THE WORLD WITHIN

A home cinema

SHETH URVI A.
Urvi Sheth Architect, Ahmedabad, India
info@urvisheth.com
Arya Architects, Ahmedabad, India
arya.architect@gmail.com

Abstract. 'The World Within' is an intimate family space, in an existing residence of goldsmith located in Ahmedabad, India. A jeweller understood and appreciated the intricacy of design as well as delicacy of workmanship in his profession, hence in architecture. Therefore, the idea of making an elegant crystal using principle of cracking is proposed to generate numerous unique facets. In order to create a unique experience different from the rest of the house outside this room, a continuous inner envelope is made. Variation of same design in 2D and 3D are used to dissolve the edges of floor, walls and ceiling. Lights are integrated by choosing specific facets forming a gradient of intensity flowing away from the screen. Voids are created within the facets to place various equipments. Design generation, iteration and integration are done through Grasshopper script. Fabrication followed standard process of cutting and numbering each piece with a CNC router. Assembly on site, done by local carpenters, remained the most challenging as well as interesting aspect of the project.

Keywords. Recursion; home cinema; generative design.

1. Introduction

The project brief was to make a home cinema that explore and experiment unconventional ideas with new technology. Proposed space for this was a covered balcony (veranda), 6.25 m x 3.5 m, on the first floor in an existing bungalow. Due to small volume and use of sound absorbing materials, in-depth acoustical analysis was not a serious consideration.

2. Design generation

Space was fragmented. North side was full window facing the street, South a blank wall, East side had a bay window with a seat built in where as from the West side one entered the space which varied in wall thickness creating a niche. Flooring was disjointed with required slope to drain water and had a stepped ceiling. Smaller gestures of adding element of interest were adding to the fragments. In order to give a unique environment, decision was made to create a continuous inner envelope that unifies five surfaces.

Generative design and digital fabrication in architecture are relatively recent and rare in India. Therefore, the choice of using 'planer facets' was made, especially for fabrication and assembly ease. Simultaneously various logics to create faceted surfaces were referred, of which, the concept of cracking, was best suitable. Same logic has been observed in the physical formation of diamonds associating to the owner's profession.

Combining two logics, envelope and facets, a continuous inner envelope was lined with larger triangular surfaces where South wall was identified for projection, ceiling gently sloping from high to low negotiating existing stepped ceiling and opened up in the North with full length window. Algorithm is applied on triangular base surfaces, which is written in Grasshopper to create facets. It followed simple steps: find the centroid of each large triangular surface; draw lines joining centroid to the vertices forming 3 smaller triangles recursively. Recursion was limited by density parameter coupled with special requirements to generate corresponding patterns. This resulted variation such as the ceiling took density gradients from low to high in South to North direction, high density cloud was generated in the niche for mural (West wall), fairly distributed in the East wall taking care of the bay window, where as projection wall was least dense. 2D was then translated to 3D by lifting up centroid perpendicular to respective flat surface responding the room size and clear height within a range of 50 – 150mm on wall and 0 – 600 mm in the ceiling resulting a homogeneous heterogeneity.

Lights were integrated by choosing specific facets following intensity gradient creating of a flow away from the screen. Mural had special light embedded. Voids were created within the facets to place various equipments like split air condition, projector, speakers, etc. Reflected ceiling pattern in 2D was used to weave a custom made carpet for the room adding to the continuity of design. Similarly curtains were designed to be embroidered or painted. Due to time constrains this is not realised. Concept was carried forward till furniture design to house equipments like DVD player, X-box, music system, etc. Seating arrangement and soft furnishing was out of scope of the project.

3. Fabrication and Assembly challenges

Design was a prototyped at scale1:20 to understand fabrication logic using laser cutting and paper foldouts. This also gave a clearer picture of the proposed design and construction logic to the client. 8mm medium density fibreboard was used for the panels and 19mm plywood formed the substructure. Actual fabrication followed standard process of cutting, engraving and numbering each piece with a CNC router using foldout templates. First batch of cut pieces were brought into workshop, for assembly and then to be installed on site. But due to the lack of experience on the part of workmanship in given method it did not work out.

From this point onwards customisation on processes based on available tools and skill set began. Traditionally in India, carpenters are used to work on site. Therefore, the plan had to be modified and entire assembly took place on site. Another fact discovered that carpenters were accustom to read three-dimensional geometry as the scaled prototype did not help them understanding construction logic. Therefore, entire design had to be converted to 2D drawings (sections and elevations) with basic dimensions including each perpendicular dimension of lifted centroid from its flat plane. The carpenters precisely chamfered each piece connecting to the next. This is only possible because of their skill set, experience, cooperation and urge to create something new.

Choice of finishes also went through various phases. Options to paint, acoustic paint vs polish, choice of colour ranging from lighter tones to black. Assumption that lighter colours (white) may create interesting shadow patterns of the facets was one where as function of home cinema needed to black out the space was the other. Black colour has negativity attached in Indian society, so the choice of darker shade of blue is finally applied on panelled surfaces and the lighter shade of blue with darker tone of lines are woven in the carpet.

4. Conclusion

In present Indian context application of generative design and digital fabrication to realize such complex geometry will require customisation of the process in resolving unforeseen issues from traditional workmanship.

Acknowledgements

References

Aranda, B. and Lasch, C.: 2005, Tooling: pamphlet architecture 27, *Cracking,* Priceton Archi-
    tectural Press, New York, 52–62.