

**DEPTH OF THE CUBE:
INSIGHT INTO THE ANALYSIS OF A SHARED FORM**

An Undergraduate Research Scholars Thesis

by

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ABSTRACT

Depth of the Cube: Insight into the Analysis of a Shared Form

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The cubic form has served as a foundation for the architectural discipline, spurring on countless projects throughout the ages. By collecting numerous examples of these projects, the developmental processes of each can be studied and compared. These processes are then organized and simplified to illustrate the various design frameworks and methodologies that the architects employed to create these designs. As these are condensed and developed into series, nearly any building that is based around the cube or similar geometric primitives can be compared to and arranged with one of the frameworks put forth by my research. Rather than having to reduce projects down to one or two aspects and measuring it up against another specific project, one can simply identify which framework a project fits into and instantly have a general understanding of the building and a way of correlating it to a host of other similar projects on that shared framework. This entire discourse was spurred on by questioning where the basis of architectural analysis originates from and how it was developed. By creating a series of comparisons between systematically similar projects throughout various periods, the change in methods of approaching the design of a bounded shape become quite apparent. The development of representation becomes inherently tied to this idea as well since the method of design

correlates to certain representational methods which have evolved from project to project.

Creating these diagrams to illustrate each design strategy is then crucial to comparing each work.

Formally analyzing these projects then becomes an essential aspect of understanding the development of architectural design throughout time.

SECTION I

RESEARCH QUESTION/MOTIVATION/ARTIFACT

Many architects have seen the cube as a wellspring of architectural ideas, despite its simple geometry. Many teachers of architecture have used the cube as a means of teaching architectural space, mine included. As Luis Gonzalez-Boada saw it, the cube should be seen as “support for all teaching, something like a blank paper but in three-dimensional space” (Gonzales-Boada). Because of its simplicity and familiarity, the cube is an easy to understand starting point for learning architecture. It allows for new concepts to be built on previous knowledge, so that each design may be grasped without extensive effort. This was the goal in Gonzalez-Boada’s project. Through a series of transformations, a cube may become a much more complex design that has shed the resemblance of the cube at a first glance. An example of this would be Peter Eisenman, who, as Luciana Bosco e Silva put it, “required an initial ideal or generic form, which he often located in the cube.” Numerous other architects have taken on this very form, ranging from Palladio’s Villa Rotonda to O.M.A.’s Tres Grande Bibliotheque proposal. Each project looks entirely different, yet each began its development as a cube, which is why my research aims to uncover those shared connections and illustrate them clearly.

Each chosen project illustrates a different representational method which directs the design in its own way, informed by the primary views and techniques. When architectural drawings in the Renaissance were primarily composed of floorplans and sectional cuts, the buildings tended to extrude along these orthogonal axes. An example of this is found in Andrea Palladio’s Villa Rotonda from the mid sixteenth century. Looking at the floorplan shows the figures which were extruded up to create the interior volumes while the section illustrates the

details of the dome and roofline as seen in Figure 1 and 2. Another more recent example of this approach can be seen in John Hejduk's Diamond House A. Hejduk still approached the building as straight extrusions of the plan, but he based his studies on the reframing of plan. Rather than designing the organization on an orthogonal grid within a square, he inserted it into a diamond. This simple act of rotating the exterior shell 45 degrees completely changes the way in which walls meet the perimeter. Figures 3 and 4 illustrate this rotation. As for more a more three dimensionally oriented design, Luis Kahn's Exeter Library is an excellent example. While floorplans and vertical section cuts, such as the one in Figure 5, still relay information on the design, they give little insight into the developmental process. In order to understand the ways in which the interior voids were created and the relation of the exterior walls, one must see the building as a series of transformations to a cube. This series is illustrated in Figure 6. Tigerman McCurry's Formica Showroom depicts a way in which the two-dimensional plan can begin to take on a more three-dimensional nature. The project, depicted in Figure 7, is a combination of two three dimensional grids superimposed to create a new massing, and a series of channels are cut through to allow circulation, as seen in Figure 8. As architecture developed, the change in representation changed the approach to design. In contrast, the Très Grande Bibliothèque from O.M.A, seen in Figure 9, could only be designed through more modern tools such as readily available architectural model making materials and the computer. Standard drawings such as plans and sections, which were the crux of design before, now become irrelevant as a means of illustrating the design. Because the design itself is a conglomeration of volumes within a cubic confine, the representation must convey their three-dimensional nature, such as with Figure 10. It is only through these advances in three dimensional spatial representations that a design composed entirely of abstract volumes could be done.

Understanding the inherent connection between representation and design is crucial for not only analyzing but also creating new projects. This series of diagrams illustrates this intertwined nature. The common framework of the cube is also a key aspect of this series because it highlights the difference in design methodologies of the past and sets up process in which future methods could be easily categorized and compared to. Emerging technologies, such as virtual reality, offer entirely new workflows which will in turn produce original designs and once there are they can be added to series of methods.

SECTION II

LITERATURE REVIEW/BACKGROUND/HISTORY/SOURCES

Representation then becomes a very crucial aspect in any architectural concept, as it is responsible for conveying the ideas of the original designer. However, there is no exact or consistent structure to perfectly transfer ideas from the mind of the architect to others. Careful consideration and craftsmanship are required to choose means that accurately illustrate ideas. Plans, sections, axonometrics, surface unrolls, or perspectives are just a few of the standard methods of representing a project but by no means are the only options.

As with anything in a discipline, representation has evolved over time in both its role and its language. The use of visual diagrams has especially undergone significant changes over the years. In Classical times, diagrams and drawings were not leaned on as much as they are now. Words and models played a much more significant role in specifying exactly how to construct buildings. Visual representation was more so reduced to descriptions of the building to be and carried little weight. It was up to the building itself and the writings of contemporary figures to carry the ideas of the architect. As structures took on more daring and intricate designs, drawings began to play a more critical role as simple descriptions didn't convey enough. Masons and architects in Medieval times relied on drawings to understand and plan out the complex vaults, walls, and spaces of towering Cathedrals. Grand feats of structural complexity were the goal of many designers and geometric drawings were the language used to achieve it.

With the discovery of linear perspective, drawings gained an extra dimension. Drawings were no longer limited to two dimensional depictions of floors and walls but could begin to portray the architectural spaces in a way that more closely resembles how humans view them.

This marked a very significant role in the progression of representation as diagrams began to have character and elements that weren't simply construction details. Drawings became things in of themselves that existed outside the confines manufacturing (Allen).

SECTION III

EXPLANATION OF EXHIBIT/VENUE

The research work within this thesis was presented at the 2020 Undergraduate Research Scholars Symposium. This exhibition involved the display of work from several undergraduate students in the form of posters. Topics for each research poster varied widely and stretched across all disciplines, allowing for an incredibly wide range of ideas to be seen through the lens of people who are not familiar with the discipline.

My exhibition consisted of a few example diagrams from my creative artifact accompanied by brief explanations for each. Four buildings were selected to show: Andrea Palladio's Villa Rotonda, Tigerman McCurry's Formica Showroom, Louis Kahn's Exeter Library, and O.M.A's Très Grande Bibliothèque. While only showing two of the analysis diagrams for each building hindered the clarity of the concepts, I was able to fill in the gaps between diagrams with explanations that specifically answered each individual person's questions as they came

SECTION IV

REFLECTION

Overall this entire thesis writing process has helped me a great deal in understanding how to communicate ideas effectively, but also in how to approach research questions. The process of my research developed over time and became inherently tied to the results of my work. Each building I studied had to be reconstructed, analyzed, and illustrated in a way that clearly communicated the central ideas of it. Often times the way in which I depicted the analyses was dependent on the way in which I digitally reconstructed the project, whether that be through straight extrusions or subtractive elements. The pipeline for researching buildings to finalized illustrations became faster and easier to perform and resulted in better results in the end.

One of the biggest concerns brought up during the Q&A was the question of purpose for the research and what it will do for the future of the discipline. While perhaps I didn't explain this as well as I could have, it is also very hard to speculate how this kind of research will impact future architects or architecture students. In any creative field ideas build on top of each other, often in ways unimagined by the original proposal. When Colin Rowe published his essay "Mathematics of the Ideal Villa" which proposed a new way of analyzing architectural designs with regards to historical precedence's, he didn't necessarily specify what kind of future works would be the result. Similarly, I hope others will see my work which emphasizes the tie between representation and design, and apply that to their own work to create new ideas that I could never think of.

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CREATIVE ARTIFACT

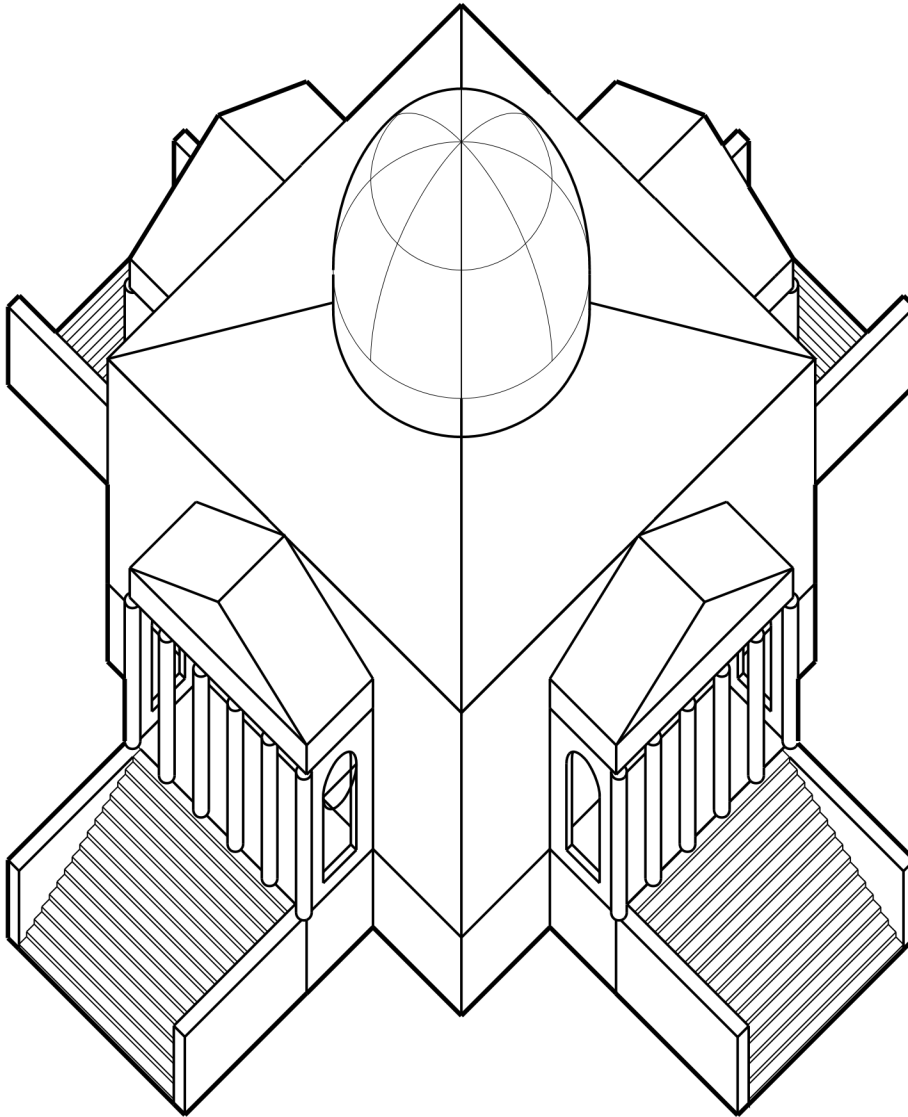


Figure 1. Villa Rotonda Axonometric.

This image depicts the exterior view of Andrea Palladio's Villa Rotonda which was built between 1550-1551. This view highlights the overall cubic form and esthetics of the building.

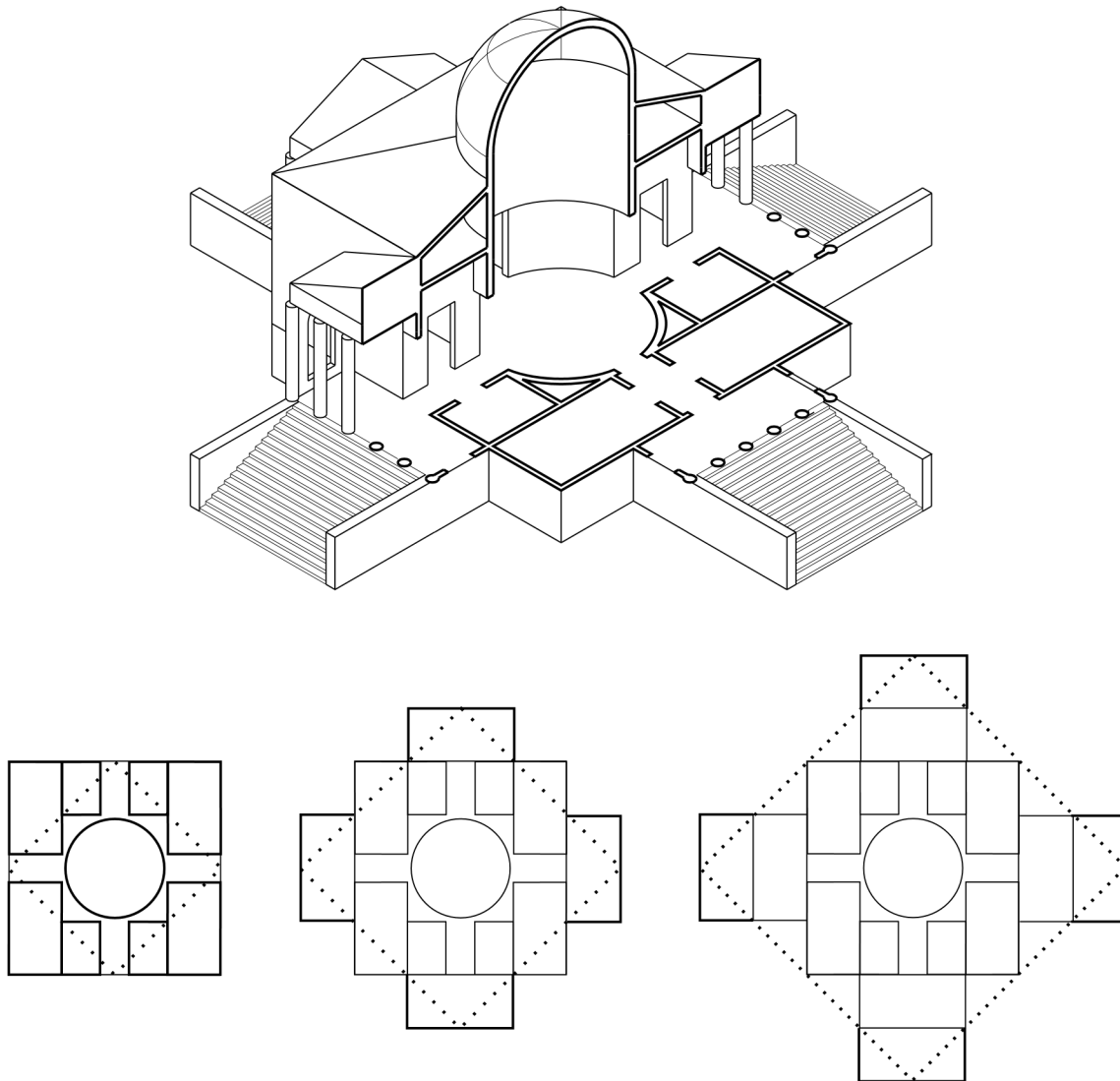


Figure 2. Plan and Elevation Cutaway for Villa Rotonda.

These floorplans and elevation cutaway highlight the way in which architects at the time worked. They would often approach the design with the plan then extrude it upward to create the final design. The initial square is divided and extended but the vertical information is all derived from the flat two-dimensional floorplan.

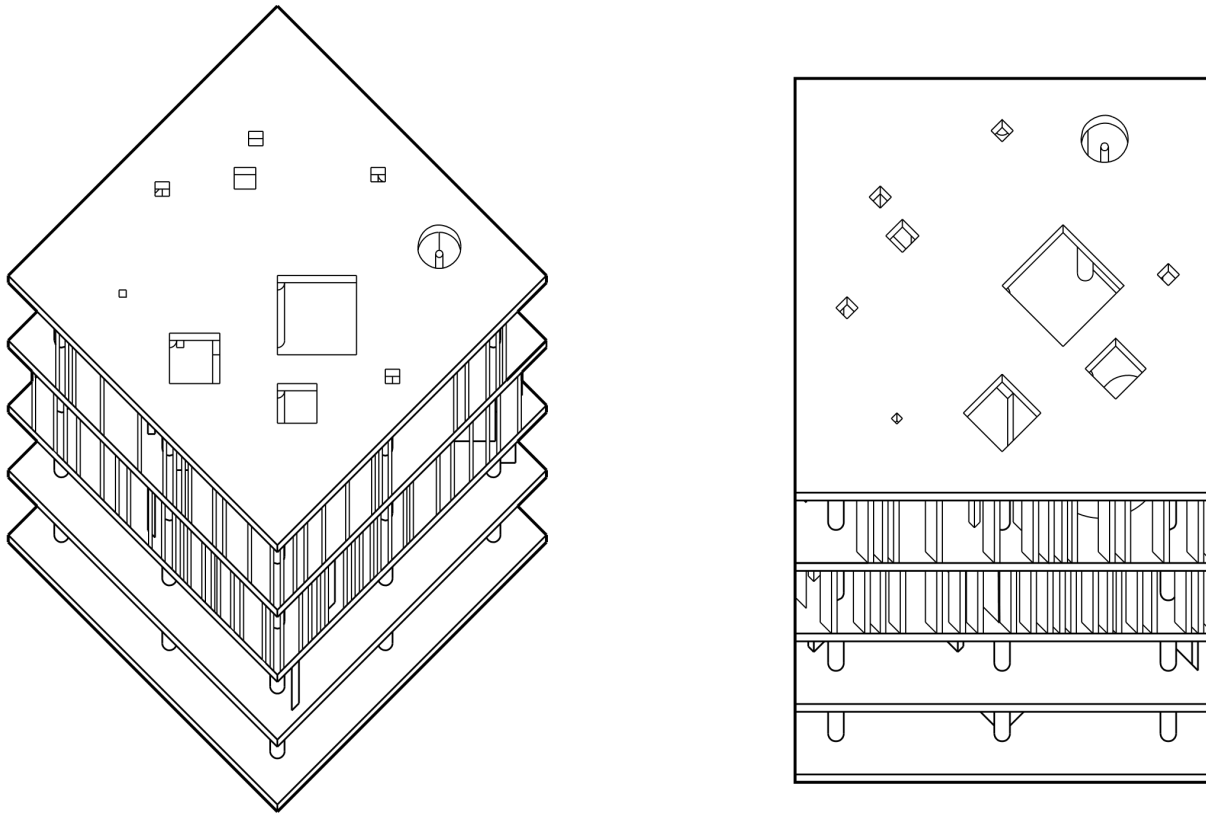


Figure 3. Axonometric Views of Diamond House A.

This design was the first in a series of designs by John Hejduk from 1963-1967. One of the major characteristics of this series was the fact that they were approached as diamonds rather than squares. This view illustrates the cubic form of the design. When viewed straight on it appears three dimensional but when rotated 45 degrees, as is normal in architectural representation, it flattens out and appears like a rectangle rather than a cube.

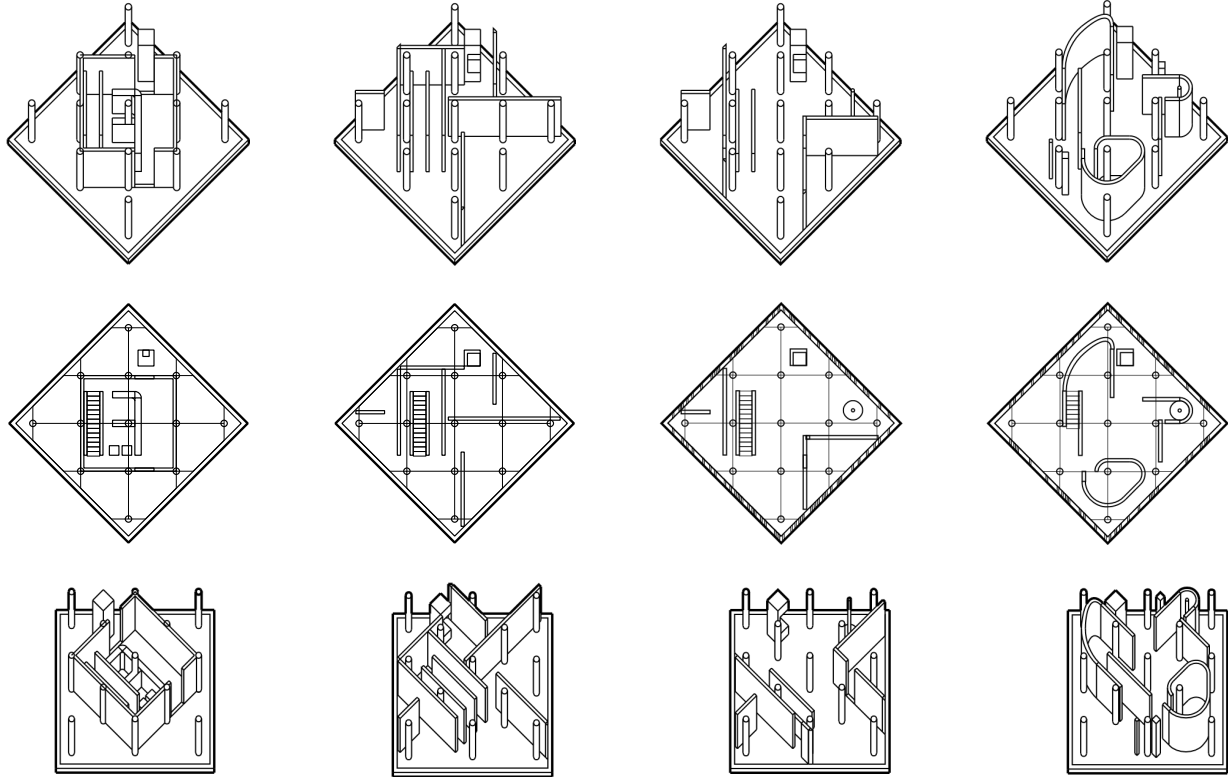


Figure 4. Floorplans of Diamond House A.

This idea of using the diamond over the cube becomes very apparent in the floorplans. The interior walls are aligned on a grid but appear angled compared to the perimeter shape. Each floor depicts the various ways in which Hejduk explored this concept in having a incongruity between the interior walls and the building shape.

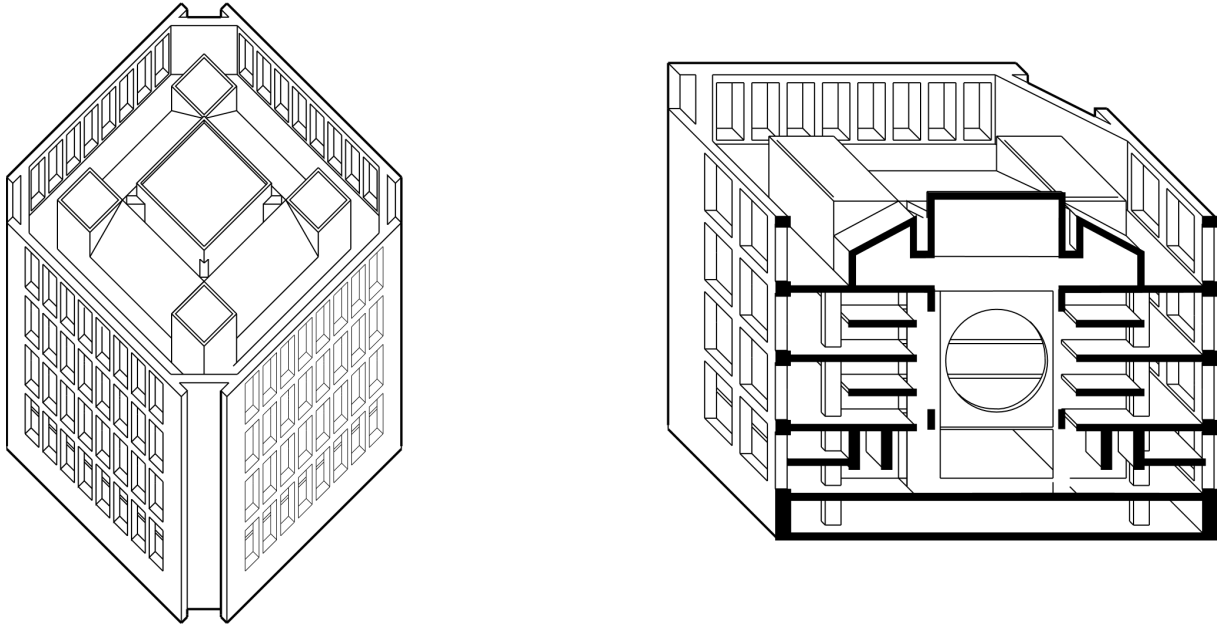


Figure 5. Exterior Views of Exeter Library.

The Exeter Library, designed by Louis Kahn and built in 1972 accentuates a more three dimensional approach to design. This exterior view shows the cubic form and the regular repetitive geometry. The vertical cutaway illustrates how open the interior is in contrast with the very solid looking exterior.

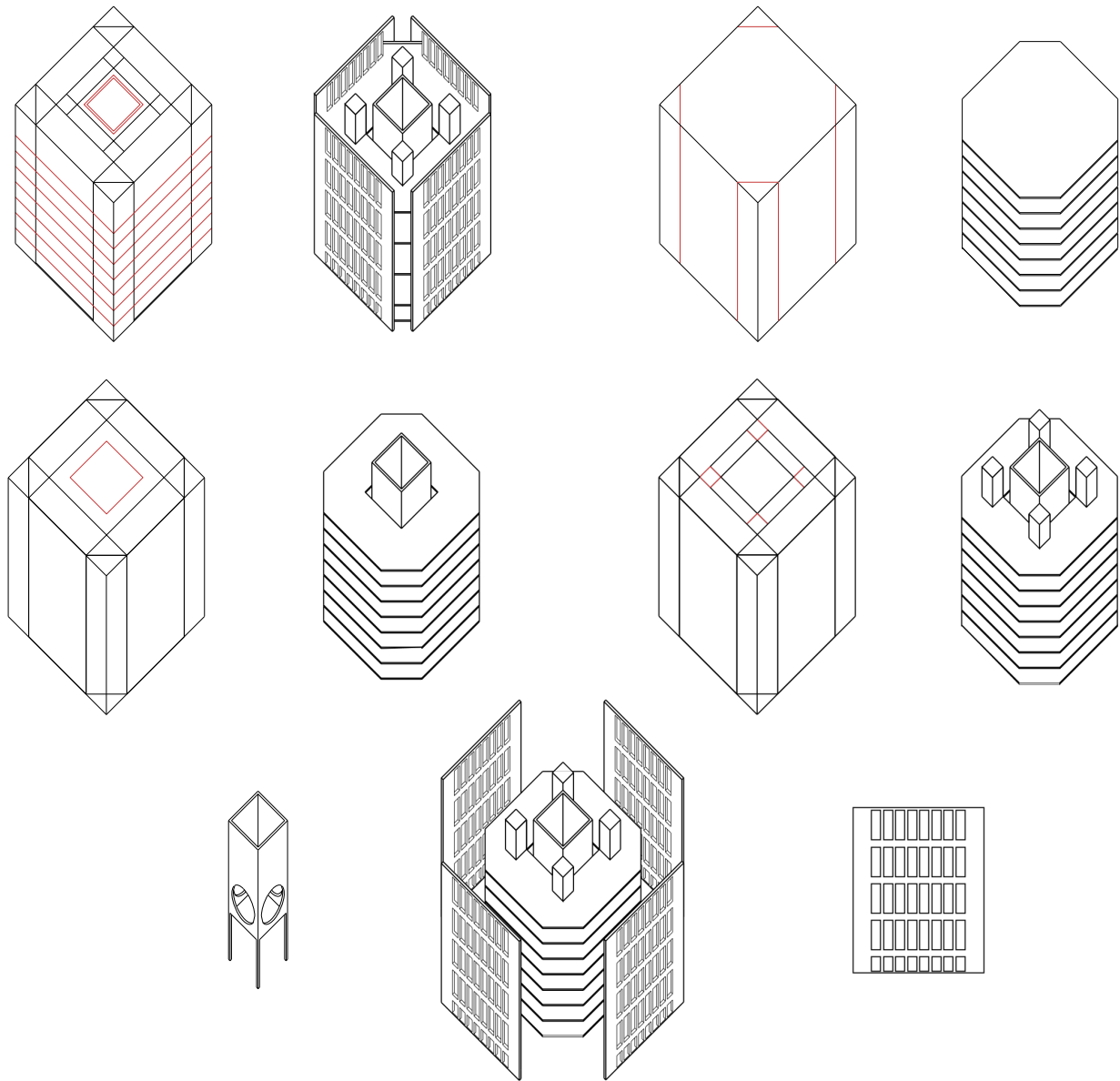


Figure 6. Developmental Process of Exeter Library.

Whereas the previous projects approach the design initially with a flat two-dimensional plan, Kahn approached this design from an initial three dimensional cube. Through a series of cuts and additions along guidelines, the final form is created as illustrated in this series of diagrams. It is only through these three-dimensional transformations that the layout and relationship of the interior voids can be understood.

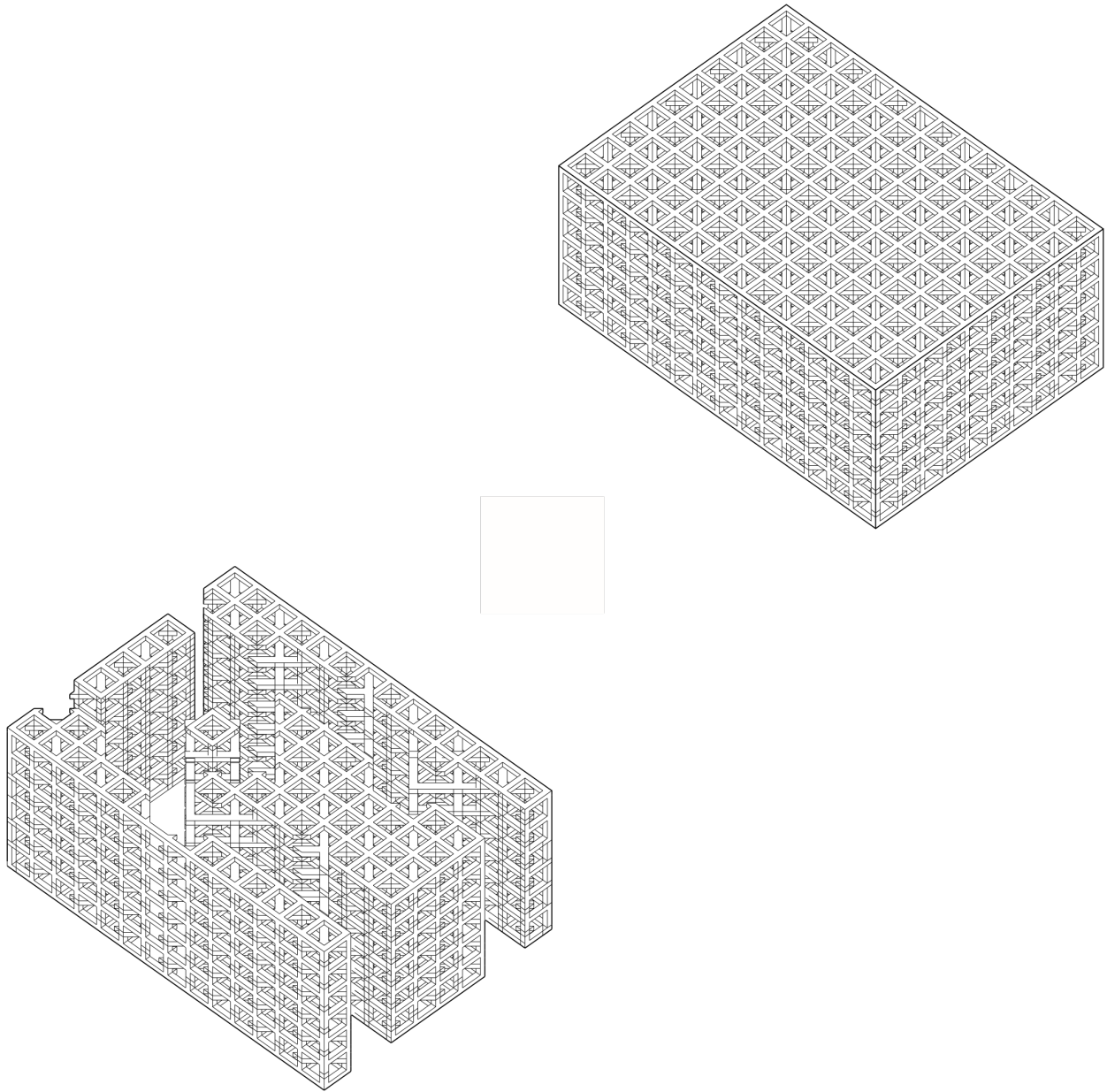


Figure 7. Axonometric View of Formica Showroom.

The Formica Showroom was designed by Tigerman McCurry Architects in 1987 and was located in Chicago Illinois. The design employs the use of two three dimensional grids which are angled and offset from each other to create a hybridization of two-dimensional layouts stacked on top of each other. This diagram shows the overall form.

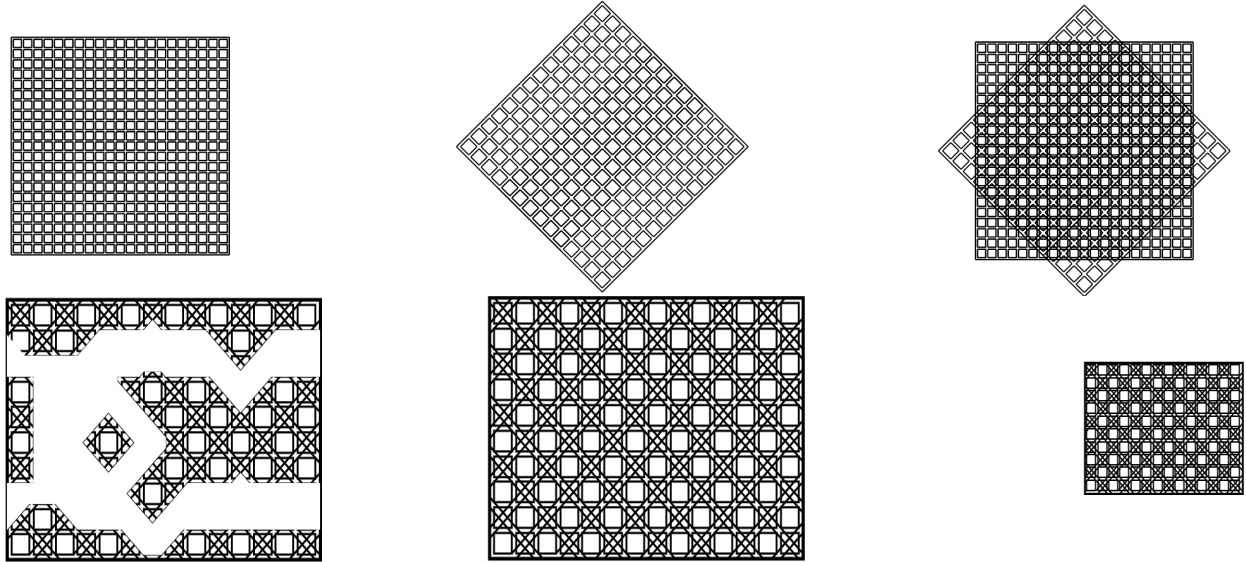


Figure 8. Plan Analysis of Formica Showroom.

This series of diagrams illustrates the exact process used to form the final design. The two offset grids are superimposed and then cropped into shape. As for the interior divisions of the grid, Tigerman McCurry referenced the Chicago River to form the channels that break up and pass through the grids.

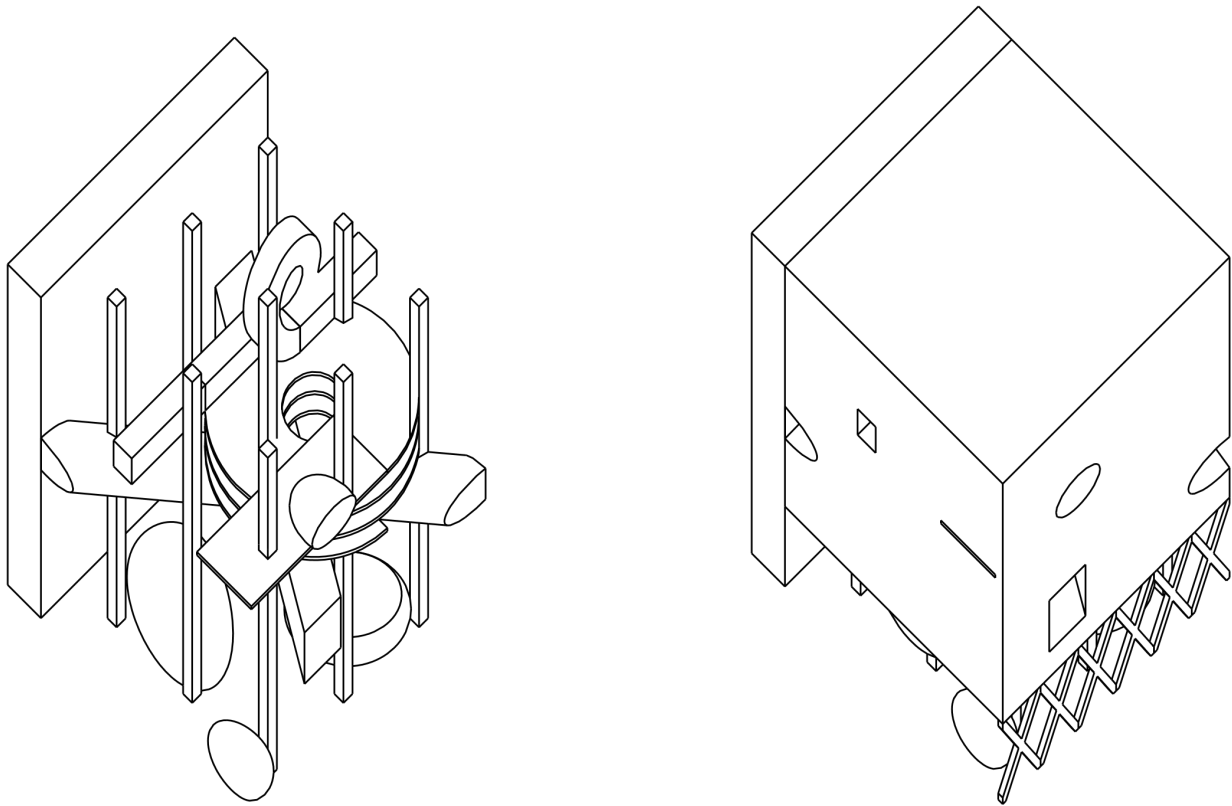


Figure 9. Positive and Negative of Tres Grande Bibliothéque.

O.M.A Architects approached the cube in 1989 with Très Grande Bibliothèque in a method that is entirely independent of two dimensional representation. Other projects still relied on some sort of diagram, primarily a floorplan, to illustrate the central idea but the Très Grande Bibliothèque relied entirely three-dimensional forms. This diagram depicts the library as a collection of these volumes shoved together in the confines of the cube, both as solids in an invisible box and as voids inside a solid box.

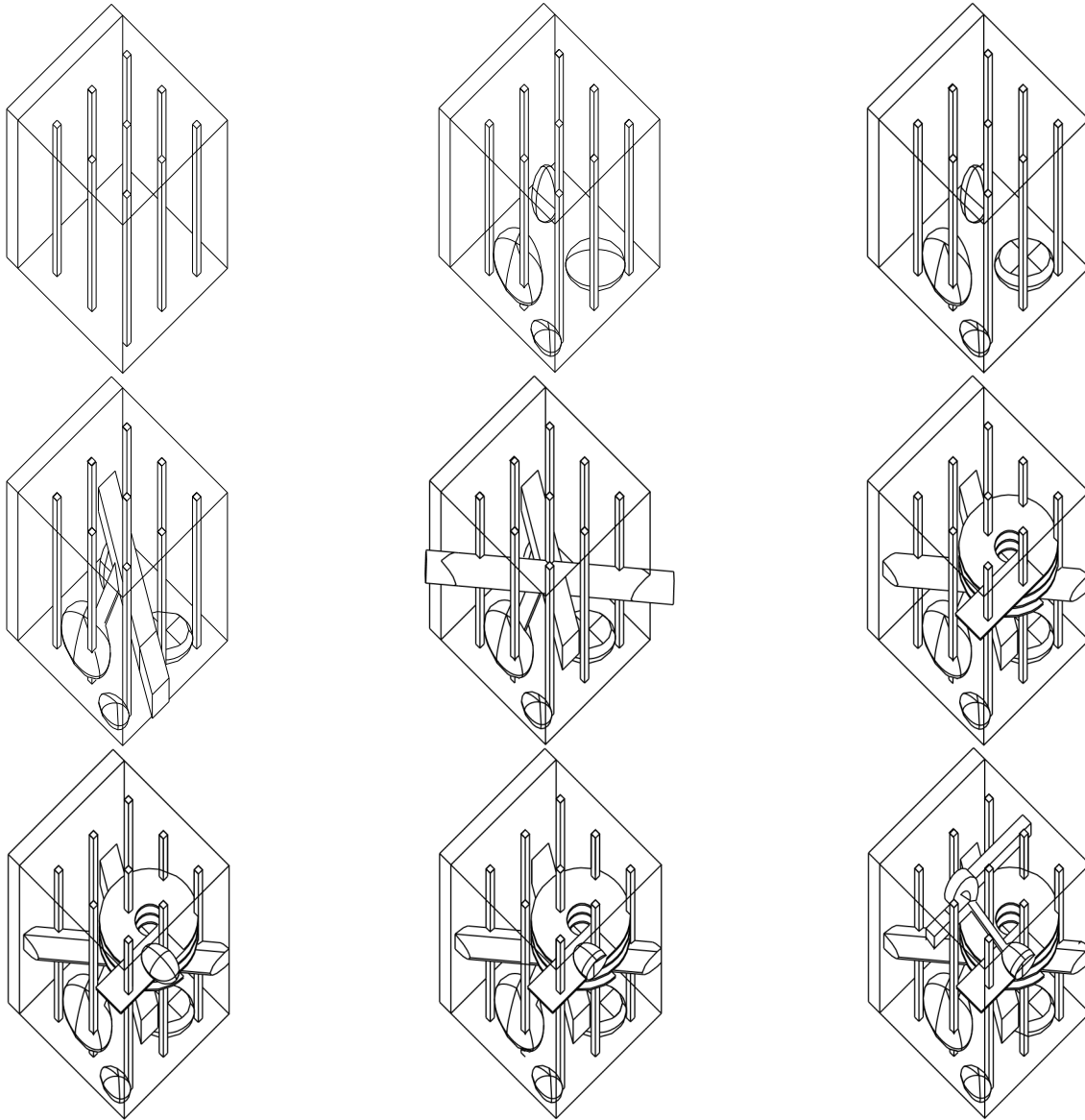


Figure 10. Tres Grande Bibliotheque Development.

This series of diagrams follows the additions of each of the volumes. Various oblong and curved shapes are stacked inside the confines of a cube and cutoff at the points where they extend past those confines. This process exists entirely in three dimensions and can only be understood through more three-dimensional diagrams.