

Constructed Fantasies | Fantastic Constructions

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The rapid adoption of digital modeling and rendering software in the design profession and in academia has precipitated a continuously expanding frontier of fantastic imagery, ripe with potent conveyance and intent, that would at best draw from an incredible pool of resources and skills or at worst, remain locked in a designer's mind. Paralleling this trend has been the development of sophisticated CAD programs that have been embraced to facilitate the coordination of complex data, create detailed construction drawings, and produce assemblage and scheduling documents, all with the intention of making manifest an idea into reality. Where the former often is understood as a family of design applications, the latter is imbued with connotations as documentation software. The relationship between the two should not be as pronounced. Although there has yet to be a universally embraced cure-all software that may bridge the disconnect between these two families, one strong component of a long-term panacea is a pedagogy that stresses software in the design curriculum that perpetuates design innovation and fantastic visualization while simultaneously encouraging a sensitivity to ensuring designs may be constructible. Both paradigms are addressed in a new undergraduate architecture course in digital fabrication offered within the Department of Architectural Science at Ryerson University.

Within the course, undergraduate students are exposed to various software applications, including form•Z, which are instrumental in fulfilling the need for an accessible application that allows students to transition from simply a visualization and representation mindset to one that works in tandem with solid geometries and ultimately with production. At the same time, students are introduced to CNC routing, 3D printing (Dimension's ABS Printer), and laser cutting hardware with a particular emphasis on the latter two technologies. The exercises undertaken by students highlight not only bold design intentions but, over the duration of the course, a sensitivity to manufacture and construct becomes an ever-increasing component in their design

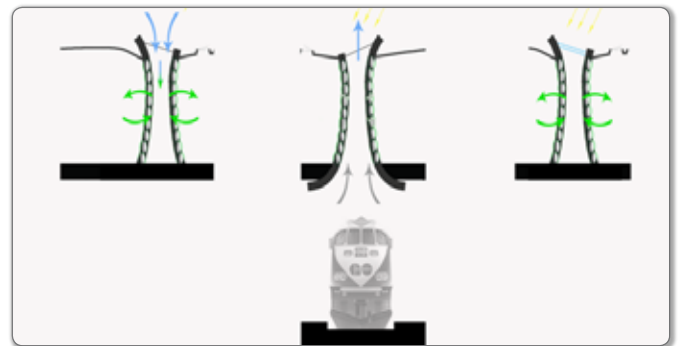
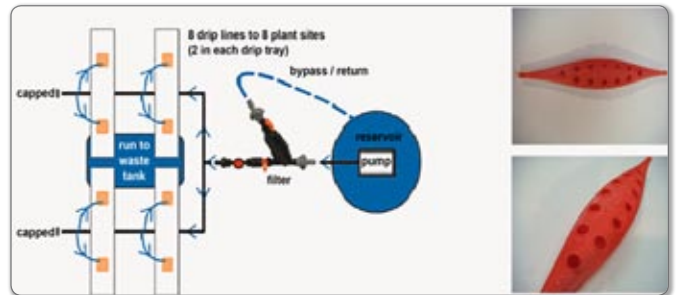
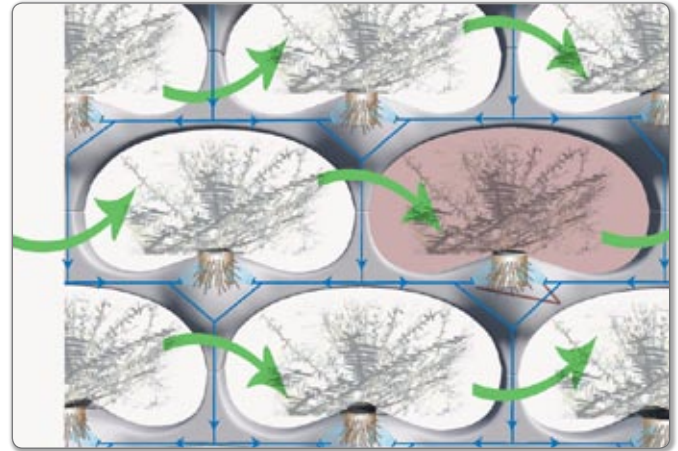


Figure 1: 'CitiesAlive' by students Michael Lanctot, Jordan Lefler, and Nadia Qadir.

work. In essence, the pedagogy focuses on reasserting the term “architect” to students and on leveraging digital media as an implement to transition from being simply an illustrator to a builder.

Representation beyond fantastic imagery

For many design students, fantastic design is driven by a large scale, spectacular potential, often dwelling upon the articulation of a “big idea” rather than delving into the details that allow a design to be brought into reality. The pedagogy of the digital fabrication course allowed for students to extend their design awareness beyond the seduction of imagery. Two projects served as a critical exercise in transitioning from design illustration to initial stages of design development and investigation.

The first project we did was the design of a green envelope system (governed by parameters of the Cities Alive green roof and wall design competition) on an existing urban block (Fig. 1). Despite the large, urban scale of the project, an added layer to the exercise was the resolution of components that made up the design work using 3D printing technologies. This design process mandated that students began to realize the negotiation between existing conditions and design proposals as they explored envelope connectivity and integration, two elements often downplayed, if not ignored, in conventional design courses.

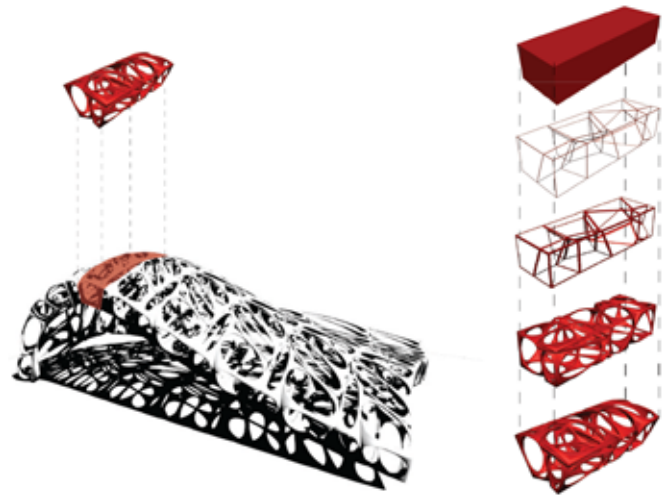


Figure 2: ‘NuiteBlanche’ by students Kamyar Rahimi and Mani Tabrizi.

A similar project called for students to develop design proposals for installations at the annual Nuite Blanche Arts festival in downtown Toronto (Fig. 2 and 3). In addition to conventional orthographic projections and rendered imagery, students were required to produce 3D prints of components of their designs to demonstrate their design consideration in a tangible manner. Once again, students not only had to develop fantastic imagery to convey their design intentions, but also to showcase a sensitivity to finer design components such as human scale, spatial relationships, and materiality.

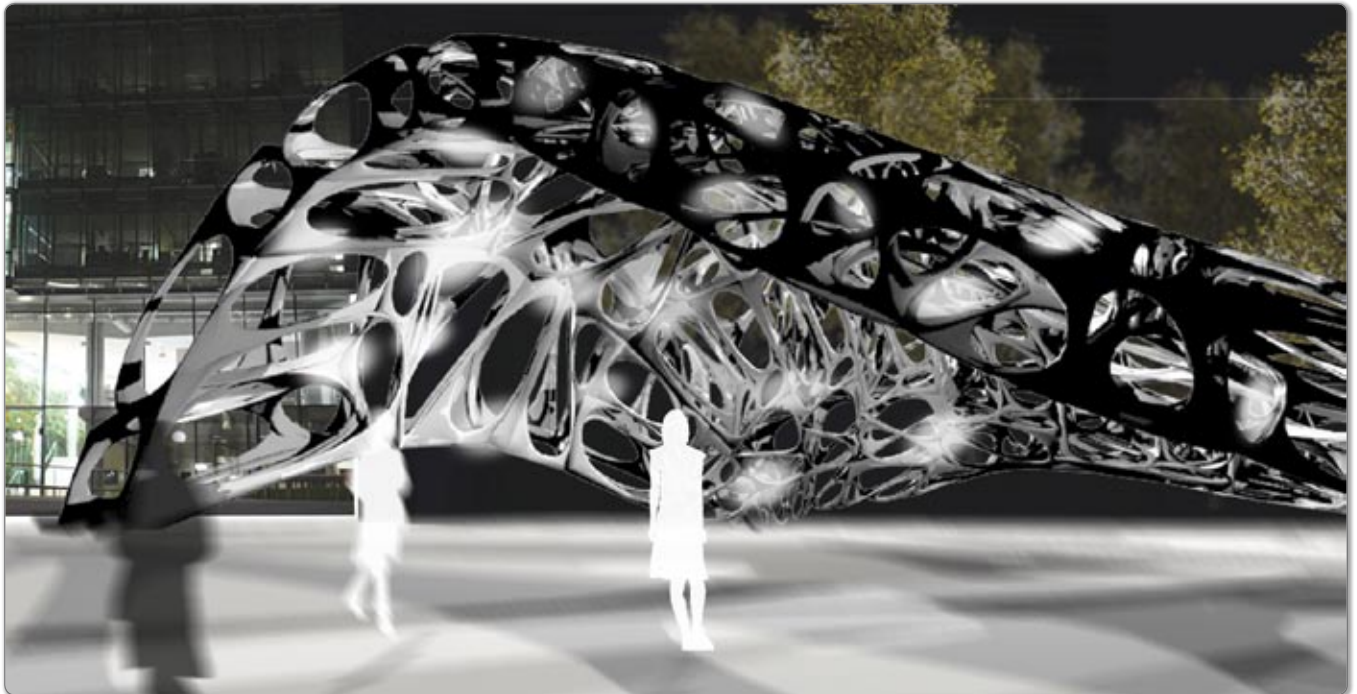


Figure 3: ‘NuiteBlanche’ by students Kamyar Rahimi and Mani Tabrizi.

As both projects shifted from simple imagery towards component design for a tangible scale model, students were able to quickly harness the solid modeling potential that is available in form•Z's robust Boolean and modeling tool set. Unlike other programs which are solely driven by visualization, negligible learning curves, and articulation of a general idea, form•Z affords students a great grounding by balancing visualization with ease of use and attention to detail, without compromising design ability. That designs emerge in a virtual realm and seamlessly transition to stereolithography without the loss of geometries or additional editing allows students to understand that digital representation and physical production are not exclusive domains.

Fabrication toward constructible reality

At its crux, architecture is preoccupied with what is built. Theory and history courses showcase where contemporary built work has emerged from and heads towards, technology and media courses demonstrate the knowledge, skills, and tools required to assemble a design, and design studios are available for students to synthesize this material and explore the possibilities of what can be built. The pedagogy in all architecture schools may vary on the degree of exploration within these facets, however the critical output remains an understanding of what can be constructed. Ubiquity, accessibility, and ease of use have ensured representational software and virtual imagery a place as a commodity within the toolset and education of contemporary design students. Though this trajectory has many advantages, it remains detached from the ethos of architecture as a preoccupation with building. A pervasive result of this has been the emergence of a dangerous trend in design schools: "If it works on screen, it works in reality. If it works in reality, it works as a final design." What is on the screen is therefore the final design. The design effectively ends at the screen. This dangerous syllogism not only undermines the nature of architecture but also the iterative design process. Rapid prototyping empowers designers and facilitates the design-opine-refine process with tangible elements. This is quickly becoming a paradigm in many contemporary design firms in the industry. With the visualization software and fabrication technologies available to today's students, it behooves architectural educators to synthesize and reinforce this potential in their coursework.

As a secondary series of projects in the digital fabrication course, students were engaged in exercises that afforded them the flexibility to go through an iterative design process while simultaneously increasing awareness of constructible design. The two projects in this portion of the course focused on the exploration of details, assembly and delivery, feasibility, and the production of full scale components.

The first project called for students to design an appropriate lamp fixture for a pendant light, while remaining cognizant of not only its production, but also how to convey its assembly to others. Rather than simply designing a single product, students had to produce three lamps with the limited number of hours available to them with the laser cutters and 3D printers available in the digital fabrication lab. As part of their evaluation, students would have to bring a completed lamp, while providing the other two lamps in collapsed form with graphic instructions sealed in an envelope for other students to assemble and evaluate based on design complexity, detailing, and fabrication criteria. The robustness of form•Z's contouring, unfolding, and sectioning tools were instrumental in allowing students to rapidly develop their designs onscreen and produce prototypes on the fly for tangibility and performance evaluation. Through such an iterative process students were able to explore their design through physical prototypes and to examine a range of design issues including materiality properties, cost of fabrication, time constraints, connections and detailing, resource management, appropriate methods of packaging, and ease of assembly, all at full scale. In many instances, the design pieces highlighted the synergies between visualization software and fabrication hardware that would not have been possible if executed autonomously (Fig 4 and 5).

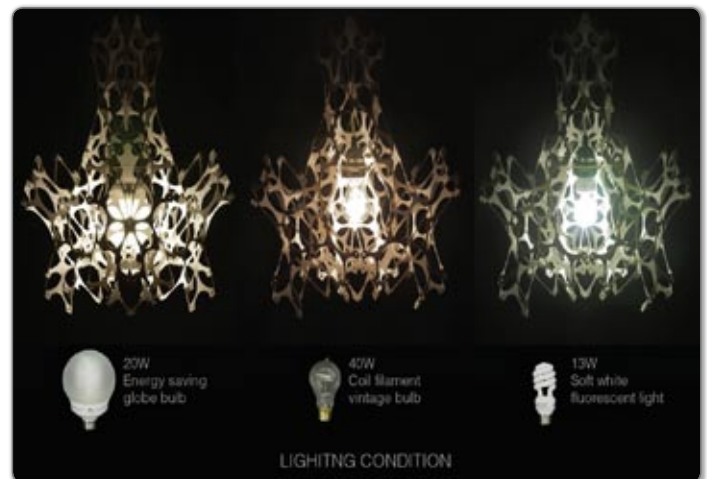


Figure 4: Lamp comparative luminosity by students Winnie Lam and Anthony Chieh.

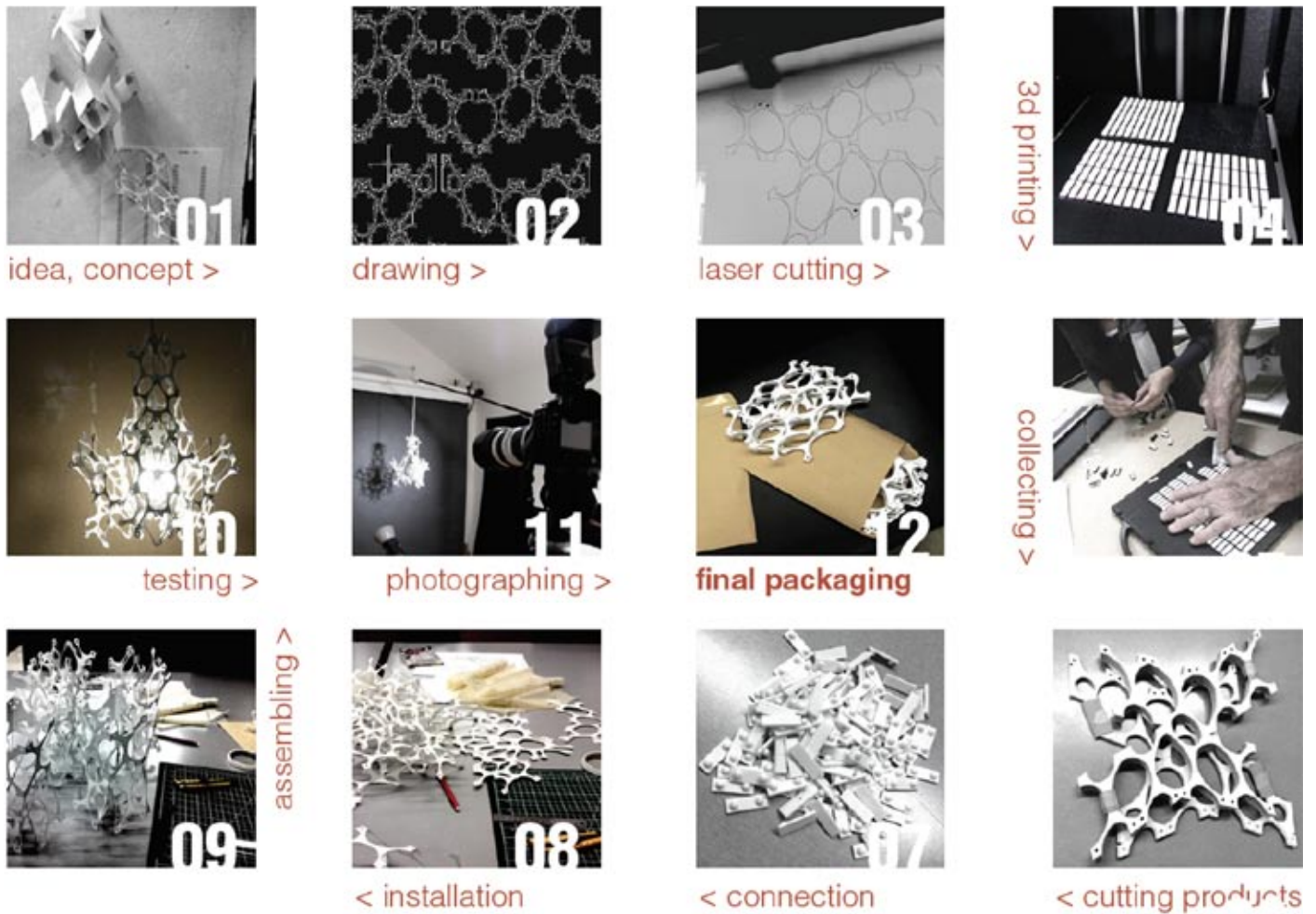


Figure 5: Lamp by students Winnie Lam and Anthony Chieh.

Another project called for students to develop components that would support urban agriculture while tenaciously maintaining the paradigm of virtual-fantasy-to-fabricated-reality but at an urban scale and continuing a stream of environmental design sensitivity. Utilizing a component-based approach to designing these projects, students developed their design and prototyping skills beyond the scale of a light fixture and produced larger systems to facilitate indoor vegetation. As with the earlier lamp project, the design process was driven by rapid prototyping and by the utilization of all the facilities in the fabrication lab, but it was also augmented by vacuum forming tools and by simple CNC machinery. Aside from its scale, this project mandated that students seriously consider the physical properties and assembly of the materials used, given the accommodations required in dealing with water and with soil such as weight, moisture, and water flow. The fantastic ideas initially proposed by students quickly had to evolve from imagery and had to become buildable; what initially appeared to work on the computer

monitors did not hold any water (literally) when brought to the prototype stage. Fortunately, in the end, all the projects evolved from virtual designs to well-constructed matrices that successfully supported thriving vegetation. From the pragmatic window farming prototypes to the playful sill-based hydroponics installation, all the projects were not only critical explorations of design, but were also showcases of a clear emphasis on constructible realities (Fig. 6, 7, and 8).

Reaffirming the architect as a builder

The developments in digital representation and advances in design computing have precipitated a preoccupation in design to relish the seduction of fantastic imagery. The emergence of digital fabrication has empowered a segment of academia and professional practice with the ability to leverage design work into a physical reality. Unfortunately this often is used to only underscore seductive imagery through scale model representation. The synergies made possible through the

appropriation of this visualization software and fabrication hardware must not only shift to a full scale mentality, but more importantly, this must occur earlier in the education of an architect. Over the past four decades, critics of computing in design have decried the potential detachment of the designer from the built design work. They worry that the ease and accessibility of these tools diminishes the relationship between the design intent and the reality; a line on a drawing no longer articulates a particular assembly, but instead remains a line on the

screen. With the increasing ubiquity and quality of such software, the fantasy and seduction of computer generated imagery potentially dulls the sensitivity and dilutes the comprehensive awareness architects must have to construct and build the world.

It is imperative that architects must adopt these tools in an appropriate and synergistic manner at an early developmental stage. Without a strong curriculum that reinforces an understanding of design as a built condition, an architect is merely a dreamer and an illustrator



Figure 6: 'GreenWall' composite rendering.



Figures 7: 'GreenWall' by students Kayeon Lee, Nicolas Boutin, Farah Kabir, Farhan Durrani, Jessica Gibson, Richy Seto, Andrew Ard, Brian Kim, Bruce Gilchrist, Derek McEneaney, Nan Sun, Samira Morshedi, and Silviu Anton.

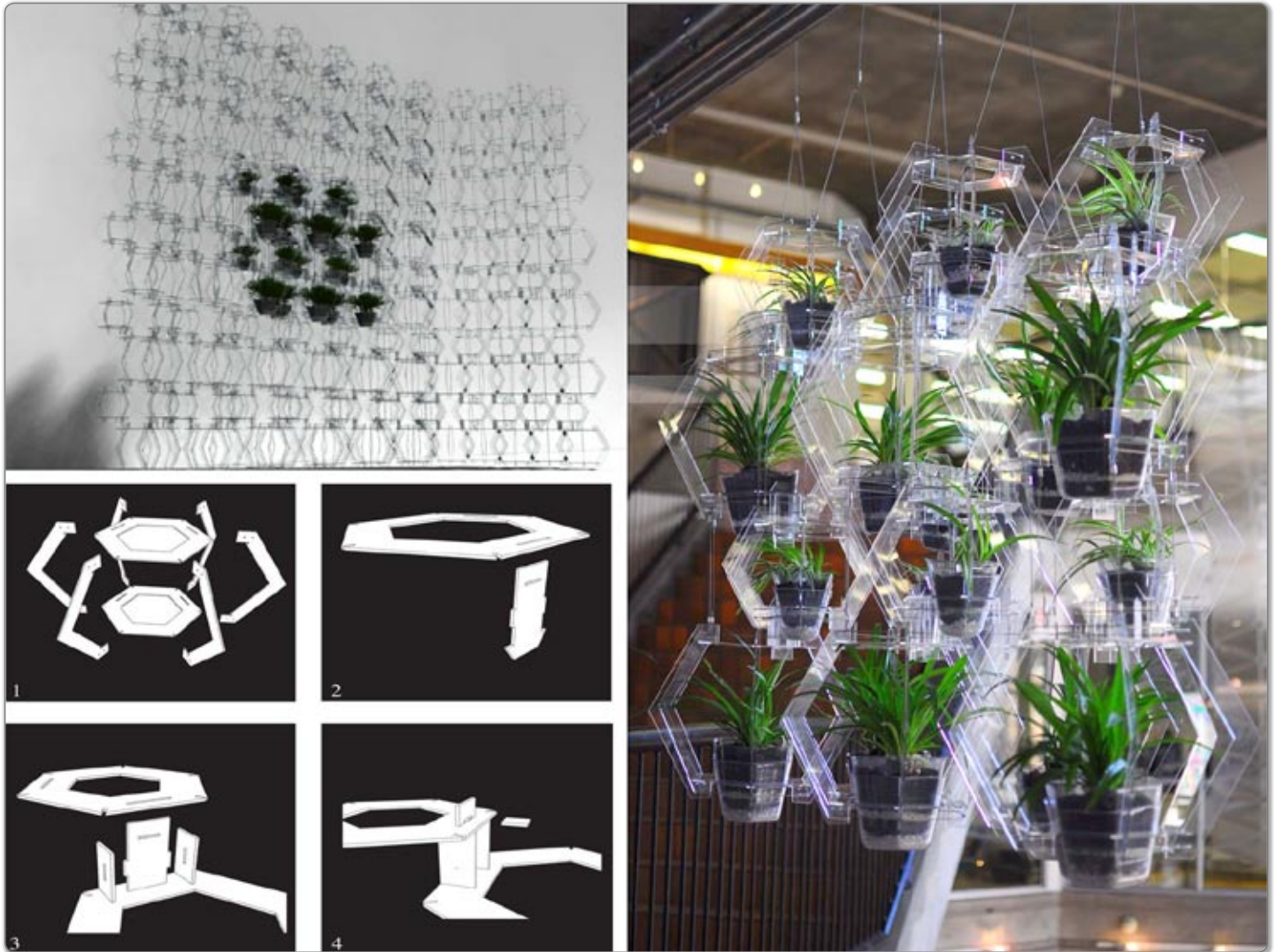


Figure 8: 'GreenWall' by students Andrew Ard, Brian Kim, Bruce Gilchrist, Derek McEneaney, Nan Sun, Samira Morshedi, and Silviu Anton.

relegated to fantasy. Though the aforementioned curricula outlined are still evolving, the outcomes and intentions are clear: students become better designers when they make their work constructible. All architectural

educators, regardless of what specific courses they teach, must therefore embrace this as their responsibility and find ways to bring this thinking to their students, the "chief builders" or architects of the future.



Vincent Hui (MRAIC, Assoc. AIA, LEED AP) received his Bachelor of Environmental Studies (Architecture), Master of Architecture, and Teaching Certification from the University of Waterloo as well as a Master of Business Administration (specializations in Marketing and Strategy) from the Schulich School of Business at York University. After gaining international and domestic work experience with firms including Wong + Tai, ZAS, and Zeidler Partnership, he became a partner at Atelier Anaesthetic in 2003. He has been awarded several teaching citations while at the University of Waterloo since 2001 within both the Schools of Planning and Architecture. He currently teaches within the Department of Architectural Science at Ryerson University in Toronto, Canada. Vincent has taught a range of courses including design studios, building construction, strength of materials/statics, and digital communication. His research interests in architecture and media, digital design, and pedagogy have brought him on various conferences around the world. Vincent has won several design competitions and his works have been exhibited in Toronto, London, Copenhagen, Brussels, Hong Kong, and Athens.