drawn by the author).*

The pillars of the previous stage (Figure 16, 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 16, 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 16, b-c). The corner tower is structurally tied to the grid by the center columns.

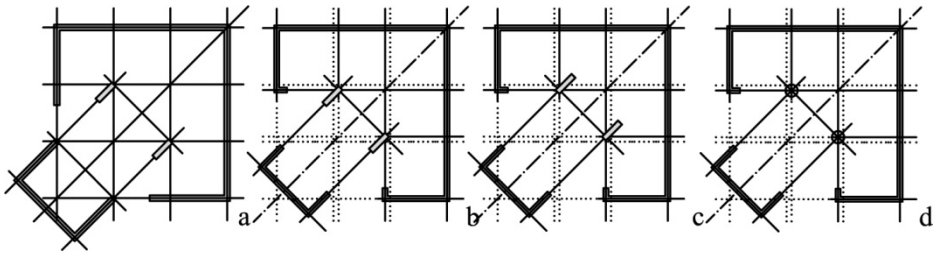

Figure 16. *Formative operations September 1984 (drawn by the author).*

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.

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 close. 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.

IV. EVALUATION [6]

Apparently, the design process, as it was theoretically reconstructed from the recorded material produced during the design process, could be very well explained with reference to the conjecture/analysis model of design. On the other hand, the following points are important for the advance and the evolution of the model.

The analysis showed that design process is about variety reduction as it was suggested by the proponents of the conjecture/analysis model, but equally, it is about variety creation. In each stage, addressing various facets of the design, many variations are created and these variations are evaluated and filtered with reference to evaluative or selective conditions. 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. Actually, a design is not a solution itself, but a thing, which might only provide potentials and conditions.

Consequently, we may also say that since not all the conditions relevant to a design can be known, either at the beginning 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, at the beginning of a design process, theoretically, there are infinite variations possible.

It is 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, the analysis showed that the process 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 in various levels.

Yet from another point of view, we may say that the procedure of conjecture/analysis or trial/error did not merely work on the level of the whole design. Rather, there were trials, in various levels and with different characteristics, such as introduction (and evaluation) of a number of entrance variations, spatial organizations, apertures, etc. superimposed on the overall

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[6] The analysis study can be evaluated from various viewpoints, with different emphases addressing different facets.

design and evaluated by the conditions of the present design situation. These ideas or elements also followed the procedure of conjecture/analysis or trial and error elimination. In this sense, we may say that the conjecture/analysis procedure or process is operational within the design process.

However, it might also be argued 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.

One can identify the evolutionary or selectionist pattern within the process. There are a set of ideas, elements, operations of formative nature that contribute to the formation (conjecturing or trials) of the design, and a set of conditions that are used for evaluation (selection or filtering) of what was proposed. The conditions not only consisted of physical conditions but also ideational ones.

When we examine the present state of the building, we can still identify an evolutionary or selectionist pattern in its life. For example, in its present state the main frontal entrance following the diagonal axis is blocked by landscaping and not used at all. Possibly, there are two conditions operational in this transformation: First, as far as the physical environment is concerned, there is hardly a need for such a pedestrian relation. Second, related with this, the main entrance just at the corner of the traffic junction is just too dangerous owing to the narrow road, a blind spot for traffic and no pedestrian sidewalk. These two conditions did not let the entrance to exist and consequently it was in a sense eliminated. Related with this, we may also say that many variations filtered during the design process might be successfully developed into a finalized design, and some of these designs even might be more successful after their completion as a building.

V. CONCUSIONS

In my opinion, what appeals to the proponents of Evolutionary Epistemology (and to Popper) in the theory of evolution or the selectionist paradigm was not primarily related with how things come into existence (or if we prefer, how conjectures or trials are created) but rather, how

unsuccessful variations (or if we prefer trials or conjectures) were selected (or eliminated) and how successful ones were retained. This was the very basis of Popper's critical approach and this was the very essence of Evolutionary Epistemology, and apparently Popper's "conjectures and refutations." I believe the model's application to architecture, the conjecture/analysis model of design, needs reconsideration with such an emphasis, and this might be one of the productive lines towards the model's advance and evolution.

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