

PATTERNED: Sensorial Material Effects and the Learning Machine

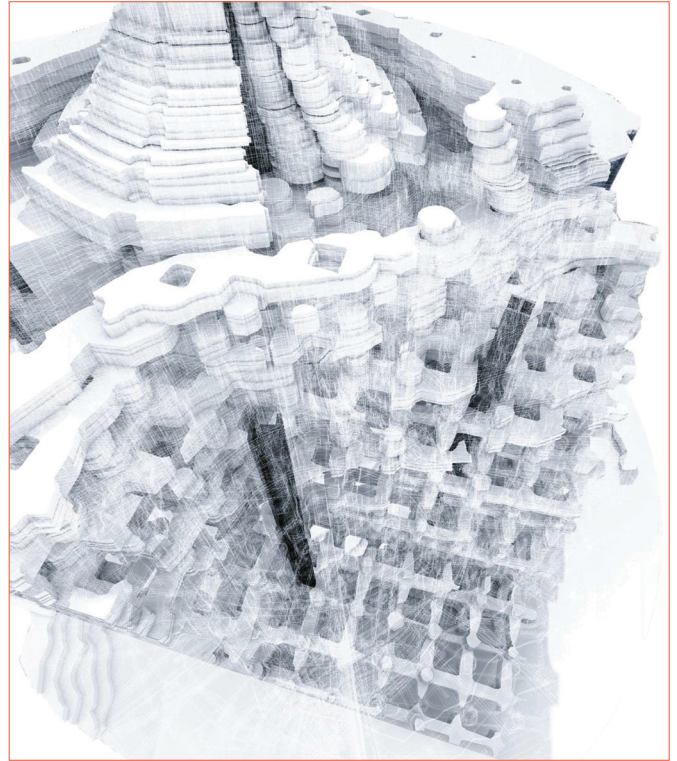


Figure 1. Three-dimensional pattern study, pattern aggregation informing spatial configuration. Student: Christopher Brewer | Course: IARC 371 (By author).

Patterns, murals, reliefs, and various types of surface articulations have long been an integral part of design. Attitudes towards surface are reflective of a broader climate of spatial production, gauging the necessity and commodity of agglomeration within spaces specifically, and the agency of liminal territories within architecture at large. Commonly deposited on surfaces within prized programs (such as churches, palaces, and mosques), patterns and their respective aggregations reference through their inscriptions deities and assert the influence of various authorities. They are also telling of traditions of making and craft, both analog and digital. Whether such formations assume anthropomorphic qualities or are fashioned around pure geometry and repetition, the agency of surface articulation remains a present yet often contested area in design.¹

The resilience of patterns and their resurgence in the digital age is a testament to their impact on our spatial experience.² From primitive markings to the most complex formal plasticity of fabricated assemblages, topical material applications are intrinsic to asserting value and identity to the spatial volume. Heterotopias by nature, patterns alter and augment the space of occupation. They cater to a different formal metabolism characterized by a unique receptiveness to the users, thus, introducing friction to interior and exterior territories. Now more than ever, the need for this friction between surfaces and their occupants is essential in an era ubiquitous with the flatness of virtual imagery³ and an overall contextual banality.

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[IN]ANIMATE SURFACES: A NONLINEAR HISTORICAL BRIEF

The agency of surfaces within the spatial construct has assumed numerous and complex roles, attuned to social, political, and technological climates. Gauging various attitudes towards enclosure and the exchanges that take place between interior and exterior, surfaces often operate within a spectrum of allowances. Rudimentary reductive, modernism's approach to surfaces aided by technological advancements in climate control systems, promoted impervious boundaries. Such an approach remains dominant in contemporary practice. While the environmental sustainability of an absolute detachment is never attainable, the conceptual sterility of the modern surface proved unsatisfactory as well. Reduced to a strict flatness, even texturally (e.g., Barcelona Pavilion), its limitation to visual stimuli came with a considerable detachment from context. This has ushered reactive attitudes towards architecture that paralleled a rethinking of its surfaces and their sensorial impact. While the assemblages of the architectural construct remain seemingly unchanged, the order and treatment of surfaces undergo significant modification, harnessing the bulk of the stylistic shifts that ensued. Responding to the austerity and lack of variety of the modern⁴, these shifts aimed to invoke an experiential depth to the otherwise rigid formality of the modern volume that is strictly assembled of flat surfaces. Embracing the multifaceted nature of modern life, Robert Venturi voiced the need for "a complex and contradictory architecture based on the richness and ambiguity of the modern experience, including that experience which is inherent in art."⁵ He writes:

I am for richness of meaning rather than clarity of meaning; for the implicit function as well as the explicit function. I prefer "both-and" to "either-or," black and white, and sometimes gray, to black or white. A valid architecture evokes many levels of meaning and combinations of focus: its space and its elements become readable and workable in several ways at once.

Such sentiments were echoed and advanced in Deconstructivism.⁶ Deconstructivism intently focused on the breaking down of solid geometry in favor of surface dislocation. The overt fragmentation of volumes supported a surface-centric reading exposing structural members and material paneling. These provocations laid the basis for an appetite for multisensory settings animated through topical distortions and variances. The need for textural complexities programmatically, formally, and experientially is not new. Although its resurgence was facilitated through digital tooling, its employment is present through various periods.

Periods where surfaces assume a grittier and ambiguous resolution such as the Baroque have often been associated with decadence and excess. While the aesthetic value of the surface resolution is often questioned, the Baroque discourse was negotiating an entirely different set of conditions. Propagated by the Baroque, the conceptual carving out of a single mass as opposed to the assemblage of parts changed the approach towards spatiality, placing interior space firmly at the center of Baroque thinking. The Baroque fully invested in interior aesthetics, thus, introducing an elasticity between interior and exterior. Through the principle of pulsating juxtaposition, formal organization and surface articulation allowed "the spatial elements to expand and contract as if they were made of elastic material."⁷ Such elasticity enabled a unique fluid exchange between interior spaces and external context.

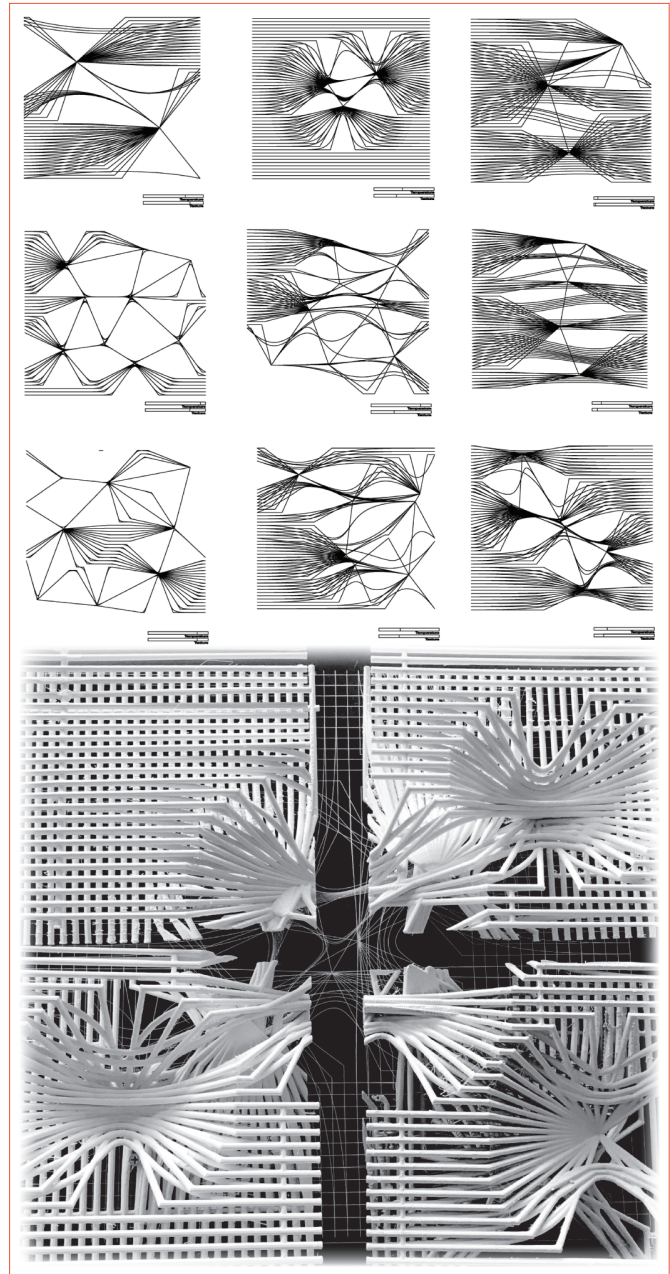


Figure 2. Top: pattern variances, serial pattern studies. Bottom: 3D printed pattern relief. Student: Katie Layman | Course: IARC 372 (By author)

In analyzing Baroque thinking, Deleuze highlights the concept of the monad that is viewed in terms of folds of space, movement, and time. In his book *The Fold*, he interprets the world as a body of infinite folds and surfaces weaving, compressed by time and space.⁸ Forsaking the assumption that these surface articulations were there for aesthetic purposes, perhaps the Baroque employed surface articulations with a sensorial agenda in mind; to dampen sound, to pulsate light, to distort views, to animate space in a period that set out to incite, to delight, to move. These animate formations laid the foundation for what we see unfold in digital surface operations today.

DIGITAL CRAFT AND THE AESTHETICISM OF SURFACE

While examining "Digital Morphogenesis," Branko Kolarevic points out the shift in formal and spatial thinking ushered in by the introduction of digital modeling software into the architectural processes. This introduction "provided a departure from the

Euclidean geometry of discrete volumes represented in Cartesian space and made possible the present use of topological, rubber-sheet geometry of continuous curves and surfaces that feature prominently in contemporary architecture."⁹ Within the digital milieu, surfaces become the proto formal elements, the building block for any spatial construct. The manifestation of this spatial synthesis is seen not only representationally, but also in digital fabrication processes that rely on an understanding of layered planer configurations to resolve solid geometries.

The paradigm shift also presented a new logic of explicit deformities and transformation as the means of surface aestheticism.¹⁰ Lynn attributes this shift to the fallout of the Cartesian spatial model rooted in coordinate defined volumes to the definition of topological surfaces with U, V vector coordinates. Through such operations, the elasticity that was introduced by the Baroque found new relevance within digital craft. The morphology of surface to skin is akin to the nature of parametric planes which tend to be composed of serial surfaces functioning within an array of points. The definition of surface as a skin led to an era of complex formal articulation. Now sentient, skins warp to create enclosures; they thicken and thin in seamless transitions that demark exchanges with elements such as light, sound, and temperature. They acquire patterns and textures regulated by computer codes and formulas. Within the digital interface, the implementation of surface articulation is integral, rooted in a performative logic rather than a misguided association with ornament.

While such integral evolutions are redefining the teaching and practice of design, industry has been slower in following suit, maintaining a strict approach to product development rooted in traditions of an industrial past. Even though we see many new materials emerge on the market and others being reappropriated to different uses, catering to the changing landscape of design education and ultimately practice necessitates a more active industry involvement in design thinking. In the past few years, new methods of integrating practice and construction systems have emerged with the advent of Building Information Modeling (BIM) in the early 2000s. While such trajectories, redefine -to some degree- the exchanges between design and execution, they do little to address the need for rethinking methods of making required for a new digitally-driven formal language. Construction systems and material uses and standards remain largely the same despite the apparent shift in architectural design processes. As a result, "the gap between the designer's vision and operations of the construction industry widened as fabrication processes remained largely analogue in how they were driven and delivered."¹¹ The disparity between the various facets of the design process is mainly due to the limited exchanges that take place between its primary agents: the academy, practice, and industry. The dominant aversion to such transactions is most evident between industry and academy. While industry has limited involvement in the emerging design discourse and its conceptual syntax, the academy (with a few exceptions) is also responsible for dismissing the need for active dialogue, limiting industry-related content to a few courses that are part of an old educational model.

STUDIO CASE STUDY

It is often an unspoken rule that the design studio's aptitude is in theory and conceptual thinking. However, within every academic design program, there exists at least one studio that has to deal

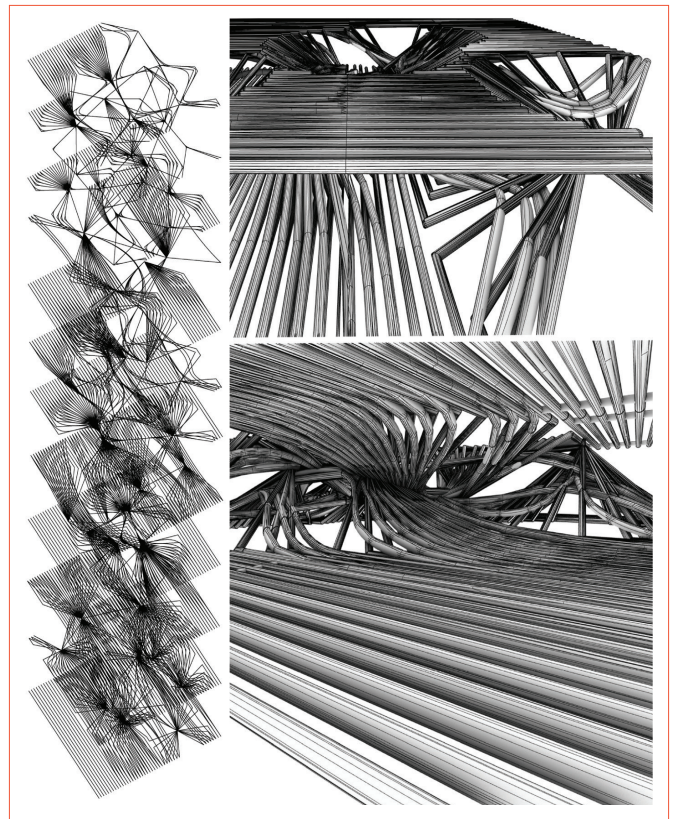


Figure 3. Studies exploring the spatial pattern configurations in relation to warping surfaces. Student: Katie Layman | Course: IARC 372 (By author)

with "real building," its various systems and performative criteria. The course comes in many names: the integrations studio, the CD (construction documents) studio, or the comprehensive studio. This is academia's bid to prepare designers to the challenges and realities of practice. Laden with accreditation standards, these studios often stir stresses and burdens on both the educators and the students' ends. While shuffling through the verbiage in the syllabi, it is easy to read an unwritten promise: here we get real about architecture. Here we abandon the unfettered follies and joys of unrestricted forms, typologies, and budgets. Here we make buildings. To further complicate the formula, industry has often taken a divergent trajectory when it comes to pedagogy. Directed by demand and supply structures and responding to fashion trends, material manufactures seldom address the climatic shifts initiated by the academy. Big industry has maintained a strict agenda when it comes to design education, primarily invested in sponsorships aiming to familiarize students with existing products and systems. Such approaches have created a triad of differing interests: research-based design education, real-world practice, and consumer-driven industry. Operatively independent, the separation of these faculties has been detrimental to our built environment in a time when we are dealing with pressing complexities and responsibilities as citizens and designers.

Facilitated by new digital frontiers, the exchanges between industry, academy, and profession are more feasible than ever.¹² While the digital tooling is often presumed responsible for a reductive material understanding in students, it also presents promising venues where integral exchanges can take place. Fueled by an appetite for a new formal language of surface articulations enabled by digital craft, the overlaps between these three municipalities are requisite. At the

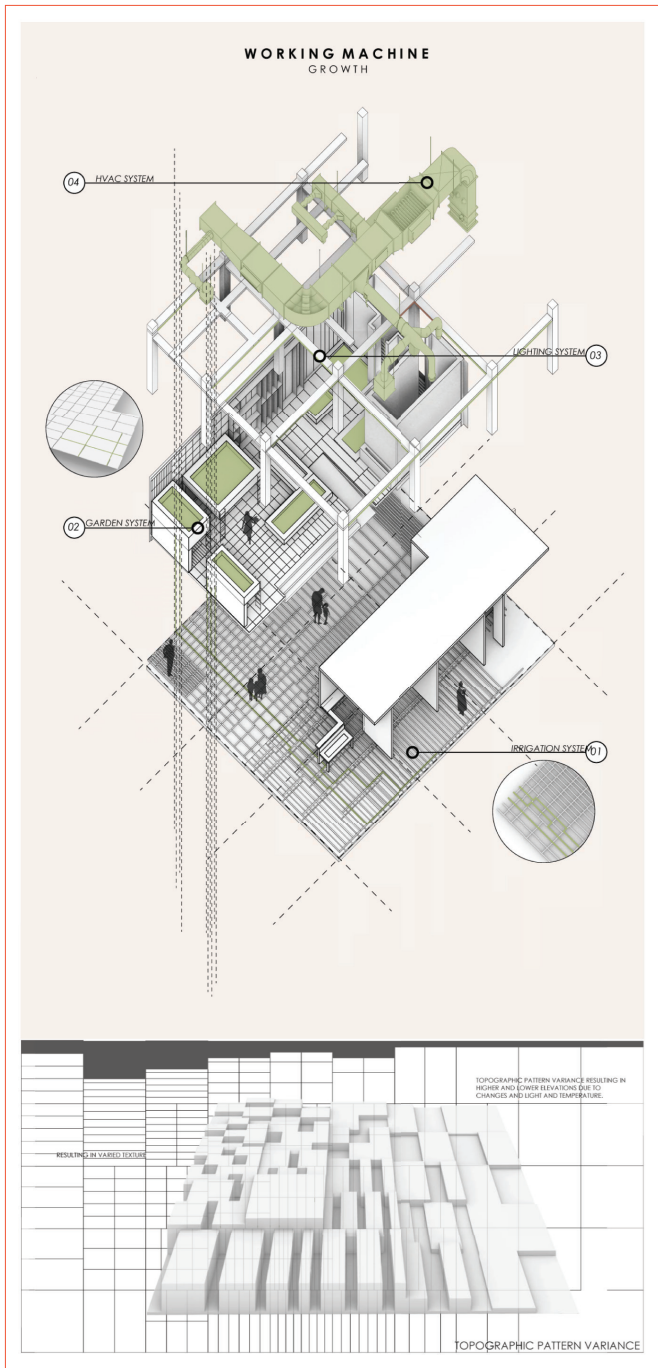


Figure 4. Exploded axonometric drawing of a proposal for a MicroSchool. The design employs the spatial diagram developed from the pattern topography below to generate the sectional and programmatic language of the design. Student: Katherine Turnbull | Course: IARC 372 (By author)

center of these overlaps is a newfound agency for students. Students are facilitators and consumers of new technologies, rendering their unique expertise invaluable to the sustenance of the discipline of design and its allied fields.

Under this premise, a collaboration between industry partners in tile manufacturing, a principal of a local school, and a motivated group of third-year design students formed. Our goal was to deploy an interactive platform in which the aforementioned theoretical charges were not only tested but also applied. Collectively, we engaged in a creative process that pursued new design opportunities involving pattern formation and spatial perception, as we questioned

how diverse perceptual modalities generate new potentials for learning environments. While such alchemy of agents is not new in the field of design and its education, the desired objectives were. The outcomes were not geared toward a design-build proposal as commonly practiced in Architecture programs; instead, the aim was to achieve a think tank that fosters reciprocal exchanges between the three parties. This collaboration served as a unique opportunity for mutual learning and promoted productive links between industry, academy, and community.

The course began with a charrette focusing on the versioning of sensorial surfaces through pattern application and extrusion. This was achieved through coding a tile pattern formation and devising twelve subsequent iterations of it. The objective was to arrive at complex material effects capable of demarking space and triggering experiential affects. Branko Kolarevic, in the book, *Architecture in the Digital Age, Design, and Manufacturing*, addresses the connection between effects and affects saying, "There is a close relationship of materiality in architecture to the extended realm of effects and affects. Articulation of surface and formal effects can have a tremendous affect on the experiential veracity of architecture."¹³ It is rather easy to understand the spatial characteristics and experiences of three-dimensional spaces (volumes). By nature, these constructs engulf their occupants and evoke specific reactions while providing for basic needs. However, can two-dimensionality (surfaces) provoke similar or even more complex affects? Can surface articulation advance more integral performative agendas? With these inquiries in mind, we engaged in the study of innovative tile systems and their evolution into respective spatial strategies. Visits to the tile manufacturing plant and consultations with material engineers augmented the conceptual studies of this phase. Further, we tested the proto tile modular in both its green and fired forms, employing the college's fabrication lab machinery. The integration of the students' skills, the industry expertise, and client input created an effective feedback loop that informed the process in its entirety.

As the first phase of the project engaged the investigation of the sensorial impact of pattern, textures and the resultant reading(s) of space, the second phase aimed to actively employ these formations towards designing learning spaces for children with a spectrum of learning or physical disabilities. The studio worked on designing a MicroSchool, which is an alternative educational model that calls for an intimate learning environment centered on small spaces that offer a range of stimuli and experiences to students. The tile pattern studies became the base for defining innovative environments that utilize a variety of spatial and material configurations while balancing spatial familiarity and novelty. To better understand the parameters of the program and needs of the students, the studio worked closely with the MicroSchool principal and students. As MicroSchools serve children of various ages, the internal functions of these settings required the mobility of interior components and a capacity to retune the space based on the psychological and physical needs of the occupants.

CONCLUSION

Addressing learning settings through the versioning of material effects proved productive; it reinforced the integral role surfaces, particularly interior surfaces, play in our built environments. Surfaces collect and reflect sounds, smells, and images of our engagements in space. They harness temperatures, provoke memories, and

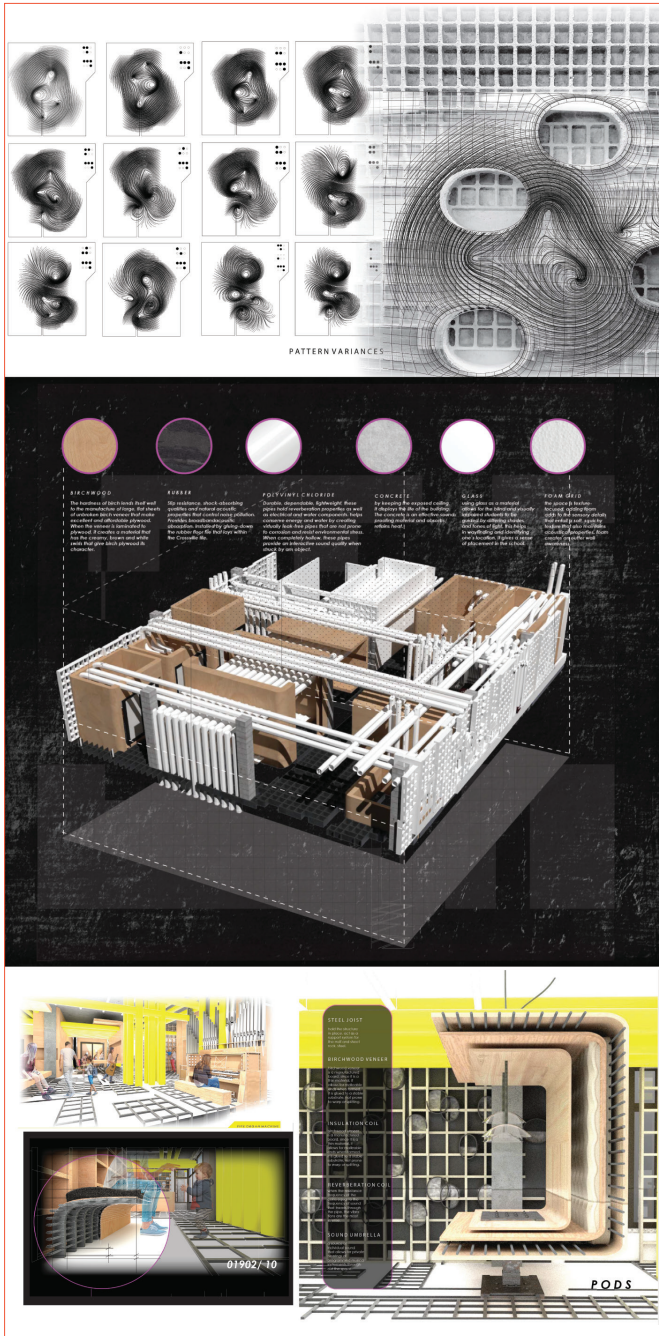


Figure 5. Design proposal for a MicroSchool for visually impaired students. The pattern studies developed in phase 01 informed the various elements of the interior. The design utilizes pattern texture, and sound vibration to activate spaces and direct circulation. Student: Annie Phillips | Course: IARC 372 (By author)

alter our perception of depth. Moreover, the textural qualities of surfaces facilitate and compel haptic exchanges between our everyday life and spaces in which this life occurs. They engender a comprehensive impact on the design process and the subsequent spatial experience and expression. The extent of such impact resides in the complexity of patterned aggregations and consequent material and tectonic resolution. As such, the integration of reciprocal experience learning strategies as illustrated in the studio case study enabled students to work directly with consultants and engineers, facilitating material experimentation and the development of novel applications and tectonics. These were directly utilized to respond to the programmatic needs of the client. The speculative trajectories

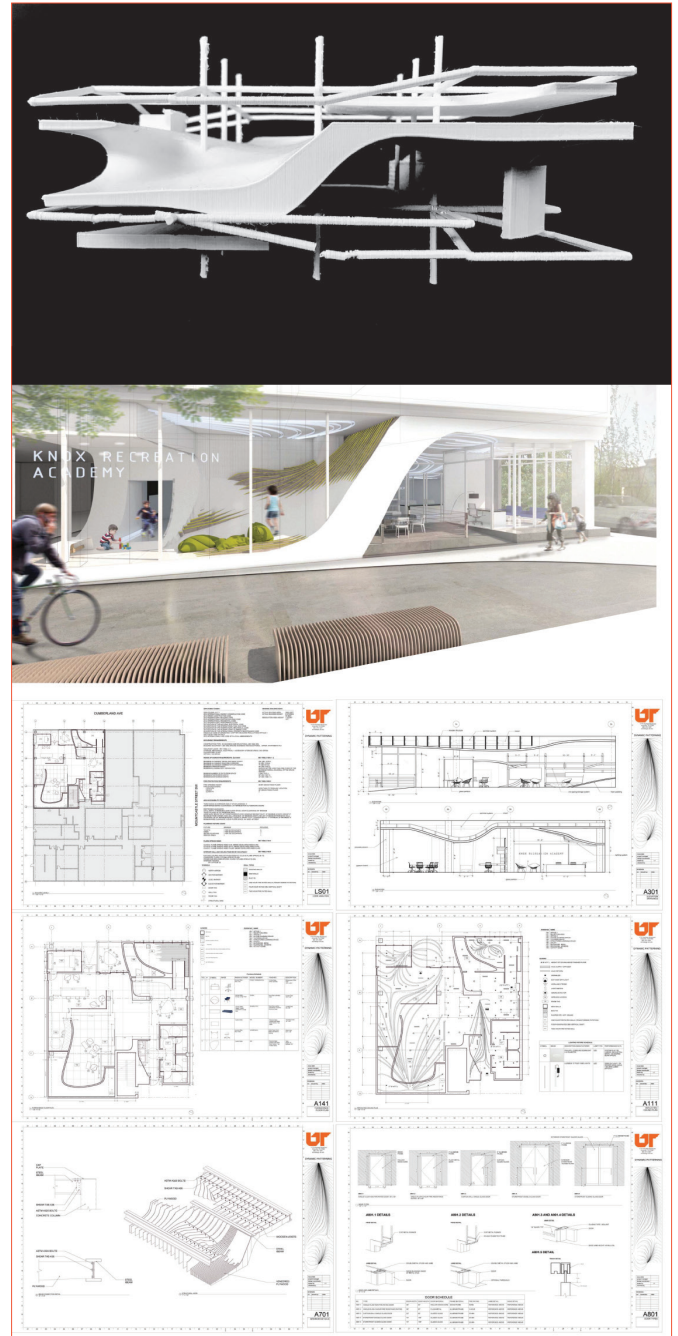


Figure 6. In this design proposal, the pattern is employed in the lighting system. The light is refracted through the fluid surfaces of the carved volume. The studio focused not only on generating innovative concepts and designs, but also on the technical aspects of design development and construction documentation. Student: Elizabeth Hankel | Course: IARC 372 (By author)

that the studio pursued were always substantiated through the active participation of the various project parties. An integration as such allows the students to participate in the design process actively and gives them agency and insight into the often overlooked area of product development. Most importantly, it enables the students, the client, and industry partners to look with fresh eyes on the interactions that define the role of the project stakeholders and paves the way for the advancement of new modes of engagement.

The ever-changing climate of design and its parallel architectural acts have been the subject and object of integral evolutions hinging on contextual parameters and emerging mediums. While the field

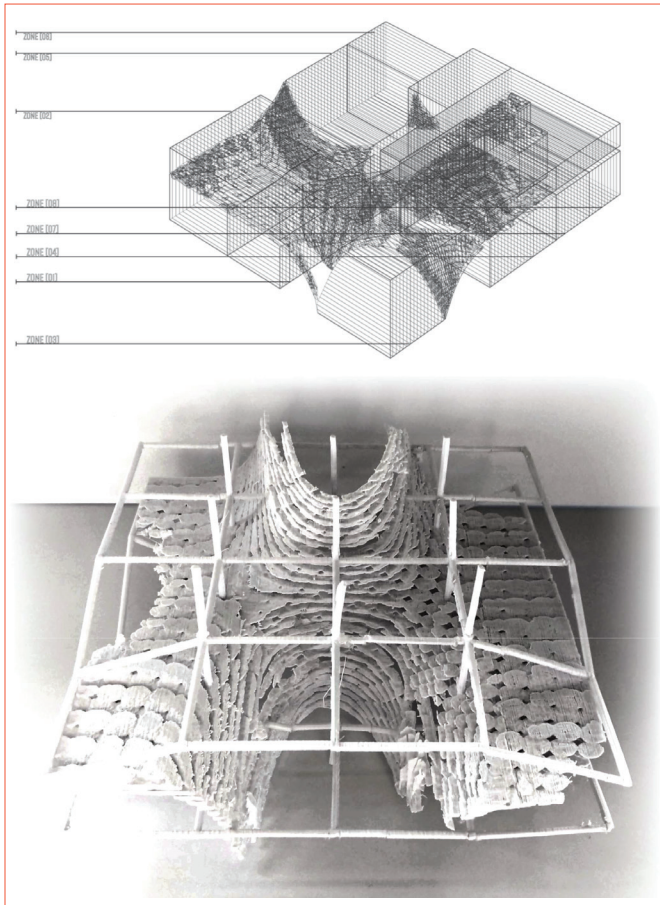


Figure 7. Conceptual diagram and 3D-printed model using aggregate surface articulation as the primary spatial construct for the design of a STEM MicroSchool. The pattern varies in response to surface curvature and programmatic functions. Student: Blair Bickmann | Course: IARC 372 (By author)



Figure 8. Interior rendering of study rooms and robotics lab. Student: Blair Bickmann | Course: IARC 372 (By author)

of architecture has been accepting of new tools and technologies and responsive to contextual variants, it has been more resistant to redefining the roles of its agents and allies. Assuming a distinct track to spatial production with predesignated roles assigned to its various parties is dispositionally impossible. Emerging formal topologies and programmatic typologies of space are contingent on reciprocal exchanges between designing and making. It is within the bounds of the teacher's hunch that a fluid engagement between pedagogy, practice, and industry can be forged. Such hunches cater to progressive design trajectories and ensure the relevance of the discourse which uniquely exists in a state of constant evolution.

Notes

1. Antoine Picon, *Ornament: The Politics of Architecture and Subjectivity* (Somerset: Wiley, 2014), 10.
2. Antoine Picon, *Ornament: The Politics of Architecture and Subjectivity* (Somerset: Wiley, 2014), 30.
3. Mahesh Senagala, "Speed and Relativity: Toward Time-like Architecture," ed. Thomas Fisher and Christine Macy (89th ACSA Annual Meeting Proceedings, *Paradoxes of Progress*, 2001), 364-70.
4. Foreign Office Architects, "The Digital and the Global," in *The Digital Turn in Architecture 1992-2012*, ed. by Mario Carpo (Chichester: Wiley, 2013), 57-61.
5. Robert Venturi, *Complexity and Contradiction in Architecture: With an Introd. by Vincent Scully* (New York, NY: Museum of Modern Art, 1983), 16.
6. Greg Lynn, *Animate Form* (New York: Princeton Architectural Press, 1999), 29.
7. Christian Norberg-Schulz, *Baroque Architecture*. (Milan: Electa, 2003), 113.
8. Gilles Deleuze, *The Fold: Leibniz and the Baroque* (Minneapolis: University of Minnesota Press, 2012), 24.
9. Branko Kolarevic, *Architecture in the Digital Age: Design and Manufacturing* (New York: Taylor & Francis, 2003), 15.
10. Greg Lynn, *Animate Form* (New York: Princeton Architectural Press, 1999), 18.
11. Bob Sheil, "Manufacturing Bespoke Architecture," *Digital Fabrication*, Nexus Network Journal, ed. Kim Williams 2012, 441-456. doi:10.1007/978-3-0348-0582-7_4.
12. SHoP/Sharples Holden Pasquarelli, *Versioning: Evolutionary Techniques in Architecture* (London: Wiley, 2002), 7.
13. Branko Kolarevic and Kevin Klinger, *Manufacturing Material Effects Rethinking Design and Making in Architecture* (Florence: Taylor and Francis, 2013), 10.