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Derivative Design Configurations – Architectural Design Methodology

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ABSTRACT

The Architectural Design process is an ever-evolving phenomenon. The ongoing development that encompasses Formal, Functional & Material exploration of temporal sets of realities is established in the form of tangible examples (Precedents). These Precedents set the basis for further study and thus referential solutions are sought for increased relevance and performance. Precedent-based Design studio teaching and learning is the most effective and popular system of conducting architecture studio. The Derivative Design Configurations – as a design process, is to evolve alternate design solutions by revisiting and relocating existing spatial design compositions.

Methodology for this Precedent-based inductive exploration in Design Studio teaching consists of three principal parts; Deciphering architectural handling, Fragmentation of spatial components, and finally Defragmentation & re-composition of the design constituents to come up with multiple iterations. The iterations will potentially generate a variety of spatial arrangements leading to inventive, ingenious, and unexpected spatial compositions.

This paper focuses on developing a method for analyzing the Precedents to extract knowledge for engendering innovative architectural design processes in the context of Architectural Design Studio for the students in the 2nd year. The modus will train learners on how to evolve design solutions by appreciating precedents' existing design and exploring further the potential of architecture precedents.

Keywords: Deciphering architecture handling, design precedents/case studies, design process, design method

1. INTRODUCTION:

An architectural studio is a specific place where students acquire the technical know-how and skill set necessary to design buildings. In general, architects are in charge of creating building designs for buildings and other structures. To become skilled at this task, architects must repeatedly engage in it during their education. However, this learning and practicing activity is a very challenging one because it involves applying all of the competencies learned from all of the subjects taught in architectural education to a single site-specific design with a set of constant criteria (Ciravoğlu 2014). The effectiveness of education has been the focus of research for many years. Education professionals have looked at, criticized, and improved educational practices involving everything from subject matter to instructional strategies to testing and assessment.

This paper is to expound a design generation process that is devised for one of our Architecture Studios. The pedagogy is successfully conducted; to support the claim, few of the examples are given in later part of this article. The intent of this publication is to equip both students and studio instructors/ teachers/ mentors with a framework

that could systematically be applied to realize unexpected design outcomes. Creativity; though subjective in essence and poetic in nature, is attempted to be ignited in an orderly manner. The method is to explore the popular idea of 'limitations' as a potential having infinite possibilities rather than the surface meaning attached with the term 'limits'. In this method, students/ apprentices are lucidly guided to produce unique and very personalized design configurations that are derived from existing building designs and compositions.

2. Literature Review:

Architecture is a multifaceted discipline. It encompasses a variety of subjects in its domain. The architectural design studio is the backbone of the overall architectural education. Between the design instructor and the students, a traditional Master and apprentice relationship is still alive and can be witnessed in the design studio. Many scholars have attempted to investigate the dimensions of a design process that can improve learning in design studios. The architectural design process is taught in design studios with a clear objective. As narrated by (Soliman 2017) the collide (2013) has noted down the first objective placed on the top of all priorities is to produce the main design solutions. The design successfully satisfies the necessary needs of human civilization and achieves the highest level of comfort between what exists and what should be (Alomari, Al-Sheikh, and Younis 2013). The details of the main solution need to be in line with the significant issues and ideas.

Working in an architectural studio frequently serves as a proxy practice (Jacobs and Utting 2019).

Traditionally the design process can be categorized into these phases including predesign stage, schematic design, design development, and construction documents phases. However, as the design process gets underway in the studio, it does more than just combine the answers to a particular problem; there is also a component of unexpected discoveries that, in turn, creates design issues or requirements capable of capturing the crucial elements of the given problem as well (Suwa, Gero, and Purcell 2000). The teachers assist the students in raising issues that are pertinent to them as they are interacted with and evaluated at almost every stage of the design process, either by questioning or pointing out the shortcomings.

There are always positive and negative aspects to a teacher's critique. It might also take different forms inside the studio. It may take the shape of verbal discussions, informal peer reviews, formal and informal desk reviews, or elevated jury reviews assessing the key work milestones (McDonald and Michela 2019). Although the purpose, procedures, norms, and expectations differ between the instructor and students in each studio, the critique is never the same.

Giving them all the recommendations by citing the precedents is very beneficial and supportive, as suggested by (Goldschmidt, Hochman, and Dafni 2010). Creativity lies in the heart of the architectural design studios. It is defined as the capacity of producing original ideas (Weisberg, 2006), and it is the starting point of learning. The way that each student learns can play a significant role in determining how well they perform in class. The exchange of innovative ideas and the best fit between the delivery of instruction and the student's preferred learning styles are key components of an architectural design studio (Demirbaş and Demirkan 2003).

Gaining an early understanding of the variety of learner styles and tailoring instruction to each student's needs are the keys to better delivery for design instructors.

When working in the architectural design studio, students typically use freehand drawings as their primary means of generating design ideas (Do and Gross 2001). They conceptualize with a pencil in hand, and it seems beneficial to concentrate on the issues at hand in terms of the

connections between the various components of the design.

Architectural designs based on knowledge are known to produce the best outcomes. The knowledge-based design process depends on having a better understanding of design precedents and is made up of a dynamic process of adapting and transforming knowledge used in practical examples or experiences to match the needs and trends of the present. It implies that the design process and the final product will be richer and more suitable if a wider range of knowledge is incorporated while designing (Gewirtzman 2017).

3. RESEARCH METHODOLOGY

This study intended to develop an inductive method for engaging students in realizing ingenuity and novelty rather than being carried away with imitation and falsification with the information of already solved issues. A list of significant precedent projects was shared with students after careful cataloguing. All students were assigned different projects according to their choice. A stagewise instruction manual was formulated to carry out the study that could aware students about embedded knowledge of the given precedent. In a broader sense, three main stages/levels with sublevels are involved in this method: Level 1. Deciphering Architectural Handling with further steps like (study of Solids & Voids - Juxtaposition of basic Volumes, Study of Light & Shadow, the study of structural elements and material allocation**),** Level 2. Fragmentation of Spatial Components and Level 3. Defragmentation & Recomposing

4. STUDIO MODUS

"Learning by Doing" is the governing spirit of this architecture design studio pedagogy. The system of instructions developed, thus, is to involve learner/apprentice in experimentation with space models for understanding space handling and spatial behaviors of already built structures. Usually, Students in Architectural studios are not provided with the principles to construct design rather they have been given a variety of precedents to learn heuristics (Akin 2002). These kinds of shortcuts usually lead them towards imitation instead learning unless a proper method is devised to study the precedents. Therefore, in this research, the teaching focus is the development of designer individuality and hence aims to create an environment, whereby personalized speculations and projections are encouraged in the realization of multiplicity, diversity, ingenuity, and creativity of design reactions. A layered mechanism is applied in close assistance to enable a smooth, directional, and productive working environment by devising detailed inductive reasoning that has been followed to establish a discipline for achieving creative and scientifically grounded architectural solutions.

5. Precedent Study - Projects Selection Criteria

A list of selected Precedents was assigned to the class individually. The personal choice of students was given priority while distributing projects in the studio. The priority of personal choice was really helpful for the student's involvement in the process of exploration. Project architects are considered to be masters of their eras. The list of projects constructed in post-1900 was decided, as the architecture of the time is more international. The architecture of the stated time period additionally is most reflective of contemporary architectural challenges and aesthetics. The list of significant projects shared with students was carefully prepared that was comprised of the most famous work by master architects. Each student was assigned a different project according to their choice. The variety of selected precedents was intended to achieve diversity in terms of Architectural handling, use of building Materials, Site sensitivity of design, and technological, or social relevance of the project. Projects were vigilantly prioritized keeping in mind the following factors like Clarity of masses & manifestation of architectural

language, Scale of the project in relevance to students' level of complexity, and Programmatic complexity based on the overall requirement of the course level.

6. PRECEDENT ANALYSIS METHOD

A detailed Study of the given projects was carried out in a piecemeal approach. A stagewise instruction manual was formulated to carry out the study according to the following system. In a broader sense, three main stages/levels with sublevels are involved in this method

- Deciphering Architectural Handling
- Fragmentation of Spatial Components
- Defragmentation & Recomposing

6.1 Level 1: Deciphering Architectural Handling

Deciphering the Architectural handling by Architect in the given precedent study involves 4 steps

6.1.1 Step1: Solids & Voids - Juxtaposition of basic Volumes:

At this stage, the given Precedent was reproduced. Points of focus were to observe and project the decisions taken by the project architect to solve the principal space puzzle of placing Solids & Voids.

Execution Method and Technique: Easily bendable thin transparent plastic sheets were used with appropriate adhesives for bonding surfaces to re-generate basic volumes. A transparent medium is instructed, as it is intended to guide students' perception in a way that the students observe how infinite spaces are delimited imaginatively. The medium was effective in resolving the volumetric composition of spatial blocks as designed by the architect. Fig-01

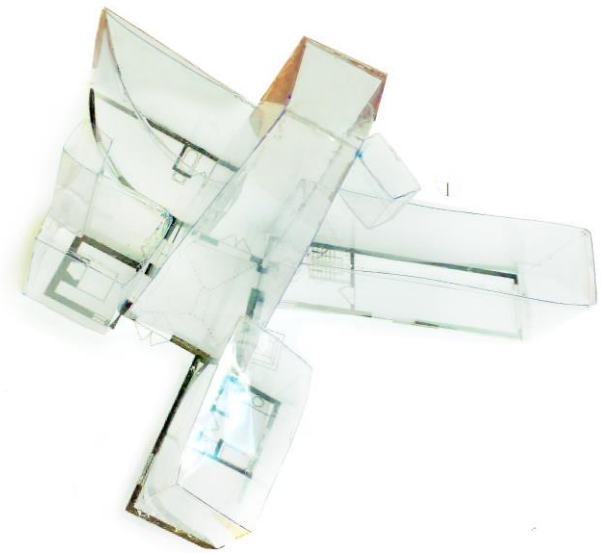

Fig.01 Solids modeled in transparent material Winston Guest House by Frank Gehry
Student Model

Fig.02 Wrapped from the outside Winston Guest House by Frank Gehry
Student Model

6.1.2 Step 2: Study of Light & Shadow:

Transparency of recreated space models was further instructed to be wrapped from the outside by closely following the original design. At this stage students analyzed and delicately observed the handling of natural light and the way, it was responded to by the project architect through

design decisions that were taken to create livable inside environments. Light, Transparency, and Opacity of surfaces were the underlying concepts that were to be explored.

Execution Method and Technique: A layer of opaque material with proper adhesive was used to veil areas, surfaces, and spaces from where no direct light was passing to the insides of the building. Fig-02

6.1.3 Step 3: Structural Elements:

Only the vertical elements i.e., columns and surfaces that are carrying a load to stabilize given the precedent of architecture were identified. The focus is to involve students to pay attention to the basic idea of manufacturing building components from a structural standpoint.

Execution Method and Technique: Different mediums i.e. physical models, drawings and sketches, etc. were recommended for this section to observe, highlight and reproduce the project's structural components. Fig.03

6.1.4 Step4: Material Allocation:

Materials define space moods and the atmosphere that is intended to offer a distinct experience. It forms the most obvious of visual experiences. At this stage of precedent analysis, students were guided to observe the treatment of building surfaces in terms of material that are defining different spaces, moods, and activities.

Execution Method and Technique: It was instructed to assign materials to all the vertical surfaces. Both 3D Models and Drawings (freehand and mechanical) were recommended to express their analysis.

(Step3 & Step4 are closely interlinked and thus, differentiated by color-coding the structural component/s)

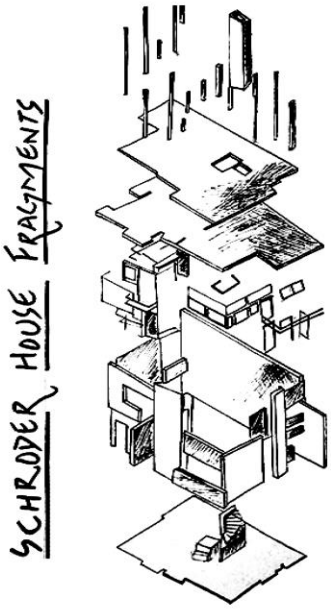

Fig.03 Fragmentation of different structural components by Maham Khattak

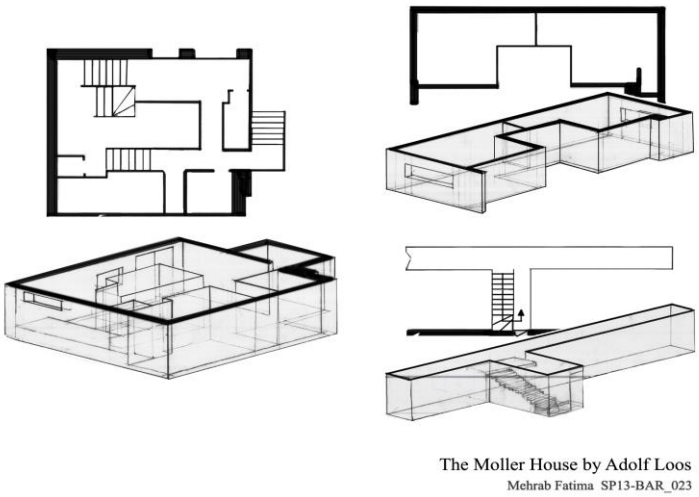

Fig.04 Fragmentation of different spatial components

6.2 Level 2: Fragmentation of Spatial Components

At this level of analysis, students were tasked to intelligently decipher the assembly of masses. The design whole was to be broken down into possible design parts. Dismembering the fragments was supposed to be carried out keeping multiple aspects in mind. Students were set free to guess, developing their reasons, for categorizing essential building constituents based on form, program, and structure. These Architectural components realized a unique and renewed identity after liberating from the assembly. The switch between spatial and formal character was observed by the students. The flexibility of architecture in terms of utility and form was thus underlined by an indirect method.

Execution Method and Technique: The resultant simplified space units were further processed to give birth to an infinite series of spatial arrangements. Fig.04

6.3 Level 3: Defragmentation & Recomposing

Multiple iterations were worked out using extracted building units. The design decisions were to be taken keeping in mind Spatial proximity, Suitability of scale, Visual balance, Weight stability, and Load transfer. Spatial arrangements worked out at this stage was having a unique identity. Dismembered constituents were recomposed to form design configurations with altogether different manifestations. Innovative and individualized arrangements sprout at this level enticing interest and curiosity to generate multiple compositions very quickly. A detailed example is given in Fig.05.

Execution Method and Technique: Color-coding of volumes was recommended to differentiate broad categories of spaces on the bases of types, utility, and from. A certain number was given to work out iterations and also a word description for each iteration was asked. Fig.5

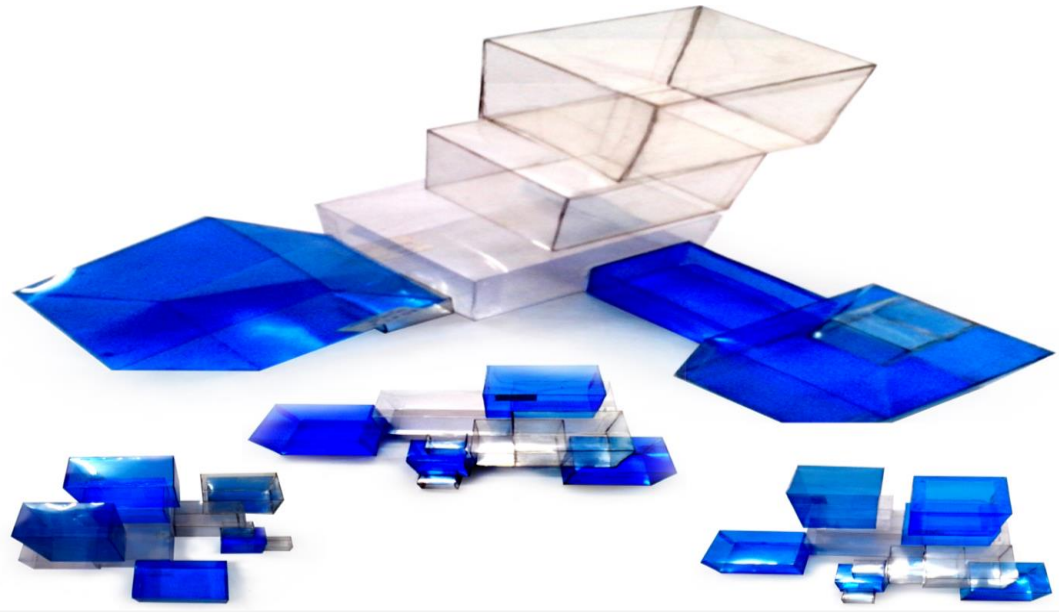

Fig.05 Chamberline Cottage by Marcel Breuer
Defragmentation models by Moazzam Ilyas

7. STUDENT WORK SAMPLES

A studio project (Fig.06) studied and projected by student Fatim Tuz Zahra is presented as a sample to further elaborate the stages and relevant sub-steps carried out while developing and conducting architecture studio teaching pedagogy at the 2nd year level of the undergrad degree program at the department of Architecture COMSATS University Islamabad Pakistan.

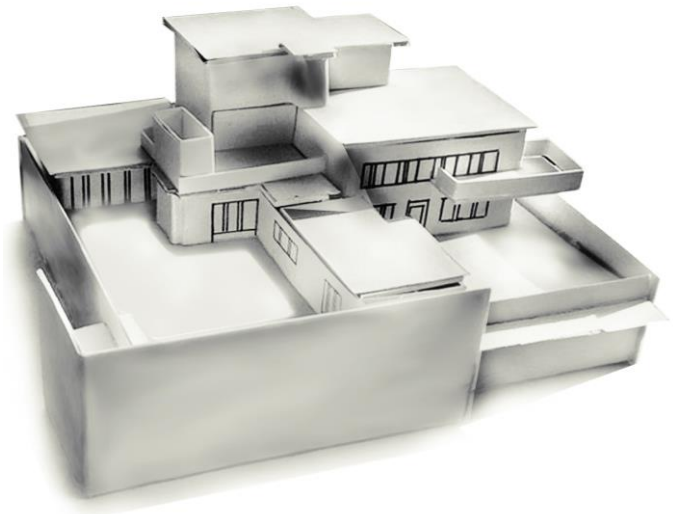

Fig.06 Wolf House at Gublin, Poland by Ludwig Mies van der Rohe
Model by Fatima Tuz Zahra
CIIT/FA17-BAR-010/ISB on 03-07-2019

7.1 Level 1: Deciphering Architectural Handling

7.1.1 Step 01: Solids & Voids

This step was to understand the volumetric composition of Wolf House, designed by Ludwig Mies van der Rohe, using transparent sheets. X-ray sheets were selected for modeling volumes of the project. The volumes that came out of the building form are given in Fig.7.

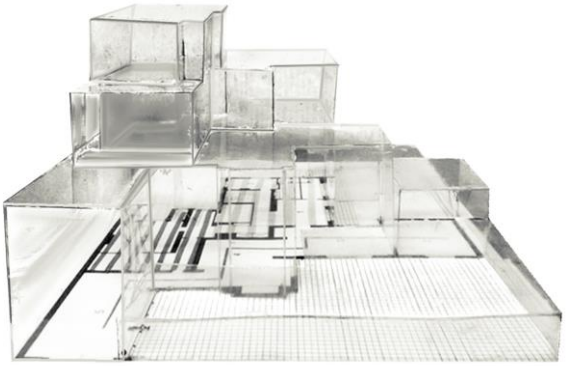

Fig.07 Transparent Volumes
Model by Fatima Tuz Zahra

Fig.08 Light finistrations
Model by Fatima Tuz Zahra

7.1.2 Step 02: Study of Light & Shadows

To understand the play of light and shadows in the given project, masking tape [an opaque material] was applied to veil surfaces that are opaque on top of the transparent model, developed in step 01. Areas and surfaces, where light enters the building were left transparent. Fig.8

7.1.3 Step 03: Structural Elements

In this step, a model was made showing load-bearing elements of the precedent. Wolf House was mostly constructed in bricks. Brick walls as structural elements are shown in Fig.9

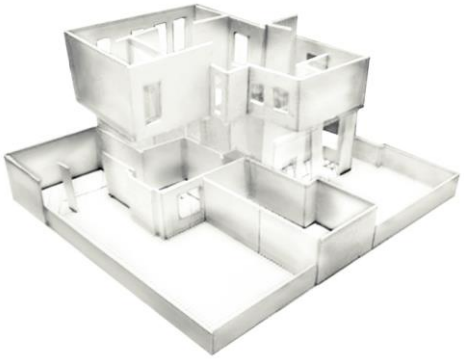

Fig.09 Vertical Elements
Model by Fatima Tuz Zahra

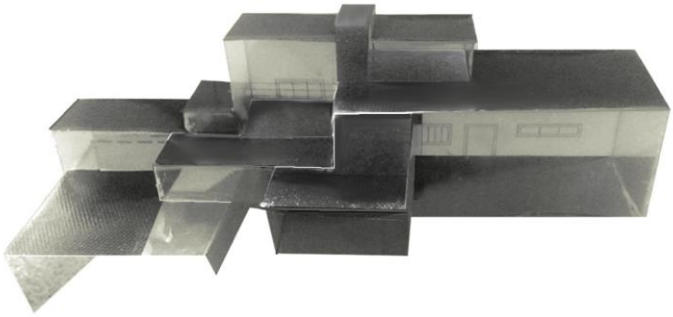

Fig.10 Comparative material
Model by Fatima Tuz Zahra

A model was made that was showing a sectional view of various building design elements. The section displays the treatment of surfaces and materials used in the design. Fig10.

7.2 Level 2: Fragmentation:

Various spatial components of the building model were fragmented. Several iterations were made at a later stage to find the best possible compositions of space that could form references for the class design project, to follow.

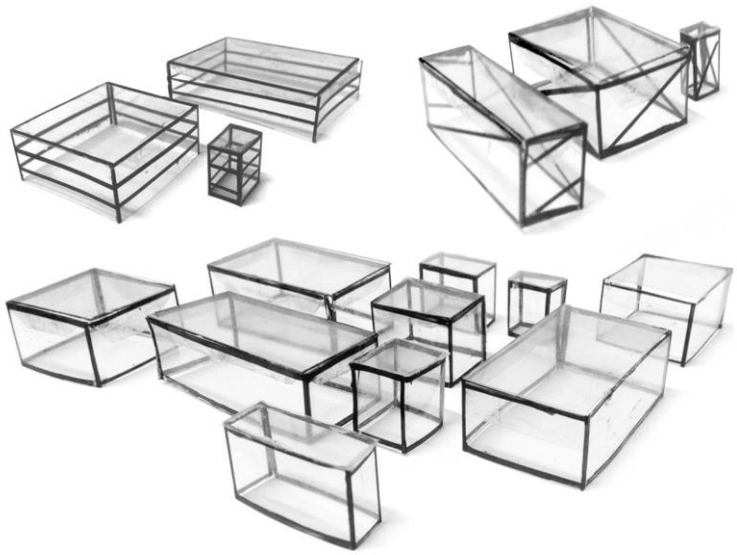

Fig.11 Fragments- Various Spatial volumes
Model by Fatima Tuz Zahra

7.3 Level 3: Defragmentation & Recomposing

7.3.1 Configuration 01:

Volumes were arranged according to the concept of architect Mies van der Rohe following the notion of minimalism and modernism. The plan is placed in a rectangle. Different levels are provided with open spaces as was done in Wolf house. Fig. 12

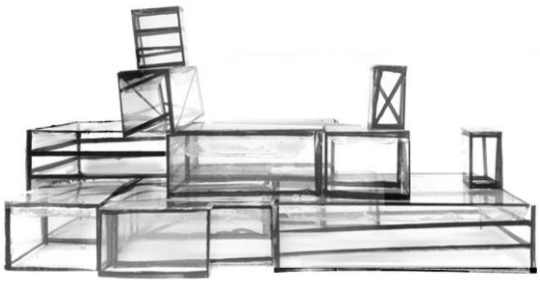

Fig.12 Defragmentation, Configuration-1
Model by Fatima Tuz Zahra

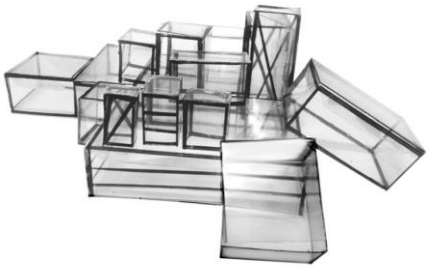

Fig.13 Defragmentation, Configuration-2
Model by Fatima Tuz Zahra

7.3.2 Configuration 02:

This arrangement has ascending volumes as we move from the front to the rear. Some volumes are tilted to give flow to ascending heights. The shape of the plan is kept rectangular. Shapes having expanded volumes are kept as the ground floor and shapes having small volumes are used to make the first floor. Fig.13

7.3.3 Configuration 03:

In this, the concept of modernism and abstraction was mixed up. The tilt is given to form different levels of volume. The concept of movement among spaces by putting them in a maze-like arrangement was also used. Some volumes are rotated to give height to the overall façade, and some are tilted as if the volumes are playing with each other. Fig.14

Fig.14 Defragmentation, Configuration-3
Model by Fatima Tuz Zahra

Fig.15 Defragmentation, Configuration -4
Model by Fatima Tuz Zahra

7.3.4 Configuration 04:

In this arrangement, some massive volumes were tilted, and used small volumes to make spaces horizontally. Some volumes are rotated vertically to gain more height. The overall arrangement looks like a play of volumes in spaces and connects them through different levels. The volume which is tilted can be used to make a space having natural light and give a view of the landscape. Small volumes at the top can be used to make a small working studio.

7.3.5 Configuration 05:

This arrangement is also according to the impression of architect Mies van der Rohe, following the volumetric properties of Wolf House. In this arrangement, first floor at some points is cantilevered. Chimneys are given on the first and ground floor; different volumes are mixed up to form this arrangement.

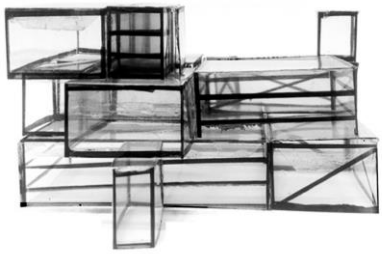

Fig.16 Defragmentation, Composition -5
Model by Fatima Tuz Zahra

8. CONCLUSION

Precedents study act as a valuable resource for future design excellence, if carried out carefully. Precedent analysis helps understand solutions that are already given to certain design questions. Reassessing exemplary work; understanding the systems and approaches that are worked out in the creation of that work can play an exceptional role to accomplish more refined and quality results by intelligently interpreting the reasons and methods that were applied. Precedent study and analysis carried out in a systematic way instigate design thinking in a more organized and productive manner. Involving learner in a variety of modes: firstly – by observing and predicting the precedent as it is (Fig 7-10), secondly- by splitting the precedent into possible fragments (Fig 11), and thirdly – by experimenting with fragmented space constituents to come up with more architectural possibilities of the same spatial units (Fig 12-16). Moreover, physical 3d models helped for a better understanding of space handling and spatial behaviors of architecture precedents. The derivative configuration model of precedent study proved to be very effective in monitoring situations where precedents are only superficially studied. This precedent study model will discourage the tradition of taking shortcuts that would usually lead students towards imitation instead learning. The teaching focus of the derivative model is to nurture a true designer outlook by creating an environment, where personalized speculations and projections are encouraged in the realization of ingenuity, multiplicity, and creativity of design responses. The aforementioned method of detailed inductive reasoning, with a close studio master's assistance, enables a smooth and directional working environment. The empirical mode of education i.e., "Learning by Doing", leads to achieving creative and scientifically grounded architectural solutions, which is fundamental to architectural design. Well-structured instruction system of the derivative model to conduct precedent study helped to achieve unexpected spatial and volumetric outcomes (fig 14,15,16) as compared to those design products achieved in the studios

with lesser involvement of instructors (Akin 2002; Wu 2014) and absence of any devised method to study precedent from instructors as apprehended by Hawkins (2021). Therefore, it is concluded that early stages of Design guided through Precedent information by a thorough systematic process i.e., Deciphering Architectural Handling, Fragmentation of Spatial Components, and Defragmentation & Recomposing, for the extraction of embedded knowledge from previously designed projects would help to open up new avenues instead of falsification and imitation as mentioned by Eliouti (2009). This study puts forth one of the ways to conduct precedent analysis to increase learners' excitement and interest, nonetheless, this research calls for further insights and experimentation to conduct precedent study/case study in Architectural Design Studio for furnishing more exciting and productive outcomes.

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