

Thinking Through Making: Ornamental Block Prototypes for Tropical Architecture

The author taught a semester-long elective related to ongoing research on concrete ornamental blocks, envisioned as the first in a series that will provide students with the opportunity of hands-on knowledge of traditional building techniques framed within tropical vernacular concrete construction. This particular course had a two-fold objective: to isolate, design and detail one building component and its negative space, and also, to develop iterative prototypes while gaining knowledge on the physical and material properties of concrete.

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Contemporary vernacular architecture has increasingly lost skilled labor in the local construction industry, and the built environment can seem to occur as an amalgamated kit of parts in which the architect has seemingly little domain. Incorporating design and building experiences to the education of the architect can begin to enhance the technical knowledge and representational narrative taught at the university level, and recently completed coursework consisting of explorations on the variations of concrete ‘ornamental block’ opens a dialogue on these pedagogical practices and opportunities of Design-Build in tropical architecture.

OBSERVATION

Students began by documenting and photographing ornamental blocks around the city districts and neighborhoods they frequent, understanding their uses and patterns of repetition. With this study, the studio takes stock of the taxonomy of blocks available locally, and accumulates data on the performance of the block inasmuch as for perimeter blocking, security, privacy, as for passive ventilation and shading strategies. Learning to isolate the visual cacophony of the city into individual pieces to the built environment is part and parcel of this exercise.

PRECEDENTS

Looking at a variety of formal case studies including, but not limited to, Frank Lloyd Wright’s concrete block houses, Marcel Breuer’s prefabricated façades, Erwin Hauer’s screen walls, and more contemporary Non-Western precedents in Joshua Bolchover & John Lin’s work in Angdong Village in China¹, we begin to work through ideas – thinking through craft – assisted by drawing exercises on positive and negative space. Case studies are not only analyzed for their performative aspects of illumination (direct versus diffuse light), ventilation, screening or privacy, etc., but also for their ease and methods of mold-making and mold construction.

PROPOSALS

Next, a series of iterative prototypes leading to mold fabrication are produced, some with the aid of digital fabrication techniques.² Molds are constructed according to each group's intent or design objective, using a wide variety of media, including but not limited to: traditional saw and jigs, computer-controlled cutting, printing and milling machines, vacuum forming, mylar sheet folding patterns, foam carvings, and textile formwork explorations. In an age of computer aided design processes, where anything can be a computer rendering of the potential of a space, the ability to test/build in the physical realm is of great importance. The designer must have the technical know-how in order to posit a plausible design, thus, working in small groups, each team struggles to find the best construction solution to the desired aesthetic design problem. The following two student works are presented, alongside global case studies that emphasize design considerations such as security, fencing, privacy, passive ventilation and shading strategies, as well as the fabrication techniques of mold-making and the performative aspects and constraints of the material, in this case, concrete.

GROUP 01

Using the Armstrong Rubber Building façade study (1969) as precedent for their design, the group³ was particularly interested in re-interpreting the variety in natural solar shading effects created by the depth and angles evident in Breuer's work. After several iterations, the group understood that in order to make a sturdy formwork that would resist multiple pours, it would be best to construct it out of solid wood, instead of intersecting planes of quarter plywood. The block pattern is designed so that it can be assembled alternating both front and back of the module in order to construct a screen wall.

GROUP 02

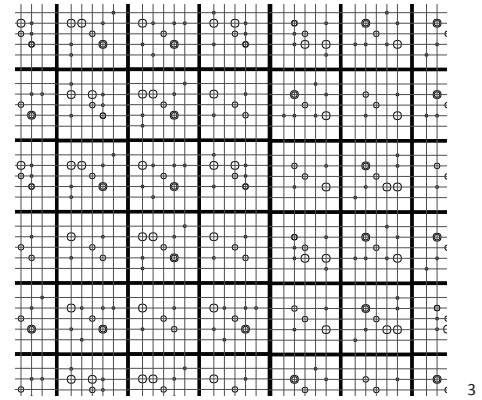
Borrowing from both Andrew Kudless of Matsys and his project for the San Francisco Museum of Modern Art, P_Wall (2009), and Miguel Fisac's experiments with flexible concrete formwork, this group⁵ used concrete and spandex to echo the evocative visual effects of sinuous curves and pinched forms. Textile formwork resulted in a playful exploration, and although difficult to control at first attempt, the group mapped varying dowel heights to fixed positions and used the unexpected nature of the concrete pour to their advantage.

ASSESSMENT

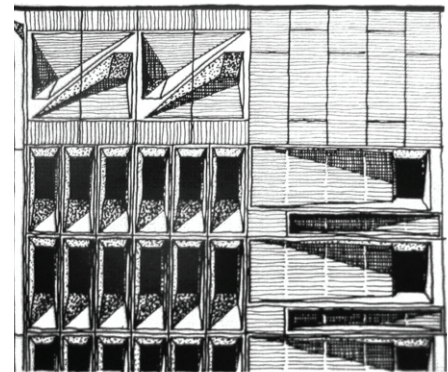
We were encouraged by the depth of ideas presented by students, and by their commitment and enjoyment of exposure to the building, pouring and curing process of concrete. Overall, final results varied in range and quality of fabrication, and future course iterations should include more hands-on emphasis on technical aspects of aggregates, the ratio of said aggregates to concrete mixtures, the addition of fly ash components to the mixture, and the inclusion of fiber reinforced elements. In addition, the elective should be cross-referenced to related required coursework in the fields of structures and building technologies, so that the student can put to test the compressive strengths of their designs. The final jury members also encouraged more explorations on control of certain parameters, such as gamut of color and variations in exposed texture and finishes, and finally, greater emphasis on applications for tropical climates.

CONCLUSIONS

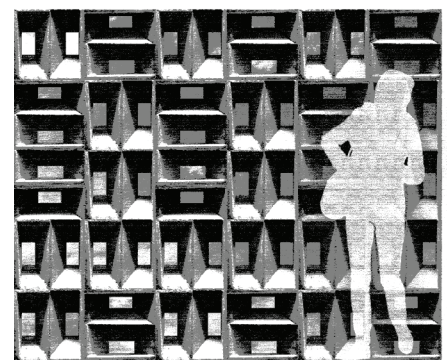
Thinking through making at the small scale of rudimentary building blocks complements both theory and practice to the education of the architect, and, in order to address current and future issues relevant to both development and practice,



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Figure 1: Armstrong Rubber Building facade, study Marcel Breuer

Figure 2: Student work, Group 01, Edgardo L. Agosto Pagan and Edwin De La Cruz Acosta. School of Architecture, University of Puerto Rico. 2014



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ENDNOTES

1. Bolchover, Joshua and Lin, John. *Rural Urban Framework: Transforming the Chinese Countryside*. Birkhauser Verlag GmbH, Basel. 2014
2. A useful pedagogical resource was found in: Iwamoto Lisa. *Digital Fabrications: Architectural and Material Techniques*. Princeton Architectural Press, New York. 2009
3. Students: Edgardo L. Agosto Pagán, Edwin De La Cruz Acosta. Assistant: Nikos Flores Kearns
4. Another valuable resource: Olgay, Aledar. *Solar Control and Shading Devices*. Princeton Architectural Press, New York. 1977
5. Students: Kathia Sánchez Ríos, Edwin V. Nieves Francis. Assistant: Nikos Flores Kearns
6. Anderson, Chris. *Makers: The New Industrial Revolution*. Random House, New York. 2012

academia must actively participate in the quest to reestablish the figure of the architect as *master builder*.

There is an added interest in designing contemporary versions of concrete blocks and linking Design-Build projects to up-to-date prototyping techniques. A greater discussion of the use of rapid prototyping equipment as micro-manufacturing techniques increasingly available to architecture students, designers and 'makers'⁶-- such as computer-controlled cutting, printing and milling machines, vacuum forming equipment, mylar or urethane sheet folding patterns, foam carvings, and textile formwork explorations, to name a few -- is in order. These techniques can become means to the end of iterative prototyping and serial production and, rather than aiming to produce an aesthetic, current machinery and equipment should enable a process by which skill and technique are made contemporary. Entrepreneurial opportunities abound.

Figure 3-4: Student work, Group 02, Kathis Kathia Sánchez Ríos, Edwin V. Nieves Francis. School of Architecture. University of Puerto Rico. 2014