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Research Article

The Hidden Geometry of the Douglas House

Saleem M. Dahabreh
Department of Architecture, University of Jordan, Jordan

Abstract: This study aims to uncover the hidden geometry that regulates and orders the design of the Douglas House by Richard Meier. Richard Meier, over a five decade career, has been associated with a recognizable design language that has a clear set of formal characteristics and design themes, including among others: geometrical order exemplified in the use of modules and proportions and visual layering that organizes space in his buildings through the arrangement of successive planes across the visual field. Taking the Douglas house as a case study, the aim of the study is to show how these themes and motifs are employed in a particular building with a particular emphasis upon the geometrical ordering of building plans and elevations and the modular and proportional systems entailed in this ordering. This choice of emphasis is not coincidental: while other aspects of Meier's language may be equally important from the point of view of the perceptual qualities or the aesthetic judgment of his buildings, geometrical ordering most closely regulates and interacts with the overall arrangement of formal elements of the building. The study concludes that the final form of the house depends on the interaction between a design program and a formal language but is not determined solely by any. Abstract spatial themes such as reversal and twin phenomena also materialize in the physical form of the building through the artful manipulation of design elements.

Keywords: Formal language, geometry and proportion, motifs and spatial themes

INTRODUCTION

In the late 1960s, the Museum of Modern Art in New York brought together the work of Peter Eisenman, Michael Graves, Charles Gwathmey, John Hejduk and Richard Meier, a group that came to be known as "The New York Five" in the subsequent book Five Architects published in 1975 by Colin Rowe. Their work, with an explicit reference and allegiance to the classics of Modernism in the 1920s and 1930s, especially that of Le Corbusier's villas, made the exhibition pivotal for the evolution of architectural theory and history because it produced acritical benchmark against which other architecture theories of postmodernism, deconstructivism, neo-modernism and others have referred, critiqued or subverted (Tafuri, 1976).

Among the five, Meier was closer to the modernist aesthetic of the Corbusian form and even the later buildings, Meier produced since then have all remained truest to this aesthetic (Din and Economou, 2012). This aesthetic is manifested in the use of the 'five points' of Le Corbusier especially the separation of skin and structure and the deployment of rational articulation of a single mass regulated by geometry and proportion. Starting with the Smith House in the 1960s, Meier developed certain work tactics with design elements and operational procedures that become constant and consistent across a wide spectrum of designs and building types, thus forming a signature 'style'. Meier's style involves the interaction spatial motifs and themes and formal syntax. A spatial motif is defined as a general abstract concept that has no specific form but can be taken as an underlying premise for the development of a design. Spatial themes are constraints drawn from the readings of the context that specify definite design desiderata without specifying particular form. A formal syntax realizes the previously unspecific desiderata into specific geometric form (Peponis *et al*., 2003). Meier's syntax include elements such as 'stairwells and ramps', 'squared white enamel skin', 'nautical railings', 'expansive glazing with aluminum mullions', 'glass blocks', 'piano curves' and brise-soleil, giving his buildings a 'machine-like' aesthetic (Rykwert, 1991; Hutt, 1999). Meier's themes include: modulation and proportionality, layering, reversal and twin phenomena, promenade architecturale, 'colorlessness' of white to dematerialize structure and construction materials to stress a situation of universality and a-contextualness design linked more to an abstract ideal process and less to real context (Cassarà, 2005; Dahabreh, 2006).

Over a five decade career, Richard Meier has been associated with a recognizable design language that consistently evolved across a wide range of building types, a language that has been sketched out across numerous publications by many authors and researchers: Rykwert (1984), Frampton (1991), Richards (1993), Giovannini (1996) and Cassarà (2005), among others. This study will not give an

exhaustive review of Meier's biography, background influences, or work; rather, it will present a nucleus of a Meier formal design language through a formal analysis of the Douglas house. The choice of the Douglas house is not coincidental: in his commentary about Meier's early houses, Morton (1973) noted that "...only in the design of a private house do ideas have an opportunity to become synthesized and crystallized...it can, in effect, stand testament to his architectural theories and design ideas." Meier (2007) commented "the residential commission allows one to formulate ideas and develop a set of principles that, one hopes will inform future works for a long time to come."[1] As such, Douglas House is selected because it represents the maturity and consistency of Meier's formal language in the 1970s, a maturity that persists across his later career.

This study aims not only to clarify 'how' Meier's design themes and motifs are employed in a particular building, but most importantly, to make explicit the underlying geometry that regulates Meier's early houses. The explication will also show how these abstract themes and geometric forms used by Meier interact with the modularity of the house. The particular emphasis upon the geometrical ordering of building plans and sections is not unintended; while other aspects of Meier's language may be equally important both perceptually and aesthetically, geometrical ordering through proportional systems and regulating lines most closely regulates and interacts with the overall arrangement of formal elements of the building.

MATERIALS AND METHODS

The house, constructed between 1971-1973 for James and Jean Douglas, is located in Harbor Springs, Michigan. The white house, aligned along a North-South axis with four floors composed in pure geometry, is anchored on a sheer bluff overlooking Lake Michigan lies in sharp contrast with the pine trees of the wooded site (Fig. 1). The entry is off a quiet country road on the east side of the house (Fig. 2). A flying bridge spans the ravine to the front door vestibule (Fig. 3). The top floor, the only floor visible from the road, contains only an entrance vestibule and roof decks, restricts the view of the lake to the west. Once inside, an enclosed stairway deposits the visitor on the upper main bedroom floor overlooking the two-story living room with the fire place in view across from the entry (Fig. 4).

On the middle level floor, the stair descends next to the living room floor, which also contains the master bedroom and then to a lower level floor that contains a dining room, a kitchen and another bedroom (Fig. 5). The lowest floor containing the basement area and mechanical equipment is accessible from a cantilever stair flies out over the treetops on the other corner of the house connecting the living room level and the dining room level decks. Another set of outdoor steps connects the deck of the living room to the bedroom level deck.

Fig. 1: The Douglas house, a white machine perched in the natural woods copyright Richard Meier

Fig. 2: Site plan of the Douglas house showing the relation to the sea and the drop off road copyright Richard Meier

Fig. 3: The flying bridge leading to the entrance of the house copyright Richard Meier

Fig. 4: The balcony furthest overlooks the lake view, chimney and the double volume living room. Natural day light also penetrates from the top skylight copyright Richard Meier

The Layout of the house expresses a programmatic separation of the public and private; small cabin-like

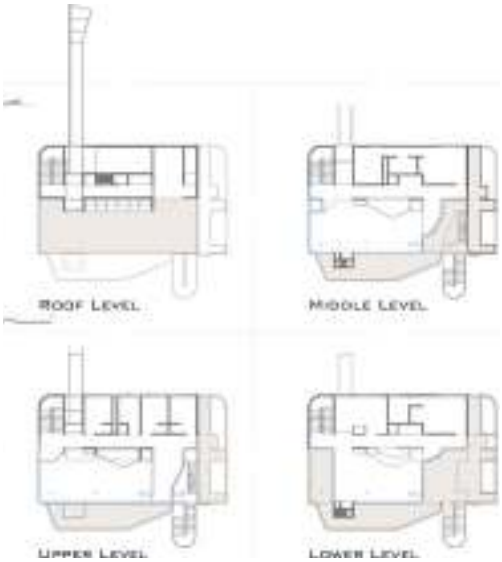

Fig. 5: The plans of the Douglas house redrawn to scale by author

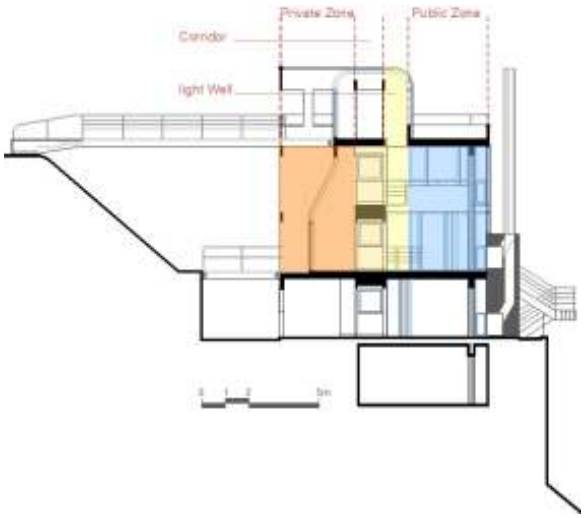

Fig. 6: Section showing the anchoring of the house to the hill and the pragmatic separation of functions

Fig. 7: Day light coming from the light well adding drama to the space and conceptually separating the functions copyright Richard Meier

Fig. 8: The curvilinear cut in the slabs brining day light towards the lower floors copyright Richard Meier

Fig. 9: The Western glazed facade showing the white concrete, glass and stainless steel pipes for the chimney copyright Richard Meier

Fig. 10: The colorlessness of the Douglas house emphasizes its dual nature especially with its contrast with nature. copyright Richard Meier

Fig. 11: The theme of ‘reversal’ or 'twin phenomena’ in the 'duality' in the external reading of the house: the western glazed façade open to the surrounding landscape, with a view of Lake Michigan, while the eastern façade, facing the road, is a white wall, fenestrated only by few windows

bedrooms are arranged on the Eastside, while the living room, dining room, in addition to the terraces and balconies are on the Westside facing the lake view (Fig. 6 to 11). These zones are mediated by a corridor

running parallel to the lake on each floor. Adjacent is a rectilinear light well that cuts through the entire living space (Fig. 7) bringing light from a skylight across the public zone through an elegant curvilinear cut in each slab (Fig. 8). As Meier's work is all in white, Douglas house is no exception, it is made up of white reinforced concrete and glass, except for the wood flooring and the stainless steel chimney pipes that function as flues to a fireplace inside a white box (Fig. 9).

Rowe (1975) talked about a duality embedded within the Smith House; ideal and abstract and real and analytic. Like its antecedent, the Douglas House has both; the abstract is manifested in the spatially layered linear system with the clear circulation that runs along and across the layers, while, the real and analytic has to do with three pairs of reference criteria: site and program, circulation and entrance, structure and enclosure (Göussel and Leuthäuser, 2005). Meier affirms his abstraction through the 'colorlessness' and 'a-contextualness' of the white mass of the house (Fig. 10).

In order to achieve the 'spatially layered' design, Meier restructured the program into public and private functions that were grouped into two consecutive zones perpendicular to the entrance axis. The vertical lighting coming through the light well conceptually emphasizes the sense of vertical separation between the public and the private zones (Goldberger, 1974). Here one can argue that the functional division also affected the physical expression of space where the private functions became a series of enclosed 'cellular' spaces marked by walls, while the public zone is a series of platforms within a single volume enclosed with glass skin, with the main circulation corridor mediated spatially between the two zones. The house itself appears to be, like the Smith House, a hyphenation of two canonical Corbusianstructures: the Citrohan house and the Domino house (Din and Economou, 2012). Furthermore, similar to Villa Savoye, the house takes advantage of the roof to function as a terrace or an outdoor recreation space.

The dialectic between the binary oppositions of 'open' and 'closed', private and public are also expressed in the structure where the private zone is of load bearing walls with openings, while the public zone is a grid of columns and beams that supports the horizontal planes with a glass skin overlooking the view, creating a 'duality' in the reading of the house. The external facade treatment also expresses the functional zoning on the inside: the western-public-façade, with its large floor-to-ceiling windows, is open to the surrounding landscape and has the view of Lake Michigan, while the eastern-private-façade, facing the road, is an opaque white wall, fenestrated only by few windows. The treatment of the facades also shows how Meier supported his concept using a progressional theme, from dark to light as well as from solid to void. As such, the duality in the treatment of the house reflects one of Meier's reoccurring themes 'reversal' or 'twin phenomena' as represented in both plan, elevation and spatially in the third dimension.

The house is connected to the site via a bridge at 90° to the 'entrance' wall suggesting a 'frontal' approach to the building (Fig. 3). Meier created the entrance as a cut through the 'entrance' wall, as labeled by Rykwert (1991), creating an element of surprise when the view of the lake is revealed through the triple volume expansive glass skin. This approach over the bridge and through the entrance wall creates a promenade architecturale that dramatizes the experience of the house. The promenade experience is further augmented by the allocation of the vertical circulation at diagonally opposed ends with the corridor as a link implying diagonal transference within the primary orthogonal organization of the plan and acknowledging the diagonal fall and magnificent outlook to the lake.

Meier (2007) refers to the Douglas house as "a machine-crafted object that has landed in a natural world". The contrast between the machine made and the natural displaces the connotations associated with Le Corbusier's dictum that the house is a machine to live in; here one lives a tension and reconciliation between the natural and the man-made, a composite order where the man-made points to the natural and acts like a stage for appreciating the natural (Fig. 10). Furthermore, the Douglas house is often called The Ship, most probably because both are white masses in contrast with naturally colored context: a ship is a machine floating over water, similarly to Douglas house, a machine that floats amidst the greenery of the forest. The ship analogy and the nautical sense of the house is further augmented by the steel chimney pipes and wooden floors, as well as the numerous terraces with rounded metal rails on multiple levels overlooking the panoramic view of the lake.

Furthermore, the use of the flying bridge as the sole entrance to the house induces the feeling of a drawbridge indicating the use of another metaphor linking the house to a castle; a vague medieval phrase. In other words, the private house and medieval castle are both single protected structures that hold people inside and protect them from the surrounding environment, with only one entrance through a flying bridge or a crossing.

Meier and geometry: It is a fact that Meier's language emphasizes modularity, measure and geometrical order as apparent in the modular cladding, structural grid, as well as the overall organization of his designs. [1]This is very clear in the manner in which Meier's publications

deploy diagrams in order to interpret the buildings for the viewer. However, as in the case of the older Meier Houses, neither diagrams nor modular cladding were deployed, thus, it is of academic interest to see whether Meier's allure to the use of geometry and proportion started earlier in his career. Furthermore, while other aspects of Meier's language, as we have seen, are equally important from the point of view of perceptual qualities and aesthetic judgment, it is geometrical ordering that allows an ordering of space to encompass composition, structure and construction. Thus, it would be of importance to see how Meier uses geometry and proportion to provide structure and order at the scale of the whole building. This interest closely coincides with the wider interest in the relationship between geometry, proportion and architecture, where if every aspect of the building from the plan in its most abstract sense to the smallest physical detail appears in a pattern and all of the patterns relate to one another dimensionally creating a continuum of scale and complexity (Hanlon, 2009), then it is of concern to see how geometry configures that pattern. Additionally, one can argue that the use of ideal geometry instills the works of architecture with discipline and harmony that transcends it over material considerations and induces a sense of order raises it to "nobility" (Unwin, 2003). Accordingly scanned images were redrawn using Auto CAD to the highest degree of accuracy, analyzed and examined to uncover underlying geometrical order that has been hidden and implicit up until now and render it explicit.

RESULTS AND DISCUSSION

The overall length and width of the house from the furthest edges along the N-W axis is 15.5 and 9 m along the E-W axis, while the actual plan is regulated by a module of 1×1 m totaling in a 9×13 m rectilinear bar. The structural module is off the basic module of the plan; five axis (1, 2, 3, 4, 5) run parallel to the E-W axis at a fixed interval of 3.65 m, while on the N-S axis, three axis (A, B, C) are identified; C marks the center of the columns, B runs through the middle of the plan and A marks the center of the East wall. The interval between centerlines C and B is 3.65 m, while the second interval between B and A is 4.5 m (Fig. 12). The allocation of the entrance bridge corresponds to neither the structural nor the module of the house. Given Meier's interest in geometry and precision, one is inclined to investigate these numbers closely to uncover underlying geometry. Accordingly, scanned images were redrawn to the highest degree of accuracy, analyzed and examined to find out the geometric means Meier used to regulate the dimensioning of the house.

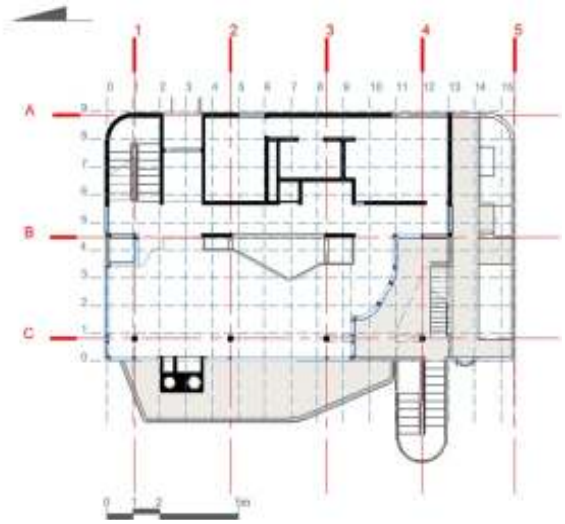

Fig. 12: The plan is regulated by a module of 1×1 m totaling in a 9×13 m rectilinear bar for the built up plan and 9×15.5 m for the whole layout

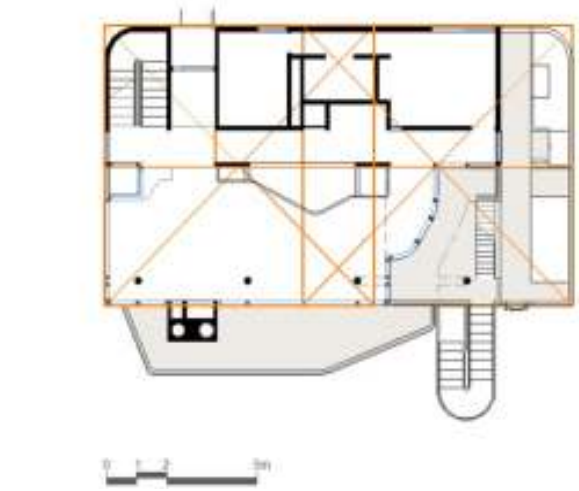

Fig. 13: The overall layout plan falls within the geometry of two 9×9 m^2 juxtaposed and overlapping at an interval of 2.5 m with their centerline passing through the center of the house

Analysis of the middle floor showed that the plan falls within the geometry of two 9×9 m^2 juxtaposed and overlapping at an interval of 2.5 m (Fig. 13). The center axis of both squares parallel to the N-S axis marks the middle of the house where the internal wall defines the corridor and aligns with centerline B as seen in Fig. 14. The allocation of the first structural centerline 1 can be explained by drawing a golden section rectangle

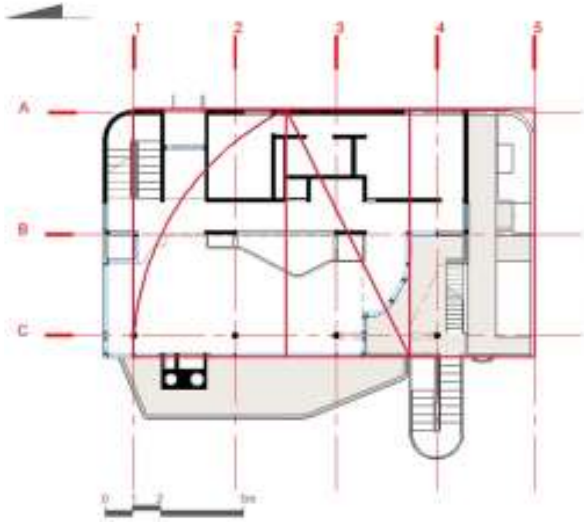

Fig. 14: Drawing a golden section rectangle from the lower S-W vertex of the plan marks the allocation of the first structural axis 1

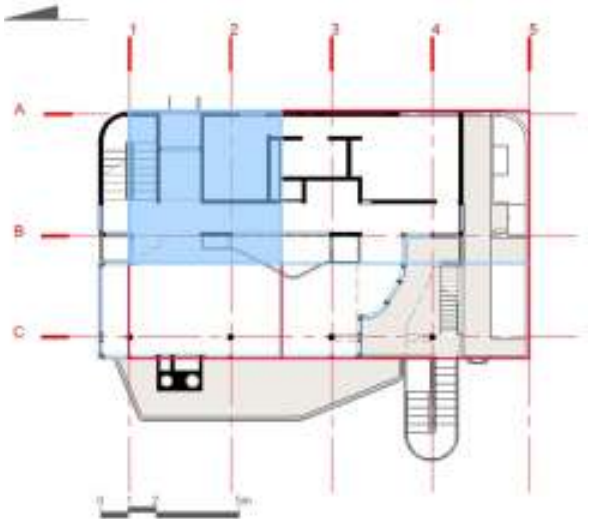

Fig. 15: Drawing the smaller square of the golden section, shown in blue marks the line that delineates the light well

(Fig. 14). This golden section also holds the key to marking the edge of the light well; taking the upper N-E vertex of the golden section rectangle and drawing the smaller square of the golden section, shown in blue in Fig. 15, marks the line that delineates the light well also shown in blue.

Nevertheless, the application of the golden section does not explain the 3.65 m structural interval or the allocation of the entrance bridge. This prompts the investigation whether other proportional systems were used to regulate the design. Further analysis uncovers

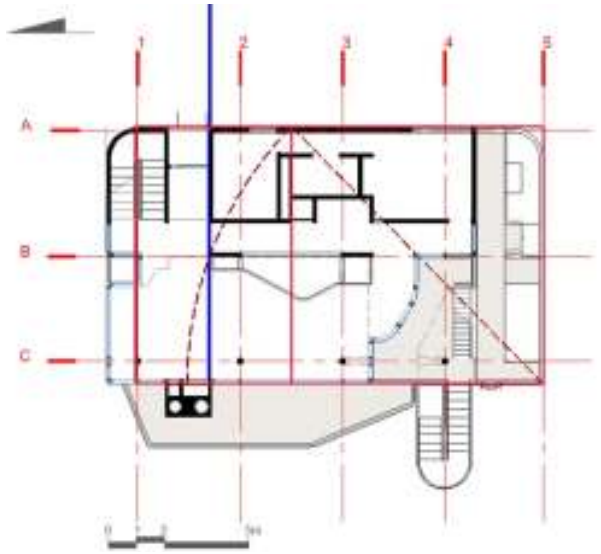

Fig. 16: The blue line extended from the intersection of the 1:√2 rectangle with the center axis of the plan marks the wall defining the bridge

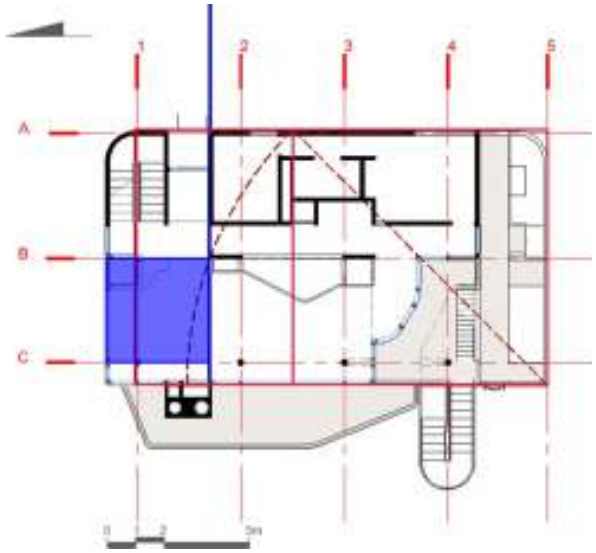

Fig. 17: The edge of the blue hatched square between the extended line and Northern wall along centerline B is 3.65 m which is exactly the same as the structural interval between columns

that the allocation of the bridge is determined by the application of a 1:√2 rectangle; drawn from the same S-W vertex of the layout as the golden section, the arc of the 1:√2 rectangle intersects with the line running through the middle of the plan (Fig. 16). The line, shown in blue in Fig. 16, extended from the intersection of the arc with the center axis of the plan marks the wall defining the bridge. The distance between the extended

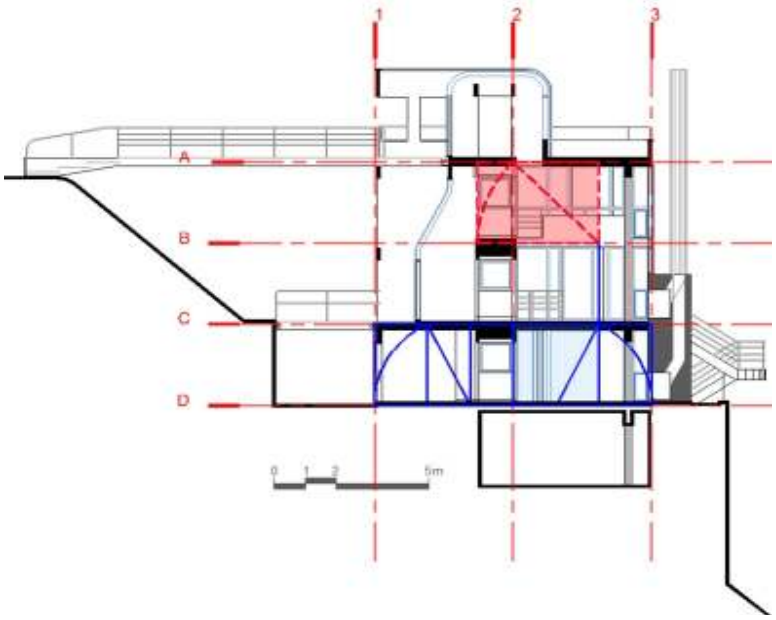

Fig. 18: Three vertical axis going through the back East elevation, the middle of the house and the front West elevation (1, 2, 3) and four horizontal axis going through the slabs (A, B, C, D) mark the main axis of the house; the axis of the slabs (A, B, C, D) is determined by a golden section rectangle shown in blue drawn from axis 2; also the allocation of the wall of the rooms delineating the corridor to the east side is also determined by a 1:√2 rectangle drawn between centerlines A and B

line of the intersection and the Northern wall along centerline B is 3.65 m, shown in blue in Fig. 17, measures the exact same interval used to regulate the structural module, consequently, determining the allocation of the columns in the plan. Thus, the application of the 1:√2 rectangle explains both the allocation of the entrance bridge and the structural interval. The only wall that is unaccounted for in the plan is the wall of the corridor delineating the rooms to the east, which will be explained shortly.

Meier's use of modules, regulating lines and proportional systems is not limited to the plan; it is extended to the section. In order to understand the geometry of the section, three vertical axis going through the back East elevation, the middle of the house and the front West elevation (1, 2, 3) and four horizontal axis going through the slabs (A, B, C, D) are drawn (Fig. 18). Axis of the slabs (A, B, C, D) obey an implicit golden section drawn from the axis 2 going through the middle of the house as can be seen in blue in Fig. 18. Drawing another golden section, also Fig. 18, but on the opposite direction marks the wall of back wall of the lowest floor.

The allocation of the wall of the rooms delineating the corridor to the east side is also determined by a 1:√2 rectangle drawn between axis A and B. The 1:√2 rectangle is drawn from the intersection point of the line, shown in blue in Fig. 18, extended from the smaller square of the golden section between axis C and D and axis B as can be seen in red in Fig. 18, thus revealing placement of the corridor wall on the plan. As can be seen from the analysis above, the overall geometry of the layout as well as location and dimensioning of the main design elements, was not at all random; various design elements were regulated and coordinated through a module, the golden section proportional system and the 1:√2 proportional system.

CONCLUSION

The preceding analysis of the Douglas House leads to a number of conclusions: the final form of the house depends on the interaction between a design program and a formal language but is not determined solely by any. Abstract spatial themes such as reversal and twin phenomena also materialize in the physical form of the building through the artful manipulation of design elements. Furthermore, the analysis of the plans and sections shows that the seemingly simple layout of the house and its spatial order is highly regulated and disciplined by the application of several dimensional and proportional systems such as the golden section and 1:√2 proportional system drawn from Meier's geometric armature. Accordingly, the theoretical density of the Douglas house in particular and Meier's designs in general, as well as their formal and aesthetic integrity, do not arise from the complexity of forms, rather, from the complex but creative layering of geometries applied

to simple forms. Thus, the aesthetic integrity of simple forms, such as the Douglas house, arises neither from merely material forms, nor from relationships between forms, but, more fundamentally, from the complex overlay of geometric and proportional principles and abstract concepts and themes manifested material form.

Photograph credits:

Illustration credits: Plans and sections were redrawn by the authors based on Meier's original drawings: http://www.richardmeier.com/www/#/projects/architecture/name/0/107/1/

Photographs are from the book Richard Meier by Frampton (2002) by Electra Milano and distributed by Phaidon Press.

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Endnote:

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